NYSERDA--9700795

Research Projects' Update

Spring 1997

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New York State
Energy Research and Development Authority

NYSERDA

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The New York State Energy Research and Development Authority (NYSERDA) is a public benefit corporation created in 1975 by the New York State Legislature.

NYSERDA has major programs in energy and environmental research, radioactive and hazardous waste management, tax-exempt bond financing, energy analysis and planning, and energy efficiency grants. Its responsibilities include:

- Conducting a multifaceted energy and environmental research and development program to meet New York State's diverse needs;
- Helping industries, schools, hospitals, and not-for-profits implement energy efficiency measures;
- Providing objective, credible, and useful energy analysis to guide decisions made by major energy stakeholders in the private and public sectors;
- Managing the Western New York Nuclear Service Center at West Valley, including: (1) overseeing the State's interests and share of costs at the West Valley Demonstration Project, a federal/State radioactive waste clean-up effort, and (2) managing wastes and maintaining facilities at the shut-down State-Licensed Disposal Area;
- Participating in the Malta Rocket Fuel Area "Superfund" site clean-up and managing facilities at the site on behalf of the State;
- Coordinating the State's activities on nuclear matters, and designing, constructing, and operating State facilities for disposal of low-level radioactive waste, once siting and technology decisions are made by the State; and
- Financing energy-related projects, reducing costs for ratepayers.

NYSERDA derives its basic research revenues from an assessment levied on the intrastate sales of New York State's investor-owned electric and gas utilities. Additional research dollars come from limited corporate funds and a voluntary annual contribution by the New York Power Authority. More than 245 of NYSERDA's research projects help the State's businesses and municipalities with their energy and environmental problems. Since 1990, NYERDA has successfully developed and brought into use more than 60 innovative, energy-efficient, and environmentally acceptable products and services. These contributions to the State's economic growth and environmental protection are made at a cost of less than $1 per New York resident per year.

Federally funded, the Energy Efficiency Services program is working with more than 220 businesses, schools, and municipalities to identify existing technologies and equipment to reduce their energy costs.

For more information, contact the Technical Communications unit, NYSERDA, Corporate Plaza West, 286 Washington Avenue Extension, Albany, New York 12203-6399; (518) 862-1090, ext. 3250; or on the World Wide Web at http://www.nyserda.org/

State of New York
George E. Pataki
Governor

Energy Research and Development Authority
William R. Howell, Chairman
F. William Valentino, President

NEW YORK STATE
ENERGY RESEARCH AND DEVELOPMENT AUTHORITY

RESEARCH PROJECTS' UPDATE

Project status as of March 31, 1997

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PREFACE

New York State imports most of its energy because it lacks abundant conventional energy resources. State energy policy, based on avoiding supply disruptions, economic liabilities, and adverse environmental impacts, depends on a viable energy research and development (R&D) program.

The New York State Energy Research and Development Authority (NYSERDA) is a public benefit corporation created by the State Legislature in 1975 as the entity primarily responsible for planning and conducting energy R&D programs. NYSERDA manages a comprehensive energy research program to help secure the State's future energy supplies, while protecting environmental values and promoting economic growth.

NYSERDA's mission is:

> *To use innovation and technology to solve some of New York's most difficult energy and environmental problems in ways that improve the State's economy. We place a premium on objective analysis, as well as collaboration, reaching out to solicit multiple perspectives and share information. We are committed to public service, striving to be a model of what taxpayers want their government to be: effective, flexible, responsive, and frugal.*

NYSERDA is governed by a 13-member Board of Directors. Ex officio members include the Chairs of the Public Service Commission (PSC) and the New York Power Authority (NYPA), and the Commissioners of the Departments of Environmental Conservation (DEC) and Transportation (DOT). Members appointed by the Governor with the advice and consent of the State Senate are two electric and gas utility executives, an environmentalist, a scientist, an economist, a consumer representative, and three public members. The Governor appoints the Chair and Chief Executive Officer. The President of NYSERDA is Chief Operating Officer. The Governor approves all official actions of the board of directors.

NYSERDA's R&D program emphasizes:

- Promoting energy efficiency to encourage economic development;
- Expanding use of New York State's own renewable energy resources; and
- Reducing or mitigating adverse environmental effects associated with energy production and use.

THE R&D PROGRAM

NYSERDA's R&D program has five major areas: Industry, Buildings, Energy Resources, Transportation, and Environment. NYSERDA organizes projects within these five major areas based on energy use and supply, and end-use sectors. As a result, cross-cutting issues such as waste management, energy products, and renewable energy technologies, among others, are addressed in several areas of the R&D program.

While projects span the entire basic-to-applied research continuum, R&D of technologies and services with potential for timely commercialization and application in New York State are emphasized. The strategies are to adapt federal and other public and private research results for application in New York State and to identify and fill research gaps to meet the State's energy, environmental, and economic needs. Working with New York contractors on energy-related growth opportunities is part of NYSERDA's effort to produce maximum benefits for the State's citizens and businesses.

The R&D program is funded by an assessment on the intrastate gas and electricity sales of the State's investor-owned utilities. Supplemental funding is provided by an annual contribution from NYPA and from limited NYSERDA corporate funds. Co-funding comes from a variety of partners, including State and national research organizations such as the Empire State Electric Energy Research Corporation (ESEERCO), the New York Gas Group (NYGAS), the Electric Power Research Institute (EPRI), the Gas Research Institute (GRI), the National Renewable Energy Laboratory (NREL), utilities, universities, industrial firms, private engineering and scientific firms, local governments, and State and federal agencies. Co-funding leverages every dollar NYSERDA spends into another three dollars and helps ensure that the technologies will be used.

Further information about NYSERDA's R&D programs may be obtained by writing or calling the New York State Energy Research and Development Authority, Corporate Plaza West, 286 Washington Avenue Extension, Albany, NY 12203-6399; (518) 862-1090 ext. 3250; fax: (518) 862-1091; e-mail tgc@nyserda.org; http://www.nyserda.org.

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INTRODUCTION

This Update reflects the status of research projects on March 31, 1997.

The project descriptions are organized within NYSERDA's R&D program areas:

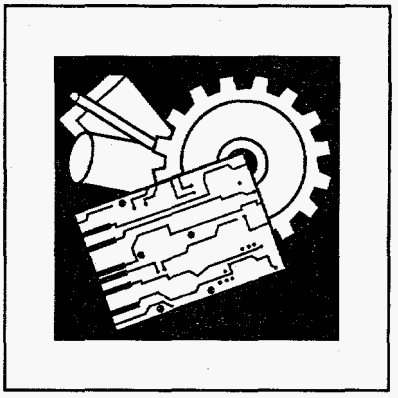
- Industry
- Buildings
- Energy Resources
- Transportation
- Environment

Descriptions of projects completed between the period April 1, 1996, and March 31, 1997, including technology-transfer activities, are at the end of each subprogram section.

All projects described in the Research Projects' Update are managed by NYSERDA's technical staff, often in cooperation with private industry, utilities, academic institutions, and the federal government. The technical merits of proposals, the caliber of the proposed contractors, and the relevance of the projects to New York State's energy needs are thoroughly evaluated before any project receives final approval.

Federal litigation has made Petroleum Overcharge funds available to states, including New York, to provide restitution to overcharged petroleum customers. Since 1987, NYSERDA has been involved in several programs funded with these monies.

INDUSTRY



Benefits and Rationale

The competitiveness of New York manufactured goods depends on the cost content of energy, materials, and labor inputs. Energy prices for New York's industrial sector are 36% higher than the U.S. average. In many New York industries, waste management and environmental compliance costs can be as significant as energy costs. Finally, the labor content of total manufacturing output is about 44% higher in New York than the U.S. average, partly because labor costs are higher in New York than some places and partly because New York industry tends to be dominated by labor-intensive finished products more than basic commodities such as mining, petrochemical, or primary steel, all of which depend more on resources and capital than labor. The development and application of innovative energy- and environmentally efficient technologies helps reduce manufacturing energy and waste costs, and increase labor productivity. These improvements reduce the State's vulnerability to energy price volatility, increase environmental quality, and foster economic growth.

New Product Development. The Industry program emphasizes interaction with small firms most vulnerable to competitive forces. Smaller companies tend to be innovative and are quick to respond to changing markets. At the same time, these companies have limited internal R&D capacity and lack access to traditional sources of capital. NYSERDA helps these companies by reducing the risk of developing new, energy-efficient, environmentally acceptable products.

Demonstration of Innovative Technology. The Industry program also provides support for engineering feasibility studies and actual hardware demonstrations of novel energy-efficient technologies. Cost-shared demonstration projects are used to reduce risk and encourage manufacturers to adopt novel process improvements that offer the potential of greater energy and environmental efficiency and higher productivity.

Targeted Industrial Collaboration. Emphasis is also placed on identifying and applying innovative solutions to energy and environmental problems common to many New York firms in the same industry. In the past few years, the Industry program has brought together research consortia consisting of companies, regional economic development groups, industry trade groups, and technical universities to reduce program costs, ensure participation of the ultimate users, and increase likelihood of technology transfer.

As the energy industry evolves with utility restructuring, the Industry program will need to ensure that its resources do not displace private support, but rather focus on those companies less likely to be served in the more competitive energy markets (i.e., smaller manufacturers), as well as higher-risk ventures that may possibly create economic value and keep businesses in New York.

Individual project funding is based on maximizing economic value, including increased energy and environmental efficiency, productivity, sales, or business retention/creation. On a year-to-year basis, actual project outcomes are compared to original expected benefits. These outcomes are taken into consideration in changing subsequent program plans.

Goals

- Help New York manufacturers become more competitive by providing technical and financial assistance to lower risks of product development and process improvements for energy and environmental applications.

- Promote targeted industrial collaboration to encourage cost-effective technology transfer and application.

- Identify specific industry energy and environmental needs through workshops, scoping sessions, industrial association interactions, and cooperation with regional economic development groups.

-> Nuclear Magnetic Resonance Spectrum Analyzer

Develop circuit and mechanical specifications for low-cost, microprocessor-based nuclear magnetic resonance spectrum analyzer.

BACKGROUND

Classical wet-chemical methods for analyzing hydrogen and moisture in fossil fuel, the fat and moisture content of food, and the moisture content of a variety of products from pharmaceuticals to mining ores have been used decades. These techniques are slow and labor-intensive and require expensive wet-chemical facilities. Problems also arise in developing appropriate sample-preparation procedures and ensuring batch-to-batch repeatability. These techniques also are destructive in nature, which limits their usefulness.

OBJECTIVE

To develop a portable, bench-top, microprocessor-based instrument that will employ the nuclear magnetic resonance (NMR) technique for detecting the presence of hydrogen atoms in both the liquid and solid state.

DESCRIPTION

The contractor will: (1) conduct a market application survey, (2) generate the NMR general description and features, (3) develop the theory of operation, (4) define the microprocessor tasks, (5) provide design specifications, (6) formulate circuit descriptions, and (7) develop a business and marketing plan.

BENEFITS

The proposed automated built-in microprocessor analyzer will provide the capabilities of a laboratory NMR instrument in a compact, portable, air-cooled, low-power-consumption bench-top unit that will be affordable to a diverse group of manufacturers. Non-destructive sample analysis will be available for incoming-material inspection and quality-control monitoring (online and offline). The analyzer will be highly reproducible, featuring rapid measurement of a large number of samples for "just in time" data availability in a production-line environment. These capabilities could result in significant energy savings in industrial processes that involve long drying times.

SCHEDULE AND STATUS

The majority of tasks are complete. The product development plan, technical publication, and announcement materials tasks are expected to be complete by the second quarter of 1997.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$145,289	0	$145,289
C4 Technologies, Inc.	60,800	0	60,800
NYS CACT	20,000	0	20,000
The Cortlandt Group	20,000	0	20,000
Info-Mall	22,500	0	22,500
APV Crepaco, Inc.	20,000	0	20,000
Advanced Refractory Technologies, Inc.	15,000	0	15,000
Central Hudson Gas & Electric Corp.	8,000	0	8,000
TOTALS	$311,589	0	$311,589

Contractor: C4 Technologies, Inc.
Site: Wappingers Falls, Dutchess County
Contract Duration: 9/95 - 6/97
Key Words: product development, industrial process
Project Manager: Barbara Caropolo (518) 862-1090 ext. 3266
Program: Industry
Subprogram: Process Improvements
Contract No.: 4131-IABR-IA-95

-> Development of a Modular Ammonia-Absorption Machine

Design modular ammonia-absorption refrigeration system that uses low-grade waste heat to provide cooling for food-processing industry.

BACKGROUND

Many industries, particularly dairies, breweries, and other food processors, require low-temperature refrigeration for production and product storage. Refrigeration normally is provided using electric motor-driven mechanical compression systems. These industries could benefit from cogeneration technologies; however, the lack of an appropriate heat sink for the thermal energy often makes the application uneconomical. Absorption cooling technologies can use the waste heat from a cogeneration system while replacing some of the existing mechanical refrigeration. Systems using ammonia and water as the refrigerant-absorbent pair would be a good match for this application, but currently are available only as custom-designed units in large tonnages. A market exists for a small-capacity modular ammonia-absorption machine that will use waste heat from a companion prime mover to augment the capacity of a mechanical refrigeration plant.

OBJECTIVE

To develop a packaged, modular absorption refrigeration system to minimize field-installation problems and cost, to use low-grade energy such as waste heat from a prime mover or other process source, and to provide cooling at a competitive cost.

DESCRIPTION

This is the first phase of an anticipated three-phase (preliminary design, prototype development and testing, and field-testing) project.

BENEFITS

The availability of this system would encourage the use of cogeneration at otherwise unsuitable sites. This will benefit users (primarily food processors) by decreasing overall energy costs and by augmenting or replacing chlorofluorocarbon mechanical refrigeration capacity.

SCHEDULE AND STATUS

The preliminary design has been completed and the Phase I report is being finalized. Phase II, which includes construction of a test unit, is under development.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$94,339	0	$94,339
Rochester Institute of Technology	12,654	0	12,654
CDH Energy Corporation	21,754	0	21,754
Ancoma	13,443	0	13,443
TOTALS	$142,190	0	$142,190

Contractor: CDH Energy Corporation
Site: Cazenovia, Madison County, and Rochester, Monroe County
Contract Duration: 9/95 - 6/97
Key Words: product development, environmental, university, industrial process, refrigeration, heat recovery
Project Manager: Ed Kear (518) 862-1090, ext. 3269
Program: Industry
Subprogram: Process Improvements
Contract No.: 4223-IABR-IA-96

-> Electric-Resistance Heating of Volatile Organic Compound-Activated Carbon

Reduce energy requirements to remove and recover volatile organic compounds from carbon-bed pollution-control equipment.

BACKGROUND

Granular activated carbon (GAC), which is used extensively by industry to control or recover volatile organic compound (VOC) emissions, has to be regenerated for reuse. This regeneration represents the principal operating cost for GAC. The conventional approach to regenerating and desorbing GAC is to use steam or inert gases, both resulting in greater energy use and higher operating costs. The contractor, Foster-Miller, Inc. (FMI) of Waltham, MA, has developed a novel method of regenerating the GAC electrically, which overcomes both of these problems.

OBJECTIVES

To determine: (1) the technical feasibility of the electric-resistance heating process for solvent recovery, (2) the operating characteristics of the new process for regeneration compared to those of steam or inert gas regeneration, (3) the energy and cost savings potential of the new process, and (4) design information for a commercial-scale unit.

DESCRIPTION

FMI will test and evaluate the electric-resistance regeneration system on a pilot scale at Air Products and Chemicals, Inc. (Staten Island) using a side-stream flow from an existing landfill-gas-refining facility. The flow contains methane, carbon dioxide, and contaminant gases. The results of the pilot-scale facility will be compared to the performance of the existing refining units operated by Air Products.

BENEFITS

The contractor projects an $80-million market worldwide for the recovery of VOCs from carbon beds. In New York, there are hundreds of potential sites where the technology could be applied, saving millions of dollars. By lowering costs for environmental compliance, the technology can help retain jobs in New York.

SCHEDULE AND STATUS

The pilot scale design and fabrication is complete. Installation will follow regulatory approval.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	0	$150,000	$150,000
Con Edison	0	150,000	150,000
Air Products and Chemicals, Inc.	0	100,000	100,000
Foster Miller, Inc.	0	100,000	100,000
ESEERCO	0	100,000	100,000
TOTALS	0	$600,000	$600,000

Contractor: Foster Miller, Inc.
Site: Fresh Kills Landfill, Staten Island, Richmond County
Contract Duration: 5/96 - 12/97
Key Words: assist business, environmental, industrial process, emissions control, VOCs
Project Manager: Bill Reinhardt (518) 862-1090, ext. 3257
Program: Industry
Subprogram: Process Improvements
Contract No.: 4044-IABR-IA-97

-> Innovative Chrome-Plating Process Alternative

Demonstrate powder coatings for industrial components to avoid energy-intensive and environmentally hazardous chrome-plating.

BACKGROUND

Chrome-plating has been used for years to repair, resize, and enhance the mechanical properties of valuable industrial components. However, the chrome-plating process is energy-intensive and generates significant hazardous metal wastes. This project will demonstrate an alternative method for applying powder coatings made from tungsten carbide cobalt and nickel chromium silicon boron alloys using a new flame-spray technology.

OBJECTIVES

To enable the application of powder coatings instead of chrome-plating on a variety of industrial components (i.e., pumps, diesel engines, turbine nozzles, and piston rods), thus eliminating the release or expensive storage of chrome-plating wastes. Thermaltec International Corp. (TIC) will own and use this technology and others will be licensed to manufacture and sell it worldwide.

DESCRIPTION

In early tasks, powder materials will be tested to identify which is best-suited as a chrome-plating substitute. In later tasks, the unique spray equipment necessary to apply the powder will be designed and demonstrated. Specific tasks include: (1) selecting and testing the coating material; (2) designing, procuring and installing the equipment; (3) field-testing; (4) monitoring; (5) disseminating information; and (6) preparing the final report.

BENEFITS

Substituting powder coatings for chrome-plating would directly eliminate hazardous chrome-waste generation. Additional benefits include: reduced energy and labor costs associated with the coating process; enhanced coating durability and longer coating life; and reduced coating-material waste.

SCHEDULE AND STATUS

Material and equipment testing has begun. Equipment component malfunctions have delayed completion of materials testing. However, a number of different materials have produced promising results and merit further testing.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$247,993	0	$247,993
Thermaltec International Corp.	247,993	0	247,993
TOTALS	$495,986	0	$495,986

Contractor: Thermaltec International Corp.
Site: East Farmingdale, Suffolk County
Contract Duration: 3/96 - 12/97
Key Words: product development, environmental, industrial process, materials, emissions control, coating
Project Manager: Bill Reinhardt (518) 862-1090, ext. 3257
Program: Industry
Subprogram: Industrial Process Improvements
Contract No.: 4104-IABR-IA-95

-> Demonstrating Ultraviolet (UV)-Curing of Wood Products

Demonstrate use of vacuum coating and ultraviolet curing of broom handles, brush blocks, and moldings.

BACKGROUND

The wood-products industry has been important throughout New York State's history. Rising energy and labor costs, continuous demands for improved product quality, and the rising cost of environmental compliance have had severe consequences on this industry. The industry is facing stringent regulation of its use and release into the environment of volatile organic compounds (VOCs) or solvents stemming from coating operations. UV coatings have no VOCs in their formulations, thus preventing pollution at the outset.

OBJECTIVES

To undertake a field-demonstration and evaluation of a UV-curing system in a wood-product manufacturing facility (E and J Industries, Inc.). Utilities and trade associations will participate in technology-transfer activities.

DESCRIPTION

The contractor will: (1) procure, install, and maintain the UV-curing system at the test site; (2) provide employee training on system operation; and (3) monitor the system's energy consumption and performance characteristics, including production rates, coating quality, cost-effectiveness, payback period, and environmental impact.

BENEFITS

Compared to conventional infrared-cured coatings for wood products, UV-curing requires 30 to 80 percent less energy. Using UV coatings as a finish coat with a vacuum coater appears to be economical due to lower energy costs, reduced down-time for cleanup, and a faster production rate.

SCHEDULE AND STATUS

Equipment selection and procurement is under way. Equipment is being shipped to the site.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	0	$120,000	$120,000
E and J Industries, Inc.	0	145,000	145,000
New York State Electric & Gas Corp.	0	5,000	5,000
Electric Power Research Institute	0	5,000	5,000
Cedar Beach, Inc. & E&R Sys. Tech. Inc.	0	8,800	8,800
TOTALS	0	$283,800	$283,800

Contractor: E and J Industries, Inc.
Site: Woodridge, Sullivan County
Contract Duration: 6/96 - 12/97
Key Words: assist business, industrial process, electrotechnology, wood products, electrical
Project Manager: Bill Reinhardt (518) 862-1090, ext. 3257
Program: Industry
Subprogram: Process Improvements
Contract No.: 4403-IABR-IA-97

-> Demonstrating an Indirect-Fired, Controlled Atmospheric Kiln to Decoat Oily Scrap

Decoat oily scrap aluminum for secondary and primary aluminum industry.

BACKGROUND

Kilns that remove oil from scrap aluminum (called decoating) are energy- and emissions-intensive, with limited production capability. Flue-gas cleaning techniques to reduce emissions are not without problems. Problems with current decoating technology may be resolved using an indirect-fired, controlled atmospheric kiln. In this project, scrap first will be fed into a sealed rotating kiln and the scrap oils will be vaporized, not combusted, by a 1500°F counterflowing gas stream with low oxygen content. By preventing oil combustion from coming into contact with the scrap, metal loss through oxidation will be avoided. The gas stream then will be passed to an incinerator, apart from the scrap, to combust the gas and destroy the volatile organic compounds. Part of the gas will return to the kiln, completing the cycle. The heat released from the oil combustion will provide all the heat needed for the decoating process.

OBJECTIVES

To demonstrate the energy and environmental benefits of an innovative, indirect-fired, controlled atmospheric kiln to decoat oily scrap. This will be the first demonstration of this technology for the secondary and primary aluminum industry in the U.S., and the first application to high- and variable-oil-laden scrap.

DESCRIPTION

This project will characterize the scrap from Roth Brothers, a secondary aluminum processor, and custom-design the system. The equipment will be tested first in the laboratory and then at Roth Brothers. Energy use and emissions reductions, and production increases, will be documented and publicized.

BENEFITS

Compared to conventional equipment, this equipment could reduce energy use more than 50 percent, and almost eliminate volatile organic chemical emissions and dust formation. The production increase could be worth millions of dollars yearly.

SCHEDULE AND STATUS

Roth Brothers scrap has been characterized. Equipment design, fabrication, and installation are complete. Start up and shakedown testing are under way.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$399,917	0	$399,917
Roth Brothers	417,444	0	417,444
Stein Atkinson Stordy, Ltd.	55,000	0	55,000
U.S. Department of Energy	0	$303,556	303,556
TOTALS	$872,361	$303,556	$1,175,917

Contractor: Roth Brothers, Energy Research Company (Subcontractor)
Site: East Syracuse, Onondaga County
Contract Duration: 4/94 - 12/97
Key Words: assist business, environmental, industrial process, emissions control, EDGE, VOC, decoat oily scrap
Project Manager: Bill Reinhardt (518) 862-1090, ext. 3257
Program: Industry
Subprogram: Process Improvements
Contract Nos.: 3103-EEED-IEA-94

-> Electronic Printing of Textiles

Develop innovative computer-controlled ink-jet technology for textile-printing industry.

BACKGROUND

The current methods for printing textiles are engraved-roller, subminable dye-transfer, flat-screen, and rotary-screen, which is the most widely used. While the rotary-screen method enables fast production, it has drawbacks in overall energy efficiency, and wastes water, solvents, fabric, and dyestuff. Rotary-screen printing also requires a significant capital investment and lead-time to produce new textile designs.

OBJECTIVE

To demonstrate the viability of ink-jet printing on textiles. This technology will be of intense interest and benefit to NYS textile- printing businesses, and to the fashion industry as a whole. The project will be conducted in two phases.

DESCRIPTION

Phase I will develop and test a print-head/ink system suitable for textile printing. Alternate transducer technologies such as piezoceramic and thermal (bubble) jet will be considered. In Phase II, a full-width (60") ink-jet print system will be designed, assembled, tested, and evaluated.

BENEFITS

Project benefits should include a 40-percent increase in energy efficiency, and a 90-percent reduction in water use and solvents over rotary-screen textile printing. Industrial waste in the form of unused dyestuffs will be eliminated. Significant capital expenditure and lead-time to accomplish textile printing will be reduced by eliminating screens. Archiving and transmittal of textile designs will be improved.

SCHEDULE AND STATUS

A print-head transducer technology has been identified and tested. The transducer array has been constructed. A full-scale system proof-of-concept prototype has been constructed. Phase III, which will develop a commercial unit, is under development.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$274,157	0	$274,157
Artisan Textiles	54,000	0	54,000
Twin Rivers Textiles	10,000	0	10,000
Rensselaer Polytechnic Institute (CAT)	224,886	0	224,886
Clarkson University (CAMP)	53,725	0	53,725
TOTALS	$616,768	0	$616,768

Contractor: Artisan Textiles
Site: Albany, Albany County, and Troy, Rensselaer County
Contract Duration: 6/94 - 6/97
Key Words: university, product development, industry, textiles, printing computer
Project Manager: Ed Kear (518) 862-1090, ext. 3269
Program: Industry
Subprogram: Process Improvements
Contract Nos.: 3100-EEED-IA-94

Design, develop, and demonstrate microwave drying system and water- or powder-based emulsion system to process preimpregnated fiberglass cloth.

BACKGROUND

Preimpregnated glass cloth, or "prepreg," is the base material used in printed circuit board manufacturing. Prepreg is also an important component in high-strength composite materials used in the aerospace and transportation industries. During manufacturing, thin sheets of prepreg pass through an organic solvent in which an epoxy has been dissolved. The prepreg then passes through a tower that uses hot-air convection drying, where the solvent evaporates, leaving the epoxy. The epoxy allows the prepreg to be layered and laminated with copper to form the printed circuit boards. Using organic solvents in this process presents an environmental and health hazard. Additionally, the hot-air drying method is quite energy-intensive. IBM, an international leader in prepreg manufacturing, operates the largest domestic plant in Endicott, NY.

OBJECTIVE

To design, construct, and demonstrate a microwave application system to replace hot-air convection in the prepreg-drying process. Microwave drying will be demonstrated in conjunction with a water- or powder-based resin that ultimately may replace organic solvents in prepreg manufacturing.

DESCRIPTION

IBM and Cober Electronics will design the physical and control components of a microwave applicator capable of distributing microwaves evenly across a wide, thin sheet. A handling system also will be developed to extend this technology to processing, drying, and monitoring 63-inch-wide prepreg cloth rolls commonly used in industry. IBM and Virginia Polytechnic Institute will develop a water- or powder-based resin that is amenable to microwave drying. IBM also will work with Applied Poleramic, Inc. to design and develop an innovative prepreg-handling system compatible with the microwave drying technology and new resins.

BENEFITS

Prepreg-processing time will decrease by more than 50 percent, doubling output capacity. The efficiency of the microwave drying process is 60 to 65 percent, compared to less than five percent for hot-air drying. For the same amount of prepreg, the microwave drying tower will consume 20 to 30 kW, compared to one MW for a hot-air drying tower. Eliminating solvent-based resins will produce significant environmental benefits. This process consumes 20 million lbs. of methyl ethyl ketone each year in the U.S. Five million lbs. of CO_2 each year are emitted into the atmosphere by a single treater tower from solvent-combustion. If successful and implemented full-scale at Endicott, solvent discharges will be eliminated.

SCHEDULE AND STATUS

Tests results are very promising. IBM has developed a pilot-scale microwave applicator system, a water-based epoxy, and software to monitor and control prepreg drying for conventional and microwave systems. IBM is in the process of transferring the technology to the microwave manufacturer and Endicott for in-process demonstrations.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$600,000	0	$600,000
IBM	1,822,887	0	1,822,887
Electric Power Research Institute	922,887	0	922,887
New York State Electric & Gas Corp.	300,000	0	300,000
TOTALS	$3,645,774	0	$3,645,774

Contractor: International Business Machines Corporation (IBM)
Site: Yorktown Heights, Westchester County, and Endicott, Broome County
Contract Duration: 11/93 - 12/97
Key Words: product development, environmental, industrial process, materials
Project Manager: Adele Ferranti (518) 862-1090, ext. 3206
Program: Industry
Subprogram: Process Improvements
Contract No.: 3132-EEED-IA-94

-> Efficient Silver Recovery from Alumina Catalyst

Develop and demonstrate innovative process to increase efficiency of silver removal and reuse from alumina catalyst.

BACKGROUND

Ames Goldsmith uses silver as a feedstock to make silver nitrate and silver oxide, which are used in the photographic, chemical, and electronics industries. The company produces 90 percent of the silver oxide used to manufacture batteries in the U.S. and is the industry leader for alumina catalyst refining. Ames processes more than one million pounds of spent alumina catalyst annually for silver removal and recovery. To meet increasing catalyst-refining demands, Ames must increase the capacity and energy/waste efficiency of its process.

OBJECTIVE

To design and construct an innovative pilot-scale catalyst-refining process to increase silver oxide recovery while reducing energy requirements and process wastes. If the silver oxide meets the requirements of Ames and its refining customer, a full-scale system, with the capacity to produce six million ounces of silver oxide annually, will be designed, constructed, and operated.

DESCRIPTION

Ames will evaluate altering its refining process to eliminate several intermediate process steps. The goal of the research will be to minimize process wastewater and sludge through recovery and reuse. Ames will evaluate the chemical and physical characteristics of the silver oxide resulting from the new refining process. Its primary refining customer will manufacture several batches of ethylene oxide and analyze the silver oxide. Energy and water consumption, and the amount of waste generated per unit of silver oxide, will be monitored and evaluated.

BENEFITS

Project benefits include reducing the amount of silver-laden sludge that needs to be dried and processed to remove the silver, reducing process water demand by up to 75 percent per ounce of silver oxide produced, reducing NO_x emissions by eliminating an intermediate processing step, and reducing the amount of wastewater that is discharged. The project also will enable Ames to increase refining capacity, hire six to eight additional employees, and decrease processing costs.

SCHEDULE AND STATUS

Ames is finalizing the Final Report.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$261,935	0	$261,935
Ames Goldsmith, Inc.	263,243	0	263,243
TOTALS	$525,178	0	$525,178

Contractor: Ames Goldsmith, Inc.
Site: Glens Falls, Warren County
Contract Duration: 8/94 - 5/97
Key Words: assist business, environmental, industrial waste, silver
Project Manager: Adele Ferranti (518) 862-1090, ext. 3206
Program: Industry
Subprogram: Process Improvements
Contract No.: 4028-IABR-IA-95

-> Novel Refractory Coating for Recuperator Use in Metals-Processing Industry

Develop novel refractory coating for recuperator use in metals-processing industry.

BACKGROUND

Many metal-processing companies waste significant energy by discharging high-temperature flue gases into the atmosphere without any heat recovery. Often, corrosive flue gases do not allow the use of recuperators. The secondary aluminum industry, the near-term commercial target, is one such industry that has received considerable attention concerning flue-gas energy recovery. Typically, a secondary aluminum smelter will exhaust its flue gases at 2200°F wasting more than 50 percent of the total thermal input.

OBJECTIVE

To test a new refractory coating in a simulated recuperator that uses a portion of the flue gases from a secondary aluminum smelter. The proposed concept incorporates a unique ceramic material, never used in this application, to coat and protect an off-the-shelf radiant-tube metallic recuperator. A combustion-air temperature of 1000°F will be attained, which will result in an energy savings of 33 percent. A major attribute of this recuperator design is that it can be recoated in place, unlike others, thus providing longevity and economical operation. The technical objective is to have the coating last for the six-month test so that its projected life will be at least three years, without recoating, and longer with recoating. Also, the recuperator performance must achieve a 1000°F preheat temperature with no air-to-flue-gas leakage.

DESCRIPTION

Energy Research Company (ERCo) will be the prime contractor responsible for project management, data collection, technology transfer, and approval of all engineering decisions. Brookhaven National Laboratory developed the coating to be used in this program. Roth Bros., in East Syracuse, NY, is a secondary aluminum smelter and will be the host site for testing. O'Brien and Gere of Fayetteville, will fabricate the prototype recuperator. The project tasks include: (1) laboratory testing of coating material, (2) test-rig design, (3) fabrication and installation of test rig at Roth Bros., (4) six-month testing period, and (5) project management and reporting.

BENEFITS

The proposed concept may reduce furnace energy use by more than 30 percent, or about 900 Btu per pound of product. A production increase of more than 30 percent is achievable without increased emissions, with a payback of less than two years. In 1993, of the 3.4 million tons of scrap aluminum consumed in the U.S., about half was used by the 34 secondary aluminum plants similar to Roth Bros. Widespread use of this technology would result in a savings of 6 trillion Btu per year in the U.S. alone, or about $15 million per year if gas costs are assumed to be about $2.50 per MMBtu.

SCHEDULE AND STATUS

Equipment and materials have been purchased and testing has begun. Materials testing has generated good results for some of the materials tested.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	0	$239,000	$239,000
U.S. Department of Energy	0	214,861	214,861
ERCo	0	14,828	14,828
O'Brien and Gere	0	10,000	10,000
TOTALS	0	$478,689	$478,689

Contractor: Energy Research Company
Site: Staten Island, Richmond County, and East Syracuse, Onondaga County
Contract Duration: 2/97 - 2/98
Key Words: product development, industrial process, gas, heat recovery, emissions control
Project Manager: Bill Reinhardt (518) 862-1090, ext. 3257
Program: Industry
Subprogram: Process Improvements
Contract No.: 4470-IABR-IA-97

-> Demonstrating a Direct/Indirect Contact Steam-Atmosphere Dryer

Develop and demonstrate prototype superheated steam-atmosphere dryer for industrial applications.

BACKGROUND

In the United States, industrial drying accounts for approximately 1.5 quads of annual energy consumption. Tecogen, Inc. has designed a closed-loop, direct-contact, steam-atmosphere dryer based on an existing APV Crepaco dryer design. APV Crepaco is a New York State manufacturer that wants to add this innovative dryer to its product line. The dryer uses superheated steam atmosphere combined with recompression of the dryer's exhaust steam. The technology has the potential to reduce energy consumption and environmental emissions compared to other industrial dryers.

OBJECTIVE

To design, construct, and perform laboratory- and field-testing of a pilot (250 lb/hr) superheated steam-atmosphere drying system on sludge from an anaerobic digester or wastewater treatment facility. In subsequent project phases, similar equipment (scaled for the specific application) may be field-demonstrated on different industrial feedstocks in New York State.

DESCRIPTION

The contractor will: (1) conduct laboratory drying tests using feedstocks from several candidate test sites, (2) design and construct the prototype steam dryer, (3) test the prototype dryer on industrial products, (4) identify a demonstration site, (5) ship and install the dryer at the demonstration site, and (6) conduct a six-month demonstration to evaluate the energy savings and operational economics associated with the dryer.

BENEFITS

The superheated steam-drying process is energy-efficient because the latent heat of vaporization is not lost in the dryer exhaust, as it is with air-drying. This technology has the potential to reduce the energy required for drying by as much as 35 to 50 percent compared to the best state-of-the-art air-drying equipment. If the project is successful and the process is replicated throughout the State, the energy savings to New York businesses could total $28 million annually. Additionally, the superheated steam-drying equipment could be manufactured in the New York.

SCHEDULE AND STATUS

The prototype system has been installed at the Village of Bergen's anaerobic digester site (NYSERDA Project No. 1906). The system is being tested using the sludge from the digester and other drying tests are under way to evaluate the effectiveness of the dryer on other feedstocks.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$410,720	0	$410,720
U.S. Department of Energy	414,970	0	414,970
Niagara Mohawk Power Corp.	220,000	0	220,000
TOTALS	$1,045,690	0	$1,045,690

Contractor: Tecogen, Inc.
Site: Waltham, MA, and Village of Bergen, Genesee County
Contract Duration: 7/91 - 9/97
Key Words: product development, environmental, industrial, municipal, drying, steam
Project Manager: Adele Ferranti (518) 862-1090, ext. 3206
Program: Industry
Subprogram: Process Improvements
Contract No.: 1759L-EEED-IEA-92

-> Recovering Waste Heat by Preheating Oxygen with Flue Gas from an Oxy-Fuel-Fired Glass Furnace

Design, test, and demonstrate oxygen preheater that uses hot flue gases from oxy-fuel glass melter.

BACKGROUND

Glass melting is an energy-intensive process during which significant heat is lost in the flue gas. Oxy-fuel combustion for glass furnaces has seen rapid adoption in the U.S. due to reduced NO_x and particulate emissions and increased production capability. However, oxy-fuel melters have higher operating costs than air-fuel melters. Praxair, Inc. is sponsoring the development of an oxygen-preheater technology to preheat combustion oxygen with hot flue gases from the glass melter. Currently, there are no known commercial oxy-fuel melters that take advantage of this high-quality waste heat.

OBJECTIVE

To design, test, and field-demonstrate an oxygen preheater in conjunction with an existing oxy-fuel melter. Praxair will attempt to safely preheat at least 70 percent of the stoichiometric oxygen requirement for the furnace to 1200°F; demonstrate use of preheated oxygen with oxy-fuel burners, and minimize NO_x emissions.

DESCRIPTION

Working with Corning, Inc. and Xothermic, Inc. as subcontractors, Praxair will engineer, design, and test the oxy-fuel/oxygen-preheater system. The existing furnace's performance will be fully characterized to provide data for the oxygen-preheater design, operation with oxygen preheating, fuel and oxygen use, and furnace capacity. The oxygen-preheater system will be operated over a six-month period to document its performance and reliability and to determine fuel and oxygen savings. An economic analysis will be done for this unit, as well as for furnaces of various sizes.

BENEFITS

Oxy-fuel/oxygen-preheating technology will enable glass producers to reduce glass-production costs and air emissions, and save energy. Total glass production in the U.S. is about 22 million tons and consumes about 300 x 10^{12} Btu annually. Commercialization of oxygen-preheating technology will make the overall oxy-fuel process more economical for a significantly greater share of this market. This technology, combined with a batch/cullet preheating technology to be tested by Corning and Tecogen, will optimize energy recovery. If successful, the project will result in a new product for Praxair.

SCHEDULE AND STATUS

System components have been designed and are being fabricated. Praxair and Corning are working out the details for the demonstration site.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$200,000	0	$200,000
Praxair, Inc.	130,828	0	130,828
Corning, Inc.	85,513	0	85,513
TOTALS	$416,341	0	$416,341

Contractor: Praxair, Inc.
Site: Fall Brook and Corning, Steuben County, and Tarrytown, Westchester County
Contract Duration: 1/96-12/97
Key Words: product development, environmental, industrial process, emissions control, heat recovery
Project Manager: Adele Ferranti (518) 862-1090, ext. 3206
Program: Industry
Subprogram: Industrial Process Improvements
Contract No.: 4242-IABR-IA-96

-> Field-Demonstration of Exhaust-Heat-Recovery System in an Industrial Bakery

Demonstrate use of direct-contact heat-recovery system with oven exhaust from wholesale bakery.

BACKGROUND

Bakeries represent one of the largest sectors of the New York State food-processing industry, and the largest in New York City in both jobs and energy use. High energy costs and product quality are both serious issues affecting the competitiveness of BakedRite and other industrial bakeries in the State.

The heat-recovery system to be demonstrated in this project shows promise for improving both energy efficiency and product quality. Brooklyn Union and NYSERDA will demonstrate this technology at BakedRite, a wholesale bakery that employs about 250 people. Then, Brooklyn Union will sponsor an aggressive technology-transfer effort to encourage the adoption of this technology by other suitable commercial and industrial facilities in New York City.

OBJECTIVES

To demonstrate an exhaust-heat-recovery system at the BakedRite bakery in Brooklyn that will preheat ventilation and combustion air, as well as makeup water, for two oil-fired boilers used to control product moisture.

DESCRIPTION

Brooklyn Union will install, maintain, and monitor the performance of the exhaust-heat-recovery system. Heat will be recovered from the exhaust-flue gases of a tunnel-type bread oven using a direct-contact water heater/stack economizer manufactured by Sofame, Inc. under the name Percotherm. The exhaust-heat-recovery system will be tested for two years. A remote-control system will continuously monitor the operation and collect data to evaluate the performance of the heat-recovery system. This information will be used to determine the economic viability and energy savings resulting from the system's operation. Brooklyn Union's industrial marketing group will undertake technology-transfer activities aimed at already-identified market segments (i.e., bakeries, multifamily housing, and other commercial facilities).

BENEFITS

Energy savings have been estimated at 3.2 billion Btu per year, for a cost savings of $8,000 to $10,000 per year. The technology will encourage switching to natural gas from oil because the heat-recovery system will only operate when the tunnel oven is burning natural gas. Another potential benefit to be investigated is the product-quality impact of reduced ambient-temperature fluctuations.

SCHEDULE AND STATUS

The project is under way. Procurement and installation are in progress, although construction delays have prevented the completion of installation.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	0	$92,000	$92,000
Brooklyn Union	0	92,000	92,000
BakedRite	0	46,000	46,000
TOTALS	0	$230,000	$230,000

Contractor: Brooklyn Union
Site: Brooklyn, Kings County
Contract Duration: 5/96 - 12/98
Key Words: assist business, industrial process, gas, heat recovery
Project Manager: Bill Reinhardt (518) 862-1090, ext. 3257
Program: Industry
Subprogram: Process Improvements
Contract No.: 4409-IABR-IA-97

-> Demonstrating a Single-Stage Low-Temperature Compressor System

Demonstrate engine-driven single-screw compressor for cooling at sub-zero temperatures.

BACKGROUND

In New York State, food-processing companies have an installed capacity of more than 300,000 tons of refrigeration capacity, equating to 250 megawatts or more of electricity demand for compressor loads. Additional energy is required for ancillary components. As much as 40 percent of this capacity is used for cooling at sub-zero temperatures. These applications are potential beneficiaries of the technology this project will demonstrate: the use of a single-screw compressor in an engine-driven high-lift -40°F refrigeration service. The successful application of this compressor at Middleport Cold Storage should help speed the acceptance of this technology by other industries in New York State.

OBJECTIVE

To modify the existing refrigeration to incorporate a new, engine-driven, single-screw compressor providing low-temperature (-40°F) refrigeration service. The capacity of the system will be in the range of 50 to 100 tons. The installation will be designed to discharge refrigerant gas from the new compressor directly to the condensers rather than through an intermediate stage as in the existing, conventional plant. This project is intended to demonstrate the benefits of using a single-screw compressor in an engine-driven high-lift application.

DESCRIPTION

Middleport Cold Storage will install the new engine-driven, single-screw compressor. System performance will be monitored and the results compared to the performance of the existing refrigeration equipment at the site. Project participants will perform technology-transfer activities.

BENEFITS

This project should increase Middleport's freezing capabilities by 25 percent while reducing utility costs significantly ($50,000-$100,000). Cost savings would be achieved by improving the energy efficiency of the refrigeration plant and substituting natural gas (running an engine set) for more expensive electricity (running an electric compressor). Heat recovery may enhance the energy efficiency of the new system.

SCHEDULE AND STATUS

Detailed cost analysis has been completed. Middleport Cold Storage is reviewing the economic data and considering refrigeration plant expansion options.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	0	$231,680	$231,680
Middleport Cold Storage	0	208,144	208,144
New York State Electric & Gas Corp.	0	70,000	70,000
CDH Energy	0	8,760	8,760
TOTALS	0	$518,544	$518,544

Contractor: Middleport Cold Storage
Site: Middleport, Niagara County
Contract Duration: 9/96 - 7/98
Key Words: assist business, industrial process, gas, natural gas engine, refrigeration
Project Manager: Bill Reinhardt (518) 862-1090, ext. 3257
Program: Industry
Subprogram: Process Improvements
Contract No.: 4405-IABR-IA-97

-> Food Industry Technology-Transfer Program

Expand use of new process technology by New York State food industry.

BACKGROUND

This technology-transfer program is designed to increase knowledge and awareness of new process technologies among different segments of New York State's food industry and consulting engineers who may need to implement these technologies.

OBJECTIVES

To: (1) stimulate interest in innovative technologies, (2) apprise selected industries and consultants of their applicability, (3) alleviate technical concerns, (4) provide information about the availability of financial support, and (5) stimulate the industrial energy-consulting marketplace.

DESCRIPTION

The American Consulting Engineers Council and the Research and Management Foundation (ACEC/RMF), with the help of Cornell University, (subcontractor), the New York Consulting Engineers Council (NYCEC), and the New York Association of Consulting Engineers (NYACE), is seeking to provide technical assistance to New York State's three largest food-industry subsectors (SIC 202 - Dairy Products, SIC 1203 - Preserved Fruits and Vegetables, and SIC 205 - Bakery Products) and the engineering-consultant community in the form of process-improvement manuals, three energy-improvement seminars, and industrial energy audits.

BENEFITS

NYSERDA's goal in supporting these activities is to accelerate the transfer of new industrial energy technology to manufacturing firms, thus revitalizing industry in New York State. For some firms, adopting innovative energy technology can provide multiple benefits such as greater energy efficiency, enhanced labor and capital productivity, and reduced environmental-control costs. Thus firms can lower their operating costs and be more competitive.

SCHEDULE AND STATUS

The manuals and seminars for the dairy, canning and preserving, and baking industries are completed. The energy-audit element is under way. Three studies have been completed.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$314,286	0	$314,286
American Consulting Engineers Council	50,000	0	50,000
Cornell University	29,958	0	29,958
NYCEC & NYACE*	24,000	0	24,000
TOTALS	$418,244	0	$418,244

* In-kind services

Contractor: American Consulting Engineers Council/Research and Management Foundation
Site: Statewide
Contract Duration: 10/88-6/97
Key Words: assist business, industrial process, heat recovery, food industry, drying, separation, refrigeration, technology transfer
Project Manager: Bill Reinhardt (518) 862-1090, ext. 3257
Program: Industry
Subprogram: Process Improvements
Contract No.: 1122-EEED-IEA-90

-> Energy-Efficient Dairy Farm Electrotechnology

Develop and demonstrate seven electrotechnologies designed to improve energy efficiency of New York State's dairy farms.

BACKGROUND

New York State is the third largest milk producer in the United States. New York's dairy farms not only supply fluid milk, but other large dairy products. Dairy farms in New York are still predominantly small, family-run operations whose survival depends on efficiency and labor-saving technologies. Cornell University has developed seven electrotechnologies targeted at improved efficiency in milking, cooling, cleaning, lighting, and air circulation.

OBJECTIVE

To develop and demonstrate electrotechnologies including: (1) milk-harvesting system using adjustable-speed drive (ASD) motor control; (2) pipeline washing system using a logic controller for washing valves and air injector; (3) partial in-line milk-cooling system using ASD motors on the milk pumps; (4) complete in-line milk-cooling system using ASD motors on both the milk and cooling pumps; (5) air-circulation system using ASD fan motors and logic controllers; (6) lighting system using properly selected lamps and luminaries, light-level sensors, and automatic controls; and (7) water-delivery system using ASD pump motors, pressure transducer, and logic controller.

DESCRIPTION

Cornell will develop and test prototype units, and then help the farmers install similar systems on their farms. The utilities will install data-collection equipment on the farms and will monitor system and farm energy consumption. Cornell will analyze the data and determine the electrotechnologies' economic viability.

BENEFITS

New York's dairy farms will benefit from the availability of energy-efficient electrotechnologies applied to their individual situations. New York State will benefit from the continuing viability of its dairy industry.

SCHEDULE AND STATUS

Demonstrations are currently under way for all of these technologies. Commercialization of the adjustable-speed control for the milk harvesting system is under way with more than 20 units installed nationwide.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$282,445	0	$282,445
Cornell University	417,461	0	417,461
Niagara Mohawk Power Corp.	136,364	0	136,364
New York State Electric & Gas Corp.	83,321	0	83,321
Rochester Gas and Electric Corp.	62,759	0	62,759
Dairy farms	83,217	0	83,217
TOTALS	$1,065,567	0	$1,065,567

Contractor: Cornell University
Site: Ithaca, Tompkins County
Contract Duration: 1/95 - 9/97
Key Words: assist business, university, industrial process improvement, dairy
Project Manager: Ed Kear (518) 862-1090, ext. 3269
Program: Industry
Subprogram: Process Improvements
Contract No.: 4017-IABR-IA-95

-> Energy-Efficient Controls for Industrial Compressed-Air Systems

Develop linear-programming-based optimizer to generate best operating setpoints for set of multiple air compressors.

BACKGROUND

More and more manufacturers are aggressively pursuing energy-cost management in an effort to become more competitive. At most industrial sites, the compressed-air system used throughout the plant is often the single largest user of electricity in the plant, accounting for as much as 25 percent of a plant's total utility bill. Plants are operated typically with multiple compressors, each running at some previously manually established operating point. The operating points of each compressor are typically established based on the human operator's knowledge of the plant, but may not be optimal from an energy-use standpoint. Automated supervisory control of multiple compressors is a key part of a complete solution for demand-based control of compressed-air systems.

OBJECTIVE

To develop a compressed-air supervisory controller that will optimally schedule the setpoints of multiple compressor systems in response to demand for air in the plant.

DESCRIPTION

A two-phased approach is planned where the contractor will perform: (1) site selection, survey, and analysis; and (2) development, installation, and one-year monitoring of the controller.

BENEFITS

Many of the electric utilities in New York State are working to form closer ties to their key customers. This program will result in new technology that can provide economic benefits to both the electric utility and its industrial customers with large compressed-air systems. In most cases, the potential reduction in electrical energy consumption will be very large.

SCHEDULE AND STATUS

Phase I is complete, Goulds Pumps in Seneca Falls is the selected site. The majority of the equipment and software has been installed and the monitoring has begun.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$249,000	0	$249,000
ESEERCO	100,000	0	100,000
New York State Electric & Gas Corp.	100,000	0	100,000
Electric Power Research Institute	150,000	0	150,000
Honeywell, Inc.	170,687	0	170,687
TOTALS	$769,687	0	$769,687

Contractor: Electric Power Research Institute
Site: Seneca Falls, Seneca County
Contract Duration: 11/95 - 11/97
Key Words: product development, industrial
Project Manager: Barbara Caropolo (518) 862-1090, ext. 3266
Program: Industry
Subprogram: Industrial Process Improvements
Contract No.: 4130-IABR-IA-96

-> Manufacturing Extension Partnership

Transfer innovative energy-efficient technologies to manufacturing sector.

BACKGROUND

This project supports energy-related outreach and technical-assistance services offered to western New York industry by the Western New York Technology Development Center, Inc. (WNYTDC). These services, part of the federally funded Western New York Manufacturing Extension Partnership (WNYMEP) program, coordinate and streamline delivery of numerous State, local, and utility services to industry. The Advanced Research Projects Agency (ARPA) has sponsored this project as part of its program to enhance the productivity and technological performance of U.S. manufacturing firms.

OBJECTIVES

To inform industry of innovative industrial technologies developed through NYSERDA's industrial programs and provide technical assistance through NYSERDA's research and development and energy efficiency services programs.

DESCRIPTION

WNYTDC will enhance the competitive edge of New York State's industry by sponsoring industrial energy workshops, supporting detailed engineering feasibility studies of innovative energy-efficient process modifications, and developing demonstrations of innovative energy-efficient manufacturing technology.

BENEFITS

This project will lower the cost and increase the benefit of technical assistance to industry. Customer service will be improved by delivering technical assistance to industries while focusing on their energy-related manufacturing needs.

SCHEDULE AND STATUS

Outreach activities began in July 1995. Three workshops have been held. A number of detailed feasibility studies are under way.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$90,000	$90,000	$180,000
WNYTDC	75,000	75,000	150,000
Advanced Research Projects Agency	20,000*	20,000	40,000
TOTALS	$185,000	$185,000	$370,000

*Total ARPA funding for the WNYMEP program was $604,113 in FY 1994-95, $872,330 in FY 1995-96 and, $936,000 in FY 1996-97.

Contractor: Western New York Technology Development Center, Inc. (WNYTDC)
Site: Erie, Niagara, Chautauqua, Allegany, and Cattaraugus counties
Contract Duration: 7/95 - 9/97
Key Words: assist business, industrial process
Project Manager: Bill Reinhardt (518) 862-1090, ext. 3257
Program: Industry
Subprogram: Process Improvements
Contract No.: 4123-IABR-IA-95

-> Paper Sludge Pelletization Technology-Transfer Program

Conduct workshops to promote pelletized paper-mill sludge as boiler fuel.

BACKGROUND
Clarkson University and James River Corporation have been studying the feasibility of pelletizing sludge from the kraft paper process to use as a fuel. This ongoing project is looking at both the pelletization and combustion processes, as well as economic issues.

OBJECTIVE
To introduce paper sludge pelletization technology to New York State's paper industry.

DESCRIPTION
Clarkson will identify paper mills in New York that produce the appropriate sludges, and also will identify other companies that could use the pelletized material as a fuel. Two workshops will be conducted to present the results of this project and promote using pelletized paper-mill sludge as a fuel.

BENEFITS
Kraft paper-mill operations in New York could benefit from a lower-cost disposal option for their sludges. Pelletized sludge users could benefit from a lower-cost fuel.

SCHEDULE AND STATUS
Workshop materials are being finalized.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA Petroleum Overcharge Funds	$150,000	0	$150,000
TOTALS	$150,000	0	$150,000

Contractor: Clarkson University
Site: Potsdam, St. Lawrence County
Contract Duration: 9/94 - 8/97
Key Words: university, environmental, sludge management, industrial waste, alternative fuels, industrial
Project Manager: Ed Kear (518) 862-1090, ext. 3269
Program: Industry
Subprogram: Industrial Process Improvements
Contract No.: 4059-IABR-POP-95

-> High-Temperature Extension Program

Transfer results of high-temperature-processing research program to industries.

BACKGROUND

Over the past four years, Rensselaer Polytechnic Institute (RPI) has conducted a high-temperature-processing research program funded under the Petroleum Overcharge Program. Five areas were investigated, among them high-temperature lubrication and seals, and aluminum extrusion control. The program resulted in several beneficial findings that are now being transferred to industry.

OBJECTIVE

To transfer findings from the high-temperature-processing program to the appropriate industries through visual demonstrations, seminars, videotapes, and other media.

DESCRIPTION

RPI will demonstrate both a taper-quenching system used in conjunction with aluminum extrusion, and the advantages of brush seals in high-temperature turbines and compressors through live demonstrations, videotapes, seminars, and printed materials.

BENEFITS

The target industries will benefit from the application of these energy-saving technologies.

SCHEDULE AND STATUS

The taper-quenching system was installed and demonstrated at Keymark in Fonda, NY. The brush seal demonstration rig has been constructed and a demonstration held at RPI. The videotapes are being produced and the final report is being written.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA Petroleum Overcharge Funds	$350,000	0	$350,000
TOTALS	$350,000	0	$350,000

Contractor: Rensselaer Polytechnic Institute
Site: Troy, Rensselaer County
Contract Duration: 1/95 - 6/97
Key Words: university, industrial process
Project Manager: Ed Kear (518) 862-1090, ext. 3269
Program: Industry
Subprogram: Industrial Process Improvements
Contract No.: 4060-IABR-POP-95

-> New York State Industrial Energy Use Profile

Develop database of energy, economic, and environmental trends of industrial sector.

BACKGROUND

The most recent in-depth profile of industrial energy use in New York State was conducted in 1977. The character of the State's manufacturing sector has changed significantly since then. New industry clusters have developed, some older industries have left, and many of those that remain have made plant and process adjustments to stay competitive. An in-depth, up-to-date evaluation of current industrial energy use in New York State would be invaluable to NYSERDA's program-planning efforts.

OBJECTIVES

To create an updated database of industrial energy-use factors in New York State that: (1) provides reliable estimates of current industrial energy use at the three- and four-digit SIC code level; (2) documents industrial energy use trends; and (3) analyzes the distribution of energy use as correlated to key economic factors such as the number and size of businesses, as well as the quantity and cost of energy used.

DESCRIPTION

The database will be constructed from all available data sources, including: the U.S. Department of Energy's Energy Information Administration, the U.S. Department of Commerce (Census Division), Empire State Development, and the New York State Department of Environmental Conservation. The analysis will develop such factors as: energy cost/value added, energy/labor cost, and energy/materials cost.

BENEFITS

This information will be used by NYSERDA to focus better on areas where benefits can be maximized and address the need to: improve efficiency in industrial processes; develop energy-efficient management of industrial waste; and develop advanced energy-related products and services that offer the potential to conserve or produce energy in the industrial sector and in local communities.

SCHEDULE AND STATUS

The project has been delayed due to the temporary closing of the Census Division in 1995, and data quality problems more recently. Final data collection is now underway. The Census Division must approve all data before it can be released.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$152,500	0	$152,500
TOTALS	$152,500	0	$152,500

Contractor: Research Triangle Institute, North Carolina
Site: Statewide
Contract Duration: 7/95 - 12/97
Key Words: product development, industrial waste, industrial fuel use, end-use demand
Project Manager: Bill Reinhardt (518) 862-1090, ext. 3257
Program: Industry
Subprogram: Energy Systems
Contract No.: 4228-IABR-IA-96

Develop energy-management strategies for controlled-environment agriculture.

BACKGROUND

Producing fresh vegetables and fruits in New York State in controlled environments (e.g., greenhouses) shows much promise due to water-quality problems in major vegetable-growing states and controlled-environment agriculture (CEA) trends in the Northeast and overseas for vegetables and ornamentals. However, these out-of-season, fresh vegetable markets (e.g., lettuce, tomatoes) for CEA crops are now dominated by foreign producers, with limited New York State output. CEA crops have consistently high quality, are available out of season, and can be grown virtually pesticide-free. Reliable production of CEA crops will depend on electricity for supplementary lighting in the winter and ventilation in the warmer months.

OBJECTIVES

To define the optimum lighting scenarios to produce four primary CEA crops, enabling New York State utilities to plan and manage the electric demand of CEA facilities and develop compatible rate structures.

DESCRIPTION

The project will: (1) determine the effect of timing, duration, and intensity of supplemental lighting on crop productivity and quality while controlling water, nutrients, carbon dioxide, temperature, pests, and diseases; (2) develop growth models for each crop to predict the effect on crop productivity of various lighting scenarios; (3) develop economic models to determine optimum lighting regimes for the principal CEA crops; (4) incorporate these analytic tools into user-friendly computer software and manuals for use by utilities and potential CEA growers; (5) model duty factors for ventilating CEA facilities to predict electric-energy use by staged-fan systems; and (6) evaluate the lighting efficiency of high-intensity-discharge (HID) luminaires. A lettuce greenhouse/pond system also will be designed for future commercialization.

BENEFITS

This project will provide utilities, government, and industry with the means to achieve demand-side management within New York's emerging CEA industry to enhance the economic benefits of CEA in the State.

SCHEDULE AND STATUS

Crop production and model development for lettuce and spinach, as well as luminaire testing, have been completed. Software and manuals for growers of lettuce and spinach are being developed. Crop production and model development for two additional crops (tomatoes and pak choi) are under way.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$365,325	0	$365,325
Cornell University	723,658	0	723,658
ESEERCO	277,000	0	277,000
New York State Electric & Gas Corp.	85,000	0	85,000
TOTALS	$1,450,983	0	$1,450,983

Contractor: Cornell University
Site: Ithaca, Tompkins County
Contract Duration: 4/91-7/97
Key Words: assist business, university, agricultural, demand-side management, lighting, industrial process
Project Manager: Bill Reinhardt (518) 862-1090, ext. 3257
Program: Industry
Subprogram: Process Improvements
Contract No.: 1548P-EEED-IE-91

Construct and operate commercial tilapia production facility.

BACKGROUND

Controlled-environment aquaculture (CEAq) has the potential to be one of the most energy-efficient and cost-effective methods of producing protein for human consumption. Improved water quality is the key to CEAq success, permitting greater fish densities, which result in decreased costs for energy, labor, and capital per unit produced. To accomplish this, however, water-treatment technologies must be developed that are effective, energy-efficient, inexpensive to install, and reliable. Water-treatment technologies and fish-handling techniques developed at Cornell University's Aquaculture Research Facility have demonstrated these attributes at pilot scale; however, the technologies have not yet been demonstrated in a full-scale commercial facility.

OBJECTIVES

To: (1) minimize the energy use in CEAq production of freshwater species for human consumption, and (2) to assist in the commercial demonstration of innovative CEAq technologies in New York State. The technical objective is to reduce the total production costs from more than $1.00/lb (current) to less than $0.70/lb, with an energy cost of less than $0.17/lb. The project is consistent with our Agricultural Electrotechnology Program, where assistance is provided to encourage commercialization of high-yield, energy-intensive, and constant-output food-production technologies.

DESCRIPTION

Cayuga Aqua Ventures, LLC (CAV) will construct a full-scale commercial CEAq facility with an annual capacity of 300,000 to 660,000 pounds of tilapia. The module will incorporate an innovative water-treatment system, and will use harvesting and fish-handling techniques developed at Cornell. Facility operation will be optimized for maximum yield and energy costs per unit output. Concurrently, CAV will work with feed suppliers to develop an optimized feed mix. Following satisfactory completion of the first facility, up to nine additional units will be constructed to round out CAV's capacity to more than 6,000,000 pounds per year.

BENEFITS

Reduce the energy consumption of an emerging industry. Establish a new industry in NYS whose output reduces net imports of food and provides load growth for utilities. Commercialize technology piloted in the lab make availability less expensive, locally grown fish, without seasonal variations in quantity and quality, and without the risk of parasitic and bacteriological contamination associated with other fish, meat, and poultry.

SCHEDULE AND STATUS

Construction of the facility is scheduled to begin in May 1997.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	0	$35,000	$200,000
Cayuga Aqua Ventures, LLC	0	580,665	580,665
Electric Power Research Institute	0	0	60,000
New York State Electric & Gas Corp.	0	20,000	20,000
TOTALS	0	$635,665	$860,665

Contractor: Cayuga Aqua Ventures, LLC
Site: Freeville, Tompkins County
Contract Duration: 3/97-3/99
Key Words: product development, electricity, wastewater treatment, agricultural
Project Manager: Ed Kear (518) 862-1090, ext. 3269
Program: Industry
Subprogram: Process Improvements
Contract No.: 4523-IABR-IA-97

-> Using Reticulated-Ceramic Baffles to Save Fuel and Reduce Emissions

Demonstrate fuel savings and emissions reductions achievable by using reticulated-ceramic baffles in kilns and incinerators.

BACKGROUND

Advanced reticulated ceramics manufactured by Hi-Tech Ceramics, Inc. are used primarily in filtering molten metals. New applications for reticulated ceramics include diesel-particulate traps and infrared curing and drying. In addition, reticulated baffles can be used in kilns and incinerators to reduce carbon monoxide (CO) emissions.

ACCOMPLISHMENTS

Baffles were produced using reticulated-ceramic material. Alfred University developed a simulation of the baffles, performed accelerated life-testing of the materials, characterized the material, and performed combustion/emission tests. Additional testing was performed at Hi-Tech Ceramics. Pilot-scale testing was not performed because a willing test site could not be found.

FINDINGS AND CONCLUSIONS

The reticulated-ceramic baffles appeared to reduce CO emissions and increase destruction of tracer hydrocarbons which were added to the fuel. This is believed to be due to the increased residence time resulting from the flow restriction caused by the baffles.

REALIZED OR ANTICIPATED BENEFITS

Reticulated-ceramic baffles could improve the energy efficiency of afterburners in the flues of kilns and furnaces, and could reduce the volume of CO and soot emitted from flues. Lower energy input could be required in incinerators burning VOCs.

TECHNOLOGY TRANSFER ACTIVITIES

Hi-Tech Ceramics has been in contact with New York State's incinerator and kiln manufacturers in an effort to obtain a location for a pilot test of the ceramic baffles. A final report is in progress.

FUNDING	TOTALS
NYSERDA	$128,698
Hi-Tech Ceramics, Inc.	94,756
Alfred University	31,077
TOTAL	$254,531

Contractor: Hi-Tech Ceramics, Inc.
Site: Alfred, Allegany County
Contract Duration: 6/93 - 12/96
Key Words: university, assist business, environmental, reticulated baffles, emissions reduction, ceramic industry
Project Manager: Ed Kear (518) 862-1090, ext. 3269
Program: Industry
Subprogram: Process Improvements
Contract Nos.: 3096-EEED-IA-94

Investigate flow and heat-transfer properties of internally finned tubes. Y95

BACKGROUND

Shell-and-tube heat exchangers are used commonly in a variety of industrial processes. Most steam-cycle power-generation facilities use them as condensers. Small improvements in exchanger performance can result in significant improvements in system efficiency. Internally finned tubes have been available for a number of years, and their potential for efficiency improvements has been recognized. The lack of adequate performance/design data, however, has limited their widespread use.

ACCOMPLISHMENTS

Variable property flow in smooth and internally-fined tubes was investigated. Heat transfer and pressure drop for thermally developing laminar and turbulent flow were obtained. Isothermal and diabatic friction factors and Nusselt numbers were measured for a range of fin geometries for both laminar and turbulent flow.

FINDINGS AND CONCLUSIONS

For laminar flow, heat-transfer enhancement compared to smooth tubes was about 75% for tubes with fewer tall fins, with an increase in pressure drop of 50%. For turbulent flow, finned tubes exhibited increased heat transfer compared to smooth tubes, between 20% to 155% depending on the fin geometry. The corresponding increase in pressure drop ranges from 0% to about 170% for these tubes. Smooth-tube variable property-correction factors was found to not be applicable to finned tubes. Improved correlations for Nusselt numbers and friction factors for turbulent flow were found.

REALIZED OR ANTICIPATED BENEFITS

Information of this type is critical to further application of internally finned tubes. The improved design data and correlations will benefit New York State's utilities and industries through the eventual availability of smaller, more efficient shell-and-tube heat exchangers.

TECHNOLOGY TRANSFER ACTIVITIES

Several papers were published in technical journals.

FUNDING	TOTALS
NYSERDA	$99,226
Rensselaer Polytechnic Institute	21,160
Wolverine Tube, Inc.	10,000
TOTALS	$130,386

Contractor: Rensselaer Polytechnic Institute
Site: Troy, Rensselaer County
Contract Duration: 12/93 - 6/96
Key Words: assist business, university, industry, heat-transfer
Project Manager: Ed Kear (518) 862-1090, ext. 3269
Program: Industry
Subprogram: Process Improvements
Contract No.: 3097-EEED-IA-94

Investigate heat-transfer and fouling characteristics of enhanced surface-condenser tubes.

BACKGROUND

Shell and tube condensers in utility power plants and other applications use plain tubes for heat-transfer surfaces. Because these tubes are subject to fouling, they must be cleaned regularly either chemically or mechanically to maintain performance and avoid energy losses. According to recent research, enhancements on the inside surfaces of the tubes may increase heat-transfer efficiency and decrease the fouling rate.

ACCOMPLISHMENTS

Enhanced surface geometries that minimize fouling were identified in a laboratory investigation; empirical relationships that could be used to design enhanced surface condensers were developed; and a small test condenser was designed, constructed and operated at a hydroelectric facility (using Mohawk River water) to demonstrate that enhanced surface tubes reduced fouling characteristics.

FINDINGS AND CONCLUSIONS

The enhanced surface tube had a lower specific fouling thermal and total resistance than the standard tube until the 50th week of exposure. At that point, the performance of the two tubes became comparable. The enhanced surface tubes do provide improved performance, but do not eliminate the need for regular cleaning.

REALIZED OR ANTICIPATED BENEFITS

Heat exchangers constructed using enhanced surface tubes could operate with a 20% smaller heat-transfer area compared to standard tubes. This would result in a significant reduction in capital cost. Furthermore, the reduced fouling and lower specific total thermal resistance of the enhanced tubes will result in higher thermal efficiency for any power plant where they are used.

TECHNOLOGY TRANSFER ACTIVITIES

Graham Corporation, a leading manufacturer of power plant condensers, was actively involved throughout this project. In addition, several papers were published in technical journals.

FUNDING	TOTALS
NYSERDA	$282,782*
Rensselaer Polytechnic Institute	21,756
Graham Corporation	43,645
Conco Systems, Inc.	17,288
TOTAL	$365,471

* including Contract 1235-EEED-IEA-89

Contractor: Rensselaer Polytechnic Institute
Site: Troy, Rensselaer County, and Colonie, Albany County
Contract Duration: 4/89 - 12/96
Key Words: university, product development, industry, enhanced tube, condenser tube, utility, heat recovery, fouling
Project Manager: Ed Kear (518) 862-1090, ext. 3269
Program: Industry
Subprogram: Process Improvements
Contract No.: 3104-EEED-IEA-94

-> Reticulated-Ceramic Inserts for Ceramic Radiant-Tube Applications

Test innovative materials to improve heat transfer in ceramic radiant tubes.

BACKGROUND

There is a growing market in the metals industry for the use of ceramic radiant-tube (CRT) burners in high-temperature furnaces, a form of indirect heating that separates the products of combustion from the materials being processed (the load). This allows the load to be heated under controlled atmospheric conditions. Market growth is limited by high operating costs due to short tube life, fuel cost, and possible future emissions-control costs compared to direct-heating with electricity. This project investigated how reticulated-ceramic inserts (core busters) made by Hi-Tech Ceramics extend tube life, reduce emissions from combustion processes, and increase the heat-transfer to CRTs from gas-fired flames.

ACCOMPLISHMENTS

Silicon carbide (SiC) reticulated-ceramic inserts' effect on the emissions and thermal behavior of CRT heat-exchangers was studied in the Alfred University combustion laboratory. Researchers collected measurements of the emissions and thermal behavior of commercially available SiC CRTs and the durability of the ceramic inserts.

FINDINGS AND CONCLUSIONS

The presence of a single core buster increased the total heat output by about 9%. This corresponds to a 9% energy savings. CO2, H2O, OH, and NOX emissions were reduced as a function of the presence of the core buster. NOX emissions were reduced by 30% and this decrease was linked to a cooling of the product gas.

REALIZED OR ANTICIPATED BENEFITS

Hi-Tech Ceramics is interested in further product development activity to refine the core buster concept into a new product. Refinements in their process for manufacturing the core buster could lead to a more durable material and an economical product with attractive benefits for users.

TECHNOLOGY TRANSFER ACTIVITIES

A draft final report has been prepared. Technical articles have been published, and results have been shared with CRT manufacturers.

FUNDING	TOTALS
NYSERDA	$99,959
Alfred University	26,636
Hi-Tech Ceramics, Inc.	10,000
TOTALS	$136,595

Contractor: Alfred University
Site: Alfred, Allegany County
Contract Duration: 9/94 - 6/96
Key Words: product development, university, industrial process, gas, heat recovery, emissions control
Project Manager: Bill Reinhardt (518) 862-1090, ext. 3257
Program: Industry
Subprogram: Process Improvements
Contract No.: 4018-IABR-IA-95

-> Model Development for Control of Galvannealing Line

Use model of intermetallic phase formation to improve process control of galvannealing line.

BACKGROUND

Galvannealing of steel results in a product with better weldability, corrosion resistance, and paint adherence than traditional galvanized steel. These advantages have resulted in increasing use of galvannealing for automobile body panels. Accurate control of the galvannealing heat cycle is required to control the microstructure of the coating and achieve optimum properties. Current trends toward reducing coating weights (thinner coatings) and competitive pressure to meet rigorous quality specifications increase the importance of accurate process control. Rensselaer Polytechnic Institute has been involved in galvannealing research sponsored by NYSERDA for the last four years. Much of this work has been directed toward developing both a fundamental understanding of the galvannealing process and a mathematical model to predict microstructure evolution during the heat cycle. Bethlehem Steel has developed a feedback controller based on a dynamic, non-linear model for its Lackawanna plant. This controller could be improved by incorporating a comprehensive microstructure model.

ACCOMPLISHMENTS

Models for microstructure growth in galvannealing coatings were developed for various substrate compositions and different coating weights. These models were based on the actual process and materials used at the Lackawanna facility. RPI also developed a computer program based on the model. The computer code was written to be compatible with code being developed by Bethlehem Steel for use in a new control system for the Lackawanna facility.

FINDINGS AND CONCLUSIONS

A model of microstructure growth in galvannealing coatings can be developed that predicts the properties of processed materials based on process parameters. Furthermore, this model can be expressed in a form compatible with current process-control technologies.

REALIZED OR ANTICIPATED BENEFITS

This project was integrated in to a parallel effort by Bethlehem Steel to design and install a sophisticated process-control system for its Lackawanna facility. The new control system is scheduled to be installed by the end of 1997. Improved process controls are expected to result in annual savings of more than $2 million.

TECHNOLOGY TRANSFER ACTIVITIES

Bethlehem Steel is using the results in its control system design effort. In addition, several papers were presented at conferences and published in technical journals.

FUNDING	TOTALS
NYSERDA	$97,472
Rensselaer Polytechnic Institute	11,913
Bethlehem Steel	33,490
TOTALS	$142,875

Contractor: Rensselaer Polytechnic Institute
Site: Troy, Rensselaer County, and Lackawanna, Erie County
Contract Duration: 9/95 - 12/96
Key Words: university, assist business, industrial process
Project Manager: Ed Kear (518) 862-1090, ext. 3269
Program: Industry
Subprogram: Process Improvements
Contract No.: 4215-IABR-IA-96

-> Reducing Waste in the Metals-Plating Industry Using Hybrid Membrane Systems

Develop and demonstrate hybrid reverse-osmosis membrane systems for cyanide-bearing waste.

BACKGROUND

Approximately 15,000 metals-plating job shops in the U.S. generate about 10 million tons of plating waste annually; 3,000 of these firms are in New York State. Spent baths and rinse waters are a major portion of plating wastes. Chemical precipitation of the heavy metals is currently the primary method to treat these materials; however, disposal of resulting hydroxide sludge is a significant environmental problem. A membrane-separation system similar to that developed by Rensselaer Polytechnic Institute (RPI) and NYSERDA for hydrofluoric etching solutions in the semiconductor industry will be developed. Stainless Design Corp. (SDC) will manufacture the recovery/reuse systems in Saugerties. The systems will be demonstrated at Keytech Corp., Buffalo.

OBJECTIVE

To develop, build, and demonstrate two hybrid reverse-osmosis membrane-separation systems to use in electroless nickel-plating. One hybrid system will be developed for electroless nickel-plating baths and rinse waters; another will be developed to separate cyanide-bearing plating wastes from process wastewater. The systems will recycle wastewater and metals back into the process, reducing waste treatment and disposal.

DESCRIPTION

A literature search and economic evaluation of the technology will be conducted. RPI will characterize the process-waste stream from the demonstration site. Two hybrid reverse-osmosis systems will be designed and built by SDC. RPI will select and evaluate thin-film composite membranes and membrane configurations for compatibility with the process wastes. The two hybrid systems will be installed at Keytech and monitored for six months. Data on removal efficiencies, flux rates, purity of recovered materials, energy consumption, membrane durability, and fouling will be collected.

BENEFITS

Plating wastes, including cyanide-containing wastes, and associated disposal liabilities and costs, would be reduced significantly. These wastes contain recoverable materials that may be reused, thereby reducing the demand for energy-intensive feedstocks. Water use and subsequent water treatment also will be reduced as water is recovered and reused. If the technology is commercialized, it would undoubtedly result in a new product line for SDC and $5-10 million in additional sales.

SCHEDULE AND STATUS

A prototype system has been installed at Keytech and process data are being collected. Keytech is looking at installing an additional membrane unit to achieve 90% recovery. The project is being expanded to look at the effectiveness of using resins to concentrate waste metals for plating rinse water.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$300,000	0	$300,000
Stainless Design Corp.	261,454	0	261,454
Rensselaer Polytechnic Institute	44,000	0	44,000
Keystone/Keytech Corp.	50,000	0	50,000
TOTALS	$655,454	0	$655,454

Contractor: Stainless Design Corp.
Site: Saugerties, Ulster County, and Buffalo, Erie County
Contract Duration: 4/95 - 12/97
Key Words: environmental, product development, industrial waste, electroplating
Project Manager: Adele Ferranti (518) 862-1090, ext. 3206
Program: Industry
Subprogram: Waste Minimization
Contract No.: 4029-IABR-IA-95

-> Water Reuse and Metals Recovery in the Metals-Plating Industry

Recover and reuse water and metals in the metals-plating industry.

BACKGROUND

Metal-finishing facilities typically have once-through systems that use large amounts of water, chemicals, and metals. Approximately 15,000 metals-plating firms in the U.S. generate about 10 million tons of plating waste annually; 3,000 of these firms are in New York State. Many opportunities exist for recovering and reusing plating baths and rinsewaters, as well as the plating metals. In some cases, commercially available technologies such as ion-exchange and ozonation could be used to recover and reuse metals-plating materials.

OBJECTIVES

To facilitate water and metals recovery and reuse technologies in the metals-plating industry. Plating wastes from three New York metals-plating firms will be analyzed to determine if commercially available technologies can be applied to various waste streams. Transfer of the relevant technologies to other New York State firms through a workshop and development of manuals is key to this project.

DESCRIPTION

The Research Foundation of the State of New York (SUNY), working with the New York State Center for Hazardous Waste Management and three New York State metals-plating companies, will develop treatability tests and manuals for evaluating water recovery and reuse technologies and practices based on the waste streams at each facility, and evaluate the applicability of ion-exchange systems, issues related to resin regeneration, and the use of ozonation for cyanide destruction. The Research Foundation also will hold a workshop to disseminate the results of the project.

BENEFITS

This project will assist New York State metals-plating firms in evaluating and selecting recovery and reuse technologies appropriate for their waste streams. Ion-exchange systems may be a cost-effective, energy-efficient recovery strategy. Ozonation also may effectively replace alkaline chlorination for cyanide destruction and may be very compatible with ion-exchange systems.

SCHEDULE AND STATUS

The project is under way. Data are being collected for the treatability studies. Ozone is being evaluated for cyanide destruction, and preliminary results look promising. Resins also are being evaluated.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	0	$66,593	$66,593
Research Foundation of SUNY	0	37,464	37,464
L.D Mc Cauley/McGard, Inc.	0	9,666	9,666
General Super Plating Co., Inc.	0	9,666	9,666
Brainerd Manufacturing Co., Inc.	0	9,667	9,667
TOTALS	0	$133,056	$133,056

Contractor: Research Foundation of SUNY, SUNY/Buffalo
Site: Buffalo, Erie County
Contract Duration: 7/96 - 7/97
Key Words: assist business, environmental, industrial waste, metals-plating
Project Manager: Adele Ferranti (518) 862-1090, ext. 3206
Program: Industry
Subprogram: Industrial Waste Minimization
Contract No.: 4412-IABR-IA-97

-> Recovering and Recycling Chrome While Producing Organic Fertilizer from Scrap Leather

Conduct bench-scale testing and analysis to determine feasibility of filtering and precipitating chrome from scrap leather.

BACKGROUND

Omnicology produces a fertilizer from leather scrap, a renewable natural resource with a high nitrogen content in the form of proteins. A non-toxic form of chrome, almost universally used to tan leather, reduces the use of scrap leather to produce fertilizer, resulting in wasted energy, significant landfill disposal requirements and costs, and excessive use of virgin chrome.

Omnicology owns patents and proprietary information for converting solid leather scrap into a pathogen-free "Natural Blend" ureaformaldehyde slow-release fertilizers trademarked "Organiform." Omnicology uses more than 2000 tons of leather cuttings annually.

OBJECTIVE

To identify an economical means of reducing the amount of tri-valent chrome in leather scrap before producing "Organiform." The chrome removed will be recovered for reuse in manufacturing leather.

DESCRIPTION

A literature search will focus on publications and patents. Then, laboratory work will explore acid/base manipulation to precipitate chrome oxide and recover it as a sulfate. Additional laboratory work will explore chrome flocculation followed by acid dissolution to recover chrome sulfate solution. The quality of the chrome recovered will be compared with the quality of the chrome used by the tanners, as will the side streams generated by the process. Also, the costs and benefits of recovering and reusing the chrome will be analyzed. Recommendations for further research, development, and demonstration activities will be included in the final report.

BENEFITS

Energy and cost savings will accrue from (1) using less natural gas than is required to produce synthetic fertilizer, (2) recovering and reusing chrome, and (3) reducing the need for scrap and sewage disposal. This project will enable Omnicology to increase its use of leather scrap that normally would be landfilled from 2,000 to 10,000 tons annually. If this project is successful, production of "Organiform" as a sludge additive for agricultural applications will increase significantly. In addition, Omnicology expects to become a competitive vendor of chrome to tanners.

SCHEDULE AND STATUS

Laboratory work is complete, showing that the chrome can be removed and a very pure form of protein produced. Omnicology is evaluating project results and anticipates additional work to integrate the process into its manufacturing operations.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$29,494	0	$29,494
Omnicology, Inc.	29,494	0	29,494
TOTALS	$58,988	0	$58,988

Contractor: Omnicology, Inc.
Site: Gloversville, Fulton County
Contract Duration: 9/94 - 7/97
Key Words: product development, environmental, industrial waste, leather, fertilizer, chrome
Project Manager: Adele Ferranti (518) 862-1090, ext. 3206
Program: Industry
Subprogram: Waste Minimization
Contract No.: 4081-IABR-IA-95

-> Recovery and Reuse of Pickling-Acid Waste

Demonstrate closed-loop waste pickling-acid recovery system for use by iron and steel industries.

BACKGROUND

The high temperatures associated with metal processing cause surface oxides to form on the metal that are normally removed by "pickling," in which the metal is immersed in an aqueous acid solution. Pickling acids are contaminated by metal salts and eventually must be discarded, reducing productivity and quality control. In the U.S., about 250 million gallons per year of waste sulfuric acid is generated from iron- and steel-pickling operations. This acid must be neutralized with lime and disposed of at a cost of $1 to $5 per gallon. The Green Technologies Group (GTG) has developed the Pickliq process, which combines membrane-diffusion dialysis with conventional refrigerated crystallization to continuously recover sulfuric acid and produce a marketable non-hazardous ferrous-sulfate crystal.

OBJECTIVE

To design, construct, demonstrate, and monitor the Pickliq system. The process will be demonstrated at O.W. Hubbell and Sons, Inc., a galvanizing plant in New York Mills.

DESCRIPTION

Following design, construction, and installation, the demonstration unit will undergo an initial start-up and shakedown phase, followed by a three-month demonstration. During this time, production capacity, process efficiency, and product characteristics will be measured and evaluated.

INFACTIX of Rotterdam will conduct a market and economic analysis to profile the potential users of the Pickliq technology and the recovered ferrous-sulfate by-product. A literature search of information on pickling-process waste technologies and ferrous-sulfate applications will be conducted, as will a search of relevant databases dealing with known pickling-acid waste generators. A survey of potential Pickliq technology and ferrous-sulfate users will be conducted.

BENEFITS

Operating at full capacity, the O.W. Hubbell facility, a relatively small galvanizing facility, could save more than $300,000 per year in material and waste costs using the Pickliq system. One ton of steel processed/pickled generates approximately 100 pounds of waste. The U.S. metals-processing industry could save $250 million to $1.25 billion per year in landfilling costs associated with lime-neutralized pickling liquor. The Pickliq process also could reduce energy usage by about 5×10^{12} Btu per year.

SCHEDULE AND STATUS

The Pickliq system has been installed and is being monitored. Waste acids are being recovered and ferrous sulfate is being sold. Several companies have expressed an interest in purchasing the system.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$235,846	0	$235,846
O.W. Hubbell and Sons, Inc.	235,846	0	235,846
TOTALS	$471,692	0	$471,692

Contractor: O.W. Hubbell and Sons, Inc.
Site: New York Mills, Oneida County, and Rotterdam, Schenectady County
Contract Duration: 9/95 - 10/97
Key Words: environmental, product development, industrial waste, electroplating
Project Manager: Adele Ferranti (518) 862-1090, ext. 3206
Program: Industry
Subprogram: Waste Minimization
Contract No.: 4202-IABR-IA-95

-> Eliminating Zinc, Cadmium, and Cyanide in Electroless Nickel-Plating

Develop and demonstrate non-zincate activator for electroless nickel-plating.

BACKGROUND

In electroless nickel (EN)-plating, nickel is deposited on a substrate without the use of electrodes or any external source of electricity. A zincate activator bath is used to prepare aluminum substrates before EN plating. Zincate contains zinc, nickel, cadmium, and cyanide, and has a pH of 10.5, while most EN baths have a pH of 4.8. This pH difference results in pits and nodes on a plated surface. As a result, excess coating is applied and polished off to obtain a smooth surface. Together with Le Kem, Inc., Metal Arts has developed a non-zincate activator bath with a pH more compatible with the EN bath. Initially, Metal Arts is targeting two aluminum applications for this technology: computer rigid memory disks (RMDs) and automotive wheels. Metal Arts will demonstrate the technology at Coating Technology, Inc. in Rochester for wheel coating and at an RMD manufacturing facility.

OBJECTIVE

To demonstrate a non-zincate activator bath to eliminate the use of hazardous and toxic chemicals such as zinc, cadmium, and cyanide in EN plating. Metal Arts and Le Kem also have developed a high-phosphorus EN bath that uses a reducing agent (sodium hypophosphate) to initiate and maintain an autocatalytic reaction to coat aluminum with a nickel-phosphorus coating.

DESCRIPTION

Metal Arts, Coating Technology, and other consultants will demonstrate and evaluate the high-phosphorus and non-zincate processes separately and in tandem. At both demonstration sites, the plating lines will be operated and process data collected. Activator bath formulas, mixing requirements, plating characteristics, energy and raw material requirements, and process wastes will be monitored and evaluated.

BENEFITS

Use of the non-zincate and high-phosphorus processes will save manufacturing time and energy, and improve surface quality. The non-zincate bath eliminates toxic zinc, cadmium, and cyanide use, treatment, and disposal, replacing these chemicals with non-hazardous materials. There will be less buildup of zincates in the EN bath, allowing for longer bath life, more metal turnovers, and less downtime for bath regeneration. In addition, use of the non-zincate activator will reduce the need for excessive plating and polishing to obtain a smooth finish. As a result, raw material and energy use, waste generation, and the costs associated with these will be reduced, while production rates will increase.

SCHEDULE AND STATUS

In-process testing is being conducted for RMDs at IBM in Minnesota and at Seagate. Several other computer-component manufacturers are evaluating RMDs that have been plated using the non-zincate process. Several wheel manufacturers also have expressed an interest in this innovative process.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$325,010	0	$325,010
Metal Arts Company, Inc.	325,010	0	325,010
TOTALS	$650,020	0	$650,020

Contractor: Metal Arts Company, Inc.
Site: Geneva, Ontario County, and Rochester, Monroe County
Contract Duration: 6/95 - 8/97
Key Words: environmental, product development, industrial waste, electroplating
Project Manager: Adele Ferranti (518) 862-1090, ext. 3206
Program: Industry
Subprogram: Waste Minimization
Contract No.: 4090-IABR-IA-96

-> Anaerobic Digestion of Industrial and Municipal Waste

Design, construct, and demonstrate anaerobic digester for industrial and municipal waste.

BACKGROUND
By reducing the quantity of waste that must be disposed of, anaerobic digestion can minimize the energy required for waste treatment and disposal.

OBJECTIVE
To design, construct, and demonstrate a full-scale, five-ton-per-day anaerobic-digestion tank to process residential and industrial food-processing wastes.

DESCRIPTION
The Village of Bergen, Larsen Engineering, and Comstock Foods are evaluating anaerobic digestion as a waste disposal alternative to landfilling or using lagoons. The project will investigate facility loading rates and their impacts on biogas production, composition of the waste, and the effect of various waste "recipes" on biogas production and compost quality. The technology's economic and environmental feasibility will be analyzed. The project team will also evaluate markets for the dried waste that results from the process.

BENEFITS
Anaerobic digestion, a proven technology, may have many other applications in the food-processing industry. The production of biogas may help Comstock Foods meet its peak electric-demand requirements. In addition, the resulting compost will be used as a soil additive.

SCHEDULE AND STATUS
The anaerobic digester is operating and producing biogas. An innovative steam dryer (NYSERDA Project No. 1759) has been installed at the site for final drying of the digestate and is being operated and monitored. The Village is investigating markets for the digestate and is working with Comstock Foods to evaluate additional food wastes.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$320,085	0	$320,085
Village of Bergen	152,330	0	152,330
Comstock Foods	134,428	0	134,428
Larsen Engineers (in-kind)	126,149	0	126,149
TOTALS	$732,992	0	$732,992

Contractor: Village of Bergen
Site: Bergen, Genesee County
Contract Duration: 12/92 - 9/97
Key Words: environmental, assist business, industrial waste, wastewater treatment, municipal
Project Manager: Adele Ferranti (518) 862-1090, ext 3206
Program: Industry
Subprogram: Waste Minimization
Contract No.: 1906M-EEED-IEA-93

-> Reducing Toxic Effluents from Metal Organic Chemical Vapor-Deposition Processes

Develop effluent-reduction/monitoring system for use with metal organic chemical vapor-deposition (MOCVD) processes.

BACKGROUND

As metal-feature sizes decrease with each new generation of integrated circuits, new metal-deposition processes must be developed to keep pace with the need for finer pitches at the wiring levels. At the submicron realm, MOCVD processes under development at CVC Products, Inc. of Rochester provide a significant reduction in processing time, material consumption, and energy use compared to the conventional physical vapor-deposition processes currently used. Problems associated with the toxicity of MOCVD reaction products, however, must be addressed before this technology will be viable from an ecological and worker safety viewpoint.

OBJECTIVES

To develop an MOCVD effluent-monitoring system and to evaluate treatment technologies with a goal of developing a monitoring/treatment subsystem compatible with the MOCVD process under development at CVC.

DESCRIPTION

An effluent-monitoring system based on mass spectrometry will be developed. Laboratory experimentation at Clarkson University will use the monitoring system to evaluate various candidate treatment technologies. The most promising candidates will be evaluated by CVC on a commercial-sized reactor using the monitoring system.

BENEFITS

The MOCVD process is a more efficient method to manufacture integrated circuits than that currently used. Integrated circuits manufactured using MOCVD can be more powerful and energy-efficient than those currently available. Integrated-circuit manufacturers and computer users will benefit. CVC will benefit from improved competitiveness. Clarkson will benefit from the real-world experience.

SCHEDULE AND STATUS

The cluster tool is undergoing testing at The University at Albany. A test rig has been constructed at Clarkson and testing is nearly complete. Equipment availability problems have resulted in unexpected delays.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$120,000	0	$120,000
CVC Products, Inc.	130,000	0	130,000
Clarkson University	16,000	0	16,000
TOTALS	$266,000	0	$266,000

Contractor: CVC Products, Inc./Clarkson University
Site: Rochester, Monroe County; Potsdam, St. Lawrence County; and Albany, Albany County
Contract Duration: 12/94 - 6/97
Key Words: product development, university, materials
Project Manager: Ed Kear (518) 862-1090, ext. 3269
Program: Industry
Subprogram: Waste Minimization
Contract No.: 4016-IABR-IA-95

-> Waste Minimization in Whiteware Manufacturing

Apply advanced ceramic-processing theory to identify and reduce causes of defects in whiteware-manufacturing process.

BACKGROUND

Problems encountered during the plastic-forming process when producing dinnerware and high-tension electric insulators represent approximately $16 million in lost energy, raw materials, and labor in New York State every year. Alfred University has identified a new technique for characterizing plasticity of clay-based systems that can be used to correlate variations in raw materials and colloidal-suspension behavior with changes in plasticity, which lead to defective products.

OBJECTIVE

To establish relationships among raw materials, colloidal suspension rheology and plasticity, and the manufacture of defective whiteware products.

DESCRIPTION

This project will be performed in two phases. In Phase I, Alfred will characterize raw materials and colloidal-suspension stability and rheology to develop a fundamental understanding of the factors that affect the processing and processability of whitewares. In Phase II, Alfred will work with the industrial partners to correlate the relationships developed under Phase I with the occurrence of defects in the normal production process. Scale batches will be produced and evaluated to determine the range of plasticity necessary to minimize waste.

BENEFITS

New York State's whiteware manufacturers will benefit from the development of techniques to minimize defects in their processes, which currently account for approximately 10-15 percent of total production.

SCHEDULE AND STATUS

Phase I of this two phase project is nearing completion, and the report is being written. Phase II is under development.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$94,451	0	$94,451
Alfred University	30,000	0	30,000
Buffalo China	43,500	0	43,500
Victor Insulator	22,300	0	22,300
TOTALS	$190,251	0	$190,251

Contractor: New York State College of Ceramics at Alfred
Site: Alfred, Allegany County; Buffalo, Erie County; and Victor, Ontario County
Contract Duration: 9/95 - 5/97
Key Words: assist business, environmental, university, industrial waste
Project Manager: Ed Kear (518) 862-1090, ext. 3269
Program: Industry
Subprogram: Waste Minimization
Contract No.: 4217-IABR-IA-96

-> Isopropyl Alcohol Recovery and Reuse

Develop resin-based purification system for continuously reprocessing waste isopropyl alcohol for high-purity applications.

BACKGROUND

High-purity isopropyl alcohol (IPA) is used as a solvent in the manufacture of semiconductors. In fact, each year the semiconductor industry consumes 5.6 million gallons of IPA. IPA is considered to be the next industrial chemical targeted for recovery and reuse by the semiconductor industry after sulfuric and hydrofluoric acids. Present practices for handling waste IPA include off-site disposal or distillation for reprocessing and recovery/reuse. Because distillation is very energy-intensive, this project is designed to develop a more energy-efficient approach. Stainless Design Corp. (SDC) of Saugerties manufactures high-purity gas and handling systems for the semiconductor industry.

OBJECTIVE

To design, construct, and demonstrate the technical and economic benefits associated with an IPA reprocessor that uses a resin-bed system instead of distillation to produce IPA with contaminants classified in parts per billion (PPB).

DESCRIPTION

Rensselaer Polytechnic Institute (RPI) will identify potential resins suitable for purifying IPA to the PPB level of contamination. SDC will conduct a market analysis to identify industries other than the semiconductor industry for cross-application of the technology. SDC will work with RPI to select and evaluate candidate resins and develop the configuration for the resin-bed system. SDC then will develop, build, and test a prototype system.

BENEFITS

Based on SDC's preliminary analysis, the reprocessor may save approximately $260,000 per year in a typical application using 27,000 gallons of IPA. The reprocessor is expected to have a recovery efficiency of 90 percent and save 96 kWh for every 100 gallons of IPA recovered and reused. This project will help a New York company develop and manufacture an energy-efficient IPA reprocessor that may be exported, as SDC has done with its other distillation technologies.

SCHEDULE AND STATUS

System performance has exceeded original expectations. SDC is finalizing arrangements for an in-process demonstration of the system and is preparing the final report.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$254,652	0	$254,652
Stainless Design Corp.	223,543	0	223,543
Rensselaer Polytechnic Institute	34,800	0	34,800
TOTALS	$512,995	0	$512,995

Contractor: Stainless Design Corp.
Site: Saugerties, Ulster County, and Troy, Rensselaer County
Contract Duration: 3/94 - 9/97
Key Words: product development, environmental, industrial process, membranes
Project Manager: Adele Ferranti (518) 862-1090, ext. 3206
Program: Industry
Subprogram: Waste Minimization
Contract No.: 3105-EEED-IEA-94

Develop chemical vapor deposition (CVD) of copper for use in semiconductor manufacturing process and use membrane technology in recovery and reuse of spent wet-etch solutions.

BACKGROUND

Reducing the size and increasing the packing density of integrated circuits have created a need for dramatic improvements in interconnect technology and contamination control. Disposing of hazardous waste, such as hydrofluoric acid (HF) solutions used in manufacturing semiconductors, is becoming more expensive due to environmental regulations.

ACCOMPLISHMENTS

New CVD methods and processes were developed that are capable of producing commercially viable copper and low dielectric polymeric films that can be used in the future for multilevel, high-speed, high-density, micro-electronic devices. This provides for a fundamental change in current aluminum-silicon dioxide technology by reducing resistance capacity and time delays, while improving electromigration resistance, one of the limitations in achieving high-speed circuits, higher performance efficiencies, and enhanced reliability. It also was proved that HF solutions can be reprocessed and ultrapurified using reverse osmosis (RO) technology.

FINDINGS AND CONCLUSIONS

Both thermal and plasma-assisted CVD can be used to produce uniform, low-resistivity, high-quality, films that can be deposited on surfaces with complex geometries under commercially acceptable process conditions. Using RO membranes to recycle HF opens up many new opportunities for RO technology. More than 90 percent of spent HF was recovered experimentally, reducing waste disposal needs, increasing wafer yields due to improved purity levels, and reducing chemical handling and energy requirements and the demand for ultrapure water.

REALIZED OR ANTICIPATED BENEFITS

CVD and low-dielectric films can be very useful in reducing integrated circuit dimensions and process costs, and enhancing yields. These materials are central to the future of the new Semiconductor Research Corporation Center for Advanced Interconnect Science and Technology that has been recently established at Rensselaer Polytechnic Institute (RPI). The Center is expected to enhance economic development in the Capital Region while increasing the competitiveness of the U.S. microelectronics industry. A New York manufacturer has adopted the RO technology for application in the metals-plating industry (NYSERDA Project No. 4029).

TECHNOLOGY TRANSFER ACTIVITIES

A course on "Modelling Multilevel CVD Processes" was held at RPI. Two research conferences discussing low-dielectric-constant materials and CVD were held at RPI, attracting several hundred attendees. Many journal articles have been published and presented at professional society meetings and national conferences. One of the papers was presented at TECHCON '96 and it won the award for best paper in the interconnect sciences category.

FUNDING	TOTALS		
NYSERDA	$675,000		
Rensselaer Polytechnic Institute	200,600	Hewlett Packard	40,000
SEMATECH Center for Excellence	280,000	Keystone	15,000
General Electric Company	39,000	Mempro	20,200
IBM	48,400	Essential research	5,000
Kodak	32,000	Reprocessing industry - various	10,000
Motorola	10,000		
TOTALS			$1,375,200

Contractor: RPI, Department of Chemical Engineering
Site: Troy, Rensselaer County, and Buffalo, Erie County
Contract Duration: 9/89 - 10/96
Key Words: university, product development, industrial process, separation, CVD
Project Manager: Adele Ferranti (518) 862-1090, ext. 3206
Program: Industry
Subprogram: Waste Minimization
Contract No.: 1301-EEED-IEA-89

-> Demonstrating an Energy-Efficient Solvent-Recovery System

Design, test, and demonstrate a hot-gas volatile organic compound (VOC) recovery system.

BACKGROUND

This project was funded under the National Industrial Competitiveness Through Environment, Energy and Economics (NICE^3) Program sponsored by the U.S. Department of Energy, the U.S. Environmental Protection Agency, and the U.S. Dept. of Commerce. The project was designed to develop an innovative, cost-effective recovery and reuse technology to assist manufacturers in reducing or eliminating the emission of VOCs into the atmosphere.

ACCOMPLISHMENTS

Mechanical Technologies, Inc. (MTI) designed, tested, and demonstrated a hot-gas solvent-recovery system that incorporates a zeolite bed. The system was constructed with commercially available components in an innovative configuration and was designed to recover solvents for reuse at a low first cost. The system was installed and operated for several weeks at Pajco Products, a paper-coating facility in Lowville.

FINDINGS AND CONCLUSIONS

MTI originally planned to design a carbon-bed adsorption system that would use the combustion products from the natural-gas-fired hydronic heater as the desorbing gas media. After many months of testing and analyses, zeolite was chosen for the adsorption system and bottled nitrogen was used for purging the zeolite bed. Both changes reduced the potential for bed fires. Solvents recovered from the system were a mixture of toluene, acetone, alcohols, and water and were not suitable for reuse in Pajco's process line. The cost to capture the VOCs is estimated at $20 per gallon using MTI's system.

REALIZED OR ANTICIPATED BENEFITS

It was anticipated that MTI's system would be a low-cost ($70,000) technology to assist manufacturers trying to meet environmental regulations related to emission of VOCs into the atmosphere. Although the system effectively captured the VOCs, it is very difficult to directly reuse the solvent captured if it is mixed with any other solvents or liquids (as is commonly done in industries such as printing). Additionally, during the time that the technology was being developed, many industries eliminated solvents from their processes.

TECHNOLOGY TRANSFER ACTIVITIES

MTI made several technical presentations promoting the project and held a demonstration of the system at Pajco. A final report also has been prepared.

FUNDING	Totals
NYSERDA	$356,008
U.S. Department of Energy	261,629
Niagara Mohawk Power Corp.	50,000
Mechanical Technologies, Inc.	174,282
Carrier Corp.	32,000
TOTALS	$873,919

Contractor: Mechanical Technologies, Inc. (MTI)
Site: Latham, Albany County, and Lowville, Lewis County
Contract Duration: 4/92 - 10/96
Key Words: environmental, product development, emissions control
Project Manager: Adele Ferranti (518) 862-1090, ext. 3206
Program: Industry
Subprogram: Waste Minimization
Contract No.: 1931-EEED-IEA-93

-> Incineration of Kraft Pulp and Paper Process Sludge

Investigate technical and economic feasibility of pulp and paper sludge pelletization and incineration for energy recovery in commercial boiler.

BACKGROUND

Primary wastewater treatment sludge is one of the major waste by-products of the pulp and paper industry. While landfilling this sludge is the most common means of disposal, reduction, reuse, and recycling also are being investigated.

Under proper conditions, it may be feasible and economical to combust pulp and paper sludges for energy recovery. However, barriers to the widespread implementation of the technology have caused hesitation on the part of the pulp and paper industry to use sludge in a waste-to-energy venture.

ACCOMPLISHMENTS

Papermill sludge was processed into pellets that were then co-fired with wood chips in a commercial boiler. Chemical mass balance on several constituents was performed. Air emissions were monitored and ash was analyzed.

FINDINGS AND CONCLUSIONS

Air emissions during the test burns were below regulatory levels for all 186 hazardous air pollutants. The ash generated was considered non-hazardous by Toxicity Characteristic Leaching Procedure (TCLP) testing. Sludge from the James River Carthage Mill can be used as an alternative fuel source with minimal environmental impact.

REALIZED OR ANTICIPATED BENEFITS

This proof-of-concept demonstration was an important step toward application of this technology. James River and other New York State papermills will benefit from this alternative disposal option. New York State will benefit from an eventual reduction in the volume of sludge disposed of in landfills.

TECHNOLOGY TRANSFER ACTIVITIES

The information developed during this project will be presented to New York State's papermills at workshops being developed by Clarkson University under 4059-IABR-POP-95.

FUNDING	TOTALS
NYSERDA	$202,596
Clarkson University	129,939
P.M. Earth, Inc.	16,150
James River Corp.	32,978
TOTALS	$381,663

Contractor: Clarkson University
Site: Potsdam, St. Lawrence County
Contract Duration: 11/93-6/96
Key Words: assist business, university, pulp sludge, paper sludge, pellet, incineration
Project Manager: Ed Kear (518) 862-1090, ext. 3269
Program: Industry
Subprogram: Waste Minimization
Contract Nos.: 3095-EEED-IA-94

-> Biological Activated-Carbon (BAC) Treatment of Waters Containing PCBs

Demonstrate and evaluate feasibility of using biological activated-carbon process to treat PCB-contaminated water.

BACKGROUND

PCBs, because of the risk they pose to health, are a pollutant of major concern in New York State and the nation. PCBs and products containing PCBs have been disposed of in ponds, lagoons, and landfills. Potential methods for treating waters containing PCBs include chemical oxidation, incineration, carbon adsorption, and biodegradation.

ACCOMPLISHMENTS

A method was developed for generating PCB aqueous solutions. Aerobic biodegeneration of PCB was studied extensively with the main focus on how sorbtion of PCBs on particulates affects biodegradability. Degradation of PCBs in aqueous solutions by ultraviolet (UV) light using titanium dioxide (TiO_2) as a photocatalyst also was investigated.

FINDINGS AND CONCLUSIONS

Excellent removal of PCBs (in excess of 90%) was achieved when they were in aqueous solutions. However, when small particles were added to the aqueous PCB solutions, significant sorption of PCBs occurred. The resulting partitioning adversely affected chemical oxidation, and both biodegradation and carbon-adsorption treatment efficiency for total PCBs. Treatment processes are most effective for contaminants in the aqueous phase. PCB partitioning onto solid phase reduces its availability and adversely impacts treatment.

REALIZED OR ANTICIPATED BENEFITS

The understanding of the effects of particulates on the treatment of aqueous PCB solutions has been greatly enhanced by this project.

TECHNOLOGY TRANSFER ACTIVITIES

The results of this project have been published in a number of technical journals.

FUNDING	TOTALS
NYSERDA	$75,779
SUNY/Buffalo	10,173
ALCOA	47,036
TOTALS	$132,988

Contractor: SUNY/Buffalo
Site: Buffalo, Erie County, and Massena, St. Lawrence County
Contract Duration: 11/93 - 9/96
Key Words: university, assist business, industry, wastewater treatment, industrial waste, biological activated carbon, biodegradation
Project Manager: Ed Kear (518) 862-1090, ext. 3269
Program: Industry
Subprogram: Waste Minimization
Contract Nos.: 3098-EEED-IA-94

-> Solvent-Free Liquid Photoimageable Solder Mask

Develop solvent-free liquid photoimageable solder mask for application in printed circuit-board industry.

BACKGROUND

Printed circuit-board (CB) manufacturing is based on the use of various organic resist coatings to define circuit-line images for etching, plating, and soldering. The final coating is typically a solder mask or resist that protects conductor and substrate areas from soldering processes and provides other thermal, chemical, and insulating functions. Approximately 20 million pounds of solder mask is applied in the U.S. annually. Corporate Advanced Design and Development, Inc. (CADD) conducted a technical feasibility study evaluating solvent-free alternatives to traditional solder mask.

ACCOMPLISHMENTS

CADD successfully developed a solvent-free solder mask for the printed circuit-board industry. A water-based formula was developed that met the stringent industrial specifications and process requirement presently met by solvent-based formulations.

FINDINGS AND CONCLUSIONS

The formula developed by CADD met all application requirements for application in the CB industry, including: (1) solubility in a 1% aqueous alkaline solution; (2) proper application viscosity for spraying, double-sided roller coating, and curtain coating; (3) good surface appearance; (4) short exposure times; (5) tack-free surface; (6) adhesion to copper and laminate surfaces; (7) no degradation, discoloration, or loss of adhesion during hot-air solder-leveling; and (8) resolution of images to 0.003 inches (three mils).

REALIZED OR ANTICIPATED BENEFITS

The waterborne solder mask could lead to significant benefits in printed circuit-board manufacturing through reduced emissions of hazardous volatile organic compounds (VOCs); increased productivity; decreases in energy requirements associated with ventilation, treatment, and curing times; and improving worker safety. There is a potential to eliminate 1.8 million pounds of VOCs now discharged into the atmosphere annually.

TECHNOLOGY TRANSFER ACTIVITIES

CADD has prepared a final report and an article for publication in a technical journal.

FUNDING	TOTALS
NYSERDA	$93,500
CADD	74,151
U.S DOE/SBIR	67,890
Zeneca Resins	8,000
American Board	31,899
General Electric R&D	4,400
Valspar	4,400
TOTALS	$284,240

Contractor: Corporate Advanced Design and Development, Inc.
Site: Schenectady, Schenectady County, and Vestal, Broome County
Contract Duration: 8/94-1/97
Key Words: environmental, product development, industrial process, printed circuit board, solder mask
Project Manager: Adele Ferranti (518) 862-1090, ext. 3206
Program: Industry
Subprogram: Waste Minimization
Contract No.: 4031-IABR-IA-95

-> Eliminating Acetone as an Industrial Cleaner

Demonstrate ultra-filtration system for recovery and reuse of aqueous-based alternative to acetone.

BACKGROUND

Emsig Manufacturing Corp. of Hudson, NY, uses polyester resin to manufacture buttons. All process containers, tools, and equipment come into contact with the resins used in manufacturing and must be cleaned constantly. Prior to this project, Emsig used acetone to clean process tools and equipment. Acetone, the cleaning solvent most commonly used in the polyester industry, is regulated both as a volatile organic compound (VOC) and as a hazardous waste. Emsig investigated an alternative aqueous-based cleaner (Cleaner No. 10); however, the alternative cleaner is three times more expensive than acetone and created a different waste-disposal problem because it does not dissolve the resin.

ACCOMPLISHMENTS

Emsig installed, tested, and evaluated the economic and technical feasibility of an ultra-filtration membrane system to recover and reuse a non-hazardous alternative cleaner. Emsig was able to eliminate the use of all the acetone in one production area and significantly reduce it in a second process.

FINDINGS AND CONCLUSIONS

The ultra-filtration system enabled the cost-effective replacement of acetone with Cleaner No. 10 through recovery and reuse of the expensive alternative cleaner. The system has a recovery rate of nearly 80%. Energy requirements for the ultra-filtration system are estimated at 76 kw per drum of reclaimed cleaner. All system components had to be resistant to styrene, a component of the resin.

REALIZED OR ANTICIPATED BENEFITS

During the first eight months of operation, the ultra-filtration system and use of Cleaner No. 10 eliminated the need for 140,000 pounds of acetone. Total material and disposal costs associated with the acetone would have been $106,000. During the same period, 31,000 pounds of cleaner No. 10 were used at a cost of $21,000, resulting in a savings of $85,000. With total system costs of $116,000, an 11-month payback is expected. Annual savings are expected to be $133,000. Emsig also avoided having to dispose of 100 tons of acetone annually.

TECHNOLOGY TRANSFER ACTIVITIES

The system was demonstrated, Emsig received a 1996 Governor's Pollution Prevention Award for the project, a paper was prepared and submitted to a technical publication, and a final report was prepared. The principal investigator at Emsig is now a regional sales representative for Cleaner No. 10 and is forming a New York State company to manufacture and distribute the ultra-filtration systems.

FUNDING	TOTALS
NYSERDA	$45,831
Emsig Manufacturing Corp.	45,831
TOTALS	$91,662

Contractor: Emsig Manufacturing Corp.
Site: Hudson, Columbia County
Contract Duration: 9/94 - 2/97
Key Words: assist business, environmental, industrial waste, volatile organic compound
Project Manager: Adele Ferranti (518) 862-1090, ext. 3206
Program: Industry
Subprogram: Waste Minimization
Contract No.: 4039-IABR-IA-95

-> Fiberglass Waste Recycling

Develop and demonstrate system to recycle waste-glass fiber using gaseous emissions.

BACKGROUND

Fiberglass manufacturers are faced with two significant waste/pollution problems: gaseous emissions and scrap glass. The most common method for dealing with these wastes is to disperse the gas through stacks and to landfill the scrap glass. Unlike the flat- and bottle-glass industry, where recycled waste glass makes up 35% or more of the batch, the scrap glass generated during fiberglass production is difficult to handle and is usually contaminated by other materials.

ACCOMPLISHMENTS

Fiber Glass Industries (FGI) of Amsterdam (Montgomery County) demonstrated a pilot system to collect scrap fiberglass and form it into a filter bed. The bed was used to filter gaseous emissions, while the gases burned off organics from the scrap. The used filter-bed material was then used as batch and fed back into the glass melt.

FINDINGS AND CONCLUSIONS

The system developed by FGI reduced emissions of boron and fluoride particulates by 97%. The resulting emissions from the pilot system had zero opacity. Waste fiberglass is an effective media for filtering gaseous emissions from the glass furnace.

REALIZED OR ANTICIPATED BENEFITS

In addition to nearly eliminating particulate emissions, the system developed by FGI could eliminate all of the plant's waste fiberglass and result in energy and waste savings of $400,000 annually.

TECHNOLOGY TRANSFER ACTIVITIES

A final report was prepared detailing the results of the project.

FUNDING	TOTALS
NYSERDA	$40,647
Fiber Glass Industries	40,647
TOTALS	$81,294

Contractor: Fiber Glass Industries
Site: Amsterdam, Montgomery County
Contract Duration: 9/95-1/97
Key Words: environmental, product development, industrial waste, electroplating
Project Manager: Adele Ferranti (518) 862-1090, ext. 3206
Program: Industry
Subprogram: Waste Minimization
Contract No.: 4203-IABR-IA-95

-> Dynamic, Variable-Area, Rechargeable Zinc-Air Battery

Develop, assemble, and optimize prototype zinc-air battery for portable electronic and electric-vehicle applications.

BACKGROUND

Traditional batteries, with their "fixed-area designs" in which every unit (size/weight) of anode is nearly matched with that of cathode, electrolyte, and container, have low energy density, among other limitations. A new, rechargeable zinc-air battery has been designed that uses dynamic variable-area multiple electrodes for charging and discharging. Fresh zinc anode, in the form of porous thin foil, is continuously passed under or coupled to a discharge cathode (wet-proofed, catalyzed carbon). Oxygen from air is supplied through a membrane to carry out the "redox" reaction. The zinc-oxide foil is continuously wound onto another roll. At the end of a cycle, the zinc-oxide sheet is unrolled under an external charge for recharging.

OBJECTIVE

To assemble and demonstrate a fully operational prototype with specific energy output in the range of 300 to 500 Watthr/kg. Phase I will address fundamental issues related to both portable electronic and electric-vehicle applications. In phase II, a prototype suitable for the portable electronic market will be assembled. To serve the electric-vehicle market, the new zinc-air battery will need to address both range and cost, which are a function of volume. Range, however, is a function of total onboard energy and the efficiency with which it is used. The zinc-air battery with fresh anode feed at 500 Watthr/kg would allow a range of up to 500 miles.

DESCRIPTION

The contractor will (1) assemble for demonstration a fully operational model with energy outputs in the range of 300 to 500 Watthr/kg and fast recharging capabilities; (2) establish discharge/recharge capability; (3) measure anode passivation rates, reaction kinetics and ZnO stability, and adherence to the substrate; (4) replace the currently used thick roll of zinc with a tape that has a thin layer of zinc; (5) optimize zinc film's thickness, conductivity and stability; (6) develop seals to contain the electrolyte; (7) optimize the electrolyte for conductivity; (8) design and assemble a prototype battery; (9) optimize the prototype battery's power- and energy-density, recharge capabilities, and system integration; and (10) conduct marketing study.

BENEFITS

The portable electronics and electric-vehicle industries both could use this novel battery, which could lead to notebook computers and camcorders operating for days and cellular phones for weeks before needing a recharge. With this battery, electric-vehicle ranges would be competitive with those of conventional gasoline-powered vehicles. The near-term portable electronics market is estimated at $10 million per year, while the longer-term electric-vehicle market is enormous. This technology could make New York State home to this high-growth-potential battery industry.

SCHEDULE AND STATUS

Phase I has been completed. Phase II will focus on the development of a prototype battery.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	0	$134,937	$359,963
Reveo, Inc.	$75,000	359,749	434,749
TOTALS	$75,000	$494,686	$794,712

Contractor: Reveo, Inc.
Site: Hawthorne, Westchester County
Contract Duration: 9/96 - 10/98
Key Words: product development, battery, materials, electric vehicle
Project Manager: Nag Patibandla and Larry Hudson (518) 862-1090, ext. 3301 and 3209
Program: Industry; Transportation
Subprogram: Materials Advancement; Alternative Fuels for Vehicles
Contract No.: 4366-IABR-IA-97

-> High-Strength Silicon Carbide Gas Igniters

Design, fabricate, test, and market high-strength sintered silicon carbide (SiC) gas igniters used in dryers, ranges, and other gas-heated appliances.

BACKGROUND

Standard Ceramics, Inc. (SCI) developed and patented a high-strength, low-cost, electrically conductive silicon carbide (ECSC) material. ECSC can be processed using a simple pressureless sintering treatment. In this project, SCI will develop a sturdy hot-surface gas (HSG) igniter for cloth dryers, ranges, hot water tanks, and furnaces. About 10 percent of the natural gas used by gas-fired appliances is consumed by their pilot-light ignition systems. The current HSG igniters are made from siliconized or recrystallized silicon carbide using an outdated process that wastes materials and energy, resulting in products with low strength, uncontrollable properties, and low yield. SCI's new ECSC technology results in products with high strength, tight property control, and much simpler and cleaner processing.

OBJECTIVES

To develop a sturdy and reliable gas igniter from ECSC for lighting gas-burning systems by taking advantage of the ECSC technology that provides a combination of desired electrical properties and mechanical strength. Specifically, to process a strong, near-net-shape hot-surface igniter that is both energy- and material-efficient and is superior to and cheaper than currently available ones. Also, to develop and define a near-net-shaping mass-production technology, such as dry-pressing and injection molding, to fulfill the market demand.

DESCRIPTION

The contractor will (1) fine-tune both composition variables, such as starting SiC powder feeds and amount of sintering additives; and processing variables, such as sinter time and temperature, to obtain a reproducible ECSC product; (2) carry-out basic material characterization; (3) develop retrofit design(s) of ECSC igniters compatible with popular holders; (4) fabricate HSG-igniters via conventional green-forming and sintering techniques; (5) characterize and test green igniters; (6) fabricate sintered-ECSC igniter assemblies; (7) optimize both process and properties; and (8) develop commercialization and marketing strategies.

BENEFITS

The process to produce the ECSC is much simpler than the currently used recrystallized-SiC process technology. In the ECSC process, the igniters are green-shaped and sintered at a temperature lower than the recrystallization temperature. It will take only one sintering furnace run to achieve the right electrical property for SCI's ECSC products, while the currently used technology averages four furnace runs for each igniter. The electricity savings for furnacing is about 1.56×10^{10} Btu. The market for HSG igniters in 1994 was $54 million, and it is expected to double by the year 2000. SCI is expected to capture about 10 percent of the HSG igniter market which will translate into annual revenues of $20 million.

SCHEDULE AND STATUS

Igniter assemblies suitable for testing at customer sites and in accordance with the established standards have been fabricated.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$212,889	0	$212,889
Standard Ceramics, Inc	215,000	$281,740	496,740
TOTALS	$427,889	$281,740	$709,629

Contractor: Standard Ceramics, Inc.
Site: Niagara Falls, Niagara County
Contract Duration: 9/95 - 10/97
Key Words: product development, materials, igniters
Project Manager: Nag Patibandla (518) 862-1090, ext. 3301
Program: Industry
Subprogram: Materials Advancement
Contract No.: 4152-IABR-IA-96

-> Silicon Nitride-Bonded Silicon Carbide for Refractory Applications

Develop, field-test, and commercialize higher-strength and better wear-, corrosion- and thermal-shock-resistant silicon carbide kiln furniture.

BACKGROUND

Silicon carbide is a high-strength, high-temperature, wear- and corrosion-resistant structural and refractory material. Most ceramic-manufacturing operations require such refractory materials. A significant component of the operating energy is used to heat up the refractory system itself. This project will develop a higher-strength, higher-bulk-density and improved oxidation- and thermal shock-resistant silicon nitride-bonded silicon carbide (SNBSC) for refractory applications such as kiln furniture (components of a bookshelf type of structure that supports the oven load). SNBSC can support the currently used levels of firing load with less mass because of its higher strength, thus reducing kiln energy consumption. For a typical kiln, energy savings of between eight and 24 percent can be expected, depending on the oven size.

OBJECTIVES

To make, field-test and commercialize high-strength SNBSC materials for refractory applications such as kiln furniture (shelves, posts, beams, etc.), tiles, burner tips, valve liners, and high temperature nozzles. Specifically, to process SNBSC by mixing silicon carbide powder with a fine dispersion of free silicon (less than 20-micron size); to optimize the starting silicon carbide and silicon powders to achieve uniform dispersion of silicon in silicon carbide; to shape-form via pressing or slip-casting (chosen based on complexity of shape), and to fire in a gas or electric oven in nitrogen atmosphere at 1400°C.

DESCRIPTION

The contractor will (1) determine ingredients for formulations; (2) design experimental matrix; (3)prepare experimental SNBSC batches; (4) produce and evaluate test samples; (5) determine optimal compositions; (6) produce field-test samples; (7) conduct field-tests; and (8) develop commercialization strategies. In addition, the contractor will pursue establishing firing conditions for both electric and gas-fired ovens and reducing the processing costs by acquiring and using a gas-fired oven.

BENEFITS

Use of SNBSC material would allow design of lighter kiln furniture with the same load-bearing capacity. For example, use of thinner SNBSC batts or setter tiles at Corning Inc.'s Erwin, NY plant could result in energy savings of about 25 percent or 16 million Btu per load (assuming 0.20 Btu/lb/°F). For the six kilns located at this facility, the energy savings would be about 10 billion Btu, or some $50,000 per year (two kiln cycles per week). The U.S. market for this type of refractory material is about $20 million. As a manufacture of SNBSC products, the contractor is expected to add jobs and revenues to New York State. SNBSC refractories are expected to be superior to and cheaper than their commercially available counterparts.

SCHEDULE AND STATUS

Small batches of refractory products such as burner nozzles and thermocouple protection tubes have been made and sold. A process scale-up and optimization is being planned.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$97,890	0	$97,890
Silicon Carbide Products, Inc.	101,886	0	101,886
TOTALS	$199,776	0	$199,776

Contractor: Silicon Carbide Products, Inc.
Site: Painted Post, Steuben County
Contract Duration: 10/95 - 5/97
Key Words: product development, materials, ceramics, silicon carbide
Project Manager: Nag Patibandla (518) 862-1090, ext. 3301
Program: Industry
Subprogram: Materials Advancement
Contract No.: 4238-IABR-IA-96

-> Modified Epoxy Resins

Develop and market single-component epoxy-based resins for high-performance pultrusion applications.

BACKGROUND

Most thermoset resins are two-component mixtures combining resin and hardener. When mixed, they harden (or "cure") and form a solid in one to two days at room temperature. In industrial-scale manufacture, the two-component resins are processed into glass or carbon fiber-reinforced composites using a process called pultrusion. Pultrusion is used to make structural components, such as hollow-drive shafts and I-beams, and sports gear such as golf clubs, ski poles, and tennis rackets. Polyset Company, Inc. developed a new single-component resin that cures exothermically and 10 times faster. Using this resin in pultrusion promises to cut electrical energy costs by a factor of 10.

OBJECTIVES

To develop and market novel epoxy resins for pultrusion applications. To this end, a new epoxy chemistry that allows rapid, low-energy, pollution-free cure will be utilized. To demonstrate that the application of this new chemistry to pultrusion would benefit the large, rapidly growing resin market that is limited by traditional epoxy resins with extremely low throughput and high costs.

DESCRIPTION

The contractor will (1) pursue chemical and engineering development; manufacturing via catalyst and resin optimization, release-agent development, cure-process development, and mechanical properties measurement; (2) optimize the new resin formulation by pultruding representative samples for physical, thermochemical, and mechanical property characterization; and (3) prepare a marketing strategy, sales brochures, and a video emphasizing the energy savings.

BENEFITS

The new single-component resins can be pultruded faster, resulting in electrical energy savings of some $130,000 per year. Other energy savings include eliminating mixing and exothermic-heat output while curing. The new resin is expected to add $20 million to Polyset's annual revenue.

SCHEDULE AND STATUS

Pultrusion trials at speeds up to four feet per minute were conducted. The resin, catalyst, and release agent are being optimized.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$150,000	0	$150,000
Polyset Company, Inc.	239,378	0	239,378
TOTALS	$389,378	0	$389,378

Contractor: Polyset Company, Inc.
Site: Mechanicville, Saratoga County
Contract Duration: 5/95 - 6/97
Key Words: product development, materials, processing, epoxy-resins, pultrusion
Project Manager: Nag Patibandla (518) 862-1090, ext. 3301
Program: Industry
Subprogram: Materials Advancement
Contract No.: 4009-IABR-IA-95

-> Sialon Reticulated Ceramics for Energy-Related Applications

Fabricate and optimize prototypes of reticulated sialon -infrared burners, -radiant tube inserts, -volume burners, and -hot gas filters.

BACKGROUND

Sialons are silicon-aluminum-oxygen-nitrogen compounds used to make high temperature wear/corrosion-resistant ceramic parts. Reticulated ceramics are open-celled, foam-like materials with continuous solid and pore phases used in molten infrared/volume burner, radiant tube insert, metal/hot gas filtration, incinerator baffle and kiln furniture applications. Fabricating these shapes using conventional processing methods is energy consuming. Benchmark Structural Ceramics Corporation, the subcontractor, developed a controlled combustion synthesis process that uses significantly less energy; this makes sialon components cost-competitive with other reticulated ceramics.

OBJECTIVES

To develop a low-cost sialon reticulated ceramic and demonstrate prototype fabrication capability. Specifically, to fabricate and test low-cost sialon reticulated ceramic components such as infrared burners, radiant tube inserts, volume burners, and hot-gas filtration components. Also, to produce prototypes, identify and assess the four above-named applications, and identify additional leading energy-related applications for reticulated sialons.

DESCRIPTION

The contractor will (1) optimize the starting raw material characteristics and the densification/sintering process; (2) fabricate base line test-coupons for property testing, optimization, and enhancement; (3) identify and analyze product opportunities; (4)fabricate prototypes; and (5) develop a thermal and mechanical properties data base. The subcontractor will optimize the sialon powder characteristics, properties, bake out and sintering procedures and advise on material and process economic issues.

BENEFITS

Conventional sialon processing costs some $130/kg, that includes energy costs of some $50/kg. Benchmark's CCS process will cost less than $11/kg and includes energy costs of 70 cents/kg, representing a 98% reduction in the processing energy inputs. The reticulated sialon components will meet the high temperature and high thermal shock-resistance requirements and allow higher operating temperatures leading to significant energy savings in operation. The applications identified in this proposal are much broader and represent a good market.

SCHEDULE AND STATUS

Characterization of samples made from alternative sialon powders has been completed. Long-term testing of prototype parts is being undertaken.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$125,063	0	$125,063
Hi-Tech Ceramics, Inc.	125,063	0	125,063
TOTALS	$250,126	0	$250,126

Contractor: Hi-Tech Ceramics, Inc.
Site: Alfred, Allegany County
Contract Duration: 6/95 - 6/97
Key Words: product development, materials, composites, ceramics, sialon.
Project Manager: Nag Patibandla (518) 862-1090, ext. 3301
Program: Industry
Subprogram: Materials Advancement
Contract No.: 4208-IABR-IA-96

-> Partially Fired, Low-Mass Refractory Crucible

Develop prototype for field-test and commercialize energy-efficient metal-encased refractory crucibles of lower mass (density).

BACKGROUND

Conventional ceramic refractory crucibles are manufactured to 80 percent or higher theoretical density. Such high density is achieved by kiln-firing at temperatures well over 2000°F (1093°C), which accounts for the majority of energy costs incurred in the manufacturing process. Less energy would be required to fire crucibles of lower density/mass and at lower temperatures. Such partially fired, low-mass refractory (PFLMR) crucibles would have less strength and therefore require metal-encasement. These lower-strength PFLMR refractory crucibles have several niche applications.

OBJECTIVES

To adopt Blasch's patented ceramic-manufacturing process of mixing ceramic slurry, injecting it into molds, freezing, drying, and kiln-firing it to make the PFLMR crucibles. To reduce the mass (density) of PFLMR crucibles 10-20 percent and the firing temperatures to 1000°F (538°C), saving 75 percent of the energy used in the post-shape-making process. Also, to design, procure, and install custom electric rack ovens for drying and 1000°F kilns for firing.

DESCRIPTION

The contractor will inject the PFLMR slurry into molds and freeze them; dry the frozen molds in an electric convection ovens instead of infrared dryers; and fire the ceramic parts at the lower temperatures. At this stage, the product is expected to be partially sintered and weigh some 15% less than its conventional counterpart. The contractor then will encase the ceramic part in a metal shell. While the low-fired, low-mass ceramic part is expected to have lower strength, it should be adequate for its intended applications and would densify (sinter) further in service. However, no dimensional change is expected, an attribute of Blasch's patented process. The contractor will also fabricate prototypes for field-testing at a customer site.

BENEFITS

The 75 percent energy savings expected in the post-shape-forming processing steps (i.e., drying and firing) will result in a more energy-efficient process and product. The new products are expected to be about 25 percent cheaper than their fully fired counterparts. The near-term market for the PFLMR crucibles is estimated at $2.5 million, leading to a 25 percent increase in Blasch's overall energy consumption. The success of electric convection drying will lead to elimination of the infrared drying used in Blasch's special products manufacturing line.

SCHEDULE AND STATUS

The contractor has begun supplying a customer with PFLMR crucibles. The results from customer field-tests are being awaited.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	0	$184,253	$184,253
Blasch Precision Ceramics, Inc.	0	185,753	185,753
TOTALS	0	$370,006	$370,006

Contractor: Blasch Precision Ceramics, Inc.
Site: Albany, Albany County
Contract Duration: 4/96 - 6/97
Key Words: product development, materials, ceramic refractory
Project Manager: Nag Patibandla (518) 862-1090, ext. 3301
Program: Industry
Subprogram: Materials Advancement
Contract No.: 4361-IABR-IA-96

-> Developing a Multilayer Ceramic on Ferrite Substrate Power Supply

Develop planar power-supply device consisting of copper metallized on ferrite-ceramic multilayer substrate.

BACKGROUND

Multilayer ceramics are a mature technology for thick-film and ceramic-tape products; however, applying this technology to ferrite power substrates is new. This project will involve planar magnetics imbedded in ceramic, a technology that uses metallized copper on a ferrite-ceramic multilayer.

OBJECTIVE

To produce and market a device that enables power-supply transformers to be manufactured in flat packaging using planarized inductor coils imbedded on ceramic substrate.

DESCRIPTION

The contractor will: (1) develop the multilayer process, (2) demonstrate the process and it's cost feasibility, (3) produce a prototype multilayer ceramic on ferrite substrate power supply, (4) optimize the device's performance and the manufacturing process, (5) define the product and file patents, and (6) develop a capital plan and procure capital.

BENEFITS

The proposed transformer will be thermally stable and highly efficient to allow for power-factor correction and waveform shaping, thereby reducing harmonics. Using this product will lower residential and industrial energy costs and increase energy efficiency.

The planar configuration, reduced materials, and elimination of plastic winding insulation are expected to improve the device's efficiency through lower heat loss, enabling further miniaturization and cost reductions for many electronic components.

SCHEDULE AND STATUS

The additional development work by Alfred University is complete. The final report is being completed by the contractor and is expected to be submitted by the end of the second quarter 1997.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$270,000	0	$270,000
Varity Zecal, Inc.	928,266	0	928,266
TOTALS	$1,198,266	0	$1,198,266

Contractor: Varity Zecal, Inc. (formerly Ceramic Packaging, Inc.)
Site: Churchville, Monroe County
Contract Duration: 1/94 - 7/97
Key Words: product development, materials, power electronics
Project Manager: Barbara Caropolo (518) 862-1090 ext. 3266
Program: Industry
Subprogram: Materials Advancement
Contract Nos.: 3118L-EEED-IEA-94

-> Optimizing Finned- and Rough-Ceramic Heat-Exchanger Tubes

Test innovative designs to improve heat-transfer in ceramic heat-exchanger tubes.

BACKGROUND

Inex, Inc. of Ransomville manufactures ceramic-radiant tubes (CRTs), the largest market for which is as a burner component in indirectly fired, high-temperature furnaces, where the products of combustion are kept separate from the materials processed (the load). The CRT was designed to withstand high-temperature and corrosive conditions.

A second, and larger, market for the CRT is as a heat-exchanger tube for applications involving high-temperature and corrosive conditions. However, this market is both price-sensitive and performance-oriented. Therefore, this project seeks to use finned and rough inner surfaces in state-of-the-art CRTs to increase thermal efficiency. Improving the performance of these ceramic tubes will lower their installed cost and may expand their market significantly.

OBJECTIVE

To identify the most effective internal-tube surface shapes to improve heat-transfer in an innovative heat-exchanger tube manufactured by Inex, Inc.

DESCRIPTION

The potential of internal-tube surfaces to enhance the performance of CRT heat-exchangers will be studied in the combustion laboratory at Rensselaer Polytechnic Institute (RPI). The most efficient tubes will undergo more complete product-testing and may be developed into new products that Inex, Inc. will market.

BENEFITS

Using finned- and rough-ceramic heat-exchanger tubes should increase heat-transfer in the radiant tube. This will expand the applications for these ceramic tubes beyond furnaces and into the much larger market of heat-exchanger tubes.

SCHEDULE AND STATUS

The project has identified effective internal-tube surface shapes that improve performance. Product testing is under way.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$77,505	0	$77,505
Rensselaer Polytechnic Institute	27,304	0	27,304
Inex, Inc.	12,820	0	12,820
TOTALS	$117,629	0	$117,629

Contractor: Inex, Inc.
Site: Ransomville, Niagara County, and Troy, Rensselaer County
Contract Duration: 4/95 - 9/97
Key Words: product development, university, industrial process, gas, heat recovery, emissions control
Project Manager: Bill Reinhardt (518) 862-1090, ext. 3257
Program: Industry
Subprogram: Materials Advancement
Contract No.: 4020-IABR-IA-95

-> Monodispersed Indium-Tin Oxide Powders and Ink

Develop economical and energy-efficient processes to manufacture fine powders for coating applications.

BACKGROUND

Indium oxide mixed with 5-10 wt% tin oxide (ITO) deposited as a thin coating on glass or plastic has several energy-saving applications. ITO films are transparent, electrically conductive, and reflective to infrared radiation (and heat). ITO films could be used for energy-saving window and automobile glass, liquid-crystal laptop computer displays, electroluminescent lamps, and cathode-ray tubes. Indium Corporation of America is the world's leading supplier of various forms of indium metal and alloys and has market access to companies providing ITO coating services. Generally, ITO films are deposited via sputtering, an expensive, energy-intensive process that limits the widespread use of ITO films.

OBJECTIVE

To develop robust, economical processes for manufacturing ITO particles suitable for commercialization. The project's two-prong approach is aimed at producing submicron- and nanometer-size ITO powders. The submicron-sized powders will be used to make low-cost and high-performance sputtering targets for introduction into Indium Corporation's current sputter target market. The nanometer-sized powders will be used to formulate an ITO ink that can be used to produce ITO films via energy-saving conventional dip or spray techniques.

DESCRIPTION

Indium Corporation, in collaboration with Clarkson University will: (1) synthesize monodispersed indium tin hydroxide (ITH) precursor particles, (2) optimize the process conditions to convert ITH precursor particles into ITO powders, (3) evaluate the sinterability of submicron-size ITO particles, (4) formulate the nanometer-size particles into an ink that could be converted into a thin, continuous film, and (5) scale up the processes to make kilogram-size batches.

BENEFITS

The dip-and-spray techniques are low-cost, energy-conserving, and environmentally acceptable alternatives to the current sputtering technique. The ink will enable glass manufacturers to apply ITO coatings at the point of manufacture, eliminating the additional energy-consuming coating step. The project may lead to widespread use of ITO films/coatings in several energy-saving applications. If it is successful, the project is expected to lead to establishment of a new manufacturing division. Near-term commercial success is expected from marketing ITO sputter targets.

SCHEDULE AND STATUS

Limited quantities of ITO powders in both submicron and nanometer size ranges have been produced.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	0	$150,000	$150,000
Indium Corp. of America	0	123,119	123,119
Clarkson University	0	27,322	27,322
TOTALS	0	$300,441	$300,441

Contractor: Indium Corporation of America
Site: Utica, Oneida County
Contract Duration: 8/96 - 12/97
Key Words: product development, materials, coatings
Project Manager: Nag Patibandla (518) 862-1090, ext. 3301
Program: Industry
Subprogram: Materials Advancement
Contract No.: 4444-IABR-IA-96

-> Porous Aluminum-Nitride Part Fabrication to Support Advanced Battery Development

Optimize process parameters and manufacturing costs of sintered aluminum-nitride (AlN) separator plates for lithium-metal sulfide (LiMS) battery.

BACKGROUND

Despite promising power and energy-density characteristics, the widespread use of LiMS batteries is hindered by a number of technical issues such as operating temperature (400-500°C) and electrolyte containment; physical issues such as volume and weight; and economical issues such as cost and lifetime. Inclusion of a low-cost, lightweight, porous, electrically resistive, and corrosion-resistant battery separator will address a number of these issues. One of the materials that satisfies the above requirements is AlN. Under a U.S. Department of Energy (DOE) Phase I Small Business Innovative Research (SBIR) contract, using an aqueous-based AlN powder-processing technology developed under a prior NYSERDA-sponsored project, Advanced Refractory Technologies, Inc. (ART) developed a cheaper roll-compaction method to produce high-strength and controlled-porosity AlN plates and had them tested at Westinghouse Electric Co. Based on promising preliminary results and with NYSERDA's support and input, ART won an SBIR Phase II award.

OBJECTIVES

To estimate the cost breakdown in processing sintered AlN separator plates. To investigate the methods of cost-reduction through process-optimization. To become the sole supplier of AlN separator plates for Westinghouse's LiMS batteries, which are used currently in several military and commercial applications. Finally, to develop a number of other electronic and structural applications for AlN.

DESCRIPTION

The contractor will (1) approach the process- and cost-reduction by addressing materials issues such as material minimization, AlN powder purity, and cost-reducing additives; and processing issues such as AlN powder-processing, large-scale and continuous-tape manufacture, and near-net shape preparation; (2) fabricate AlN separator plates and characterize for porosity, thickness, purity, and strength; (3) test single- and multiple-cell assemblies for power density, term/shelf life, and cyclic charge/discharge rate; (4) generate a database useful for marketing and commercialization; and undertake battery testing, and economic evaluation.

BENEFITS

The energy consequence of a tougher and stronger ceramic-component LiMS battery is far-reaching and is expected to advance the battery industry. The AlN separator plate is expected to cost $0.30. At that price, a number of advanced-battery applications are expected to become a reality. The success of this project is expected to create a manufacturing facility in the Buffalo area and the sale of AlN battery separators is expected to contribute significantly to New York's Gross State Product.

SCHEDULE AND STATUS

Testing of AlN prismatic-shaped separator plates has been completed. LiMS battery testing is currently under way at Westinghouse.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$125,000	0	$125,000
ART, Inc.	160,803	0	160,803
U.S. Department of Energy	599,703	0	599,703
TOTALS	$885,506	0	$885,506

Contractor: Advanced Refractory Technologies, Inc.
Site: Buffalo, Erie County
Contract Duration: 5/94 - 6/97
Key Words: product development, materials, battery
Project Manager: Nag Patibandla (518) 862-1090, ext. 3301
Program: Industry
Subprogram: Materials Advancement
Contract No.: 4033-IABR-IA-95

-> Improved Kiln Design

Compare geodesic kiln using innovative block-design system to conventional orthogonal kiln.

BACKGROUND

Kiln technology currently consists primarily of orthogonal designs that lead to turbulent gas flow, resulting in inefficient combustion, significant temperature variation, and increased loss of fired wares. Kilns with rounded walls would be more efficient; however, state-of-the-art rounded kilns require each refractory brick to be precision-hand-cut and custom-assembled, resulting in an expensive structure that is not cost-effective to manufacture and install. PolyCeramics, Inc. has patented an innovative block-design system that allows for the construction of rounded structures from simple unit shapes that do not have to be precision-cut and custom-assembled.

OBJECTIVE

To investigate the use of this ceramic-block system for an improved kiln design. The performance of a rounded kiln will be compared to a conventional kiln. This information will be used to market geodesic kiln designs.

DESCRIPTION

A rounded kiln and a conventional orthogonal kiln of the same size and materials will be constructed. The two kilns then will be tested and compared for energy efficiency and temperature uniformity.

BENEFITS

The rounded kiln design is expected to reduce energy consumption by as much as 25-30 percent. The more uniform temperature is expected to result in an increase in quality control and a decrease in firing defects.

SCHEDULE AND STATUS

Development of an improved block design delayed kiln construction, but promises to result in a more cost-effective product. Kiln construction using the new blocks has been initiated.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$96,440	$17,940	$114,380
PolyCeramics	125,041	56,709	181,750
Frederickson Kiln	10,109	0	10,109
TOTALS	$231,590	$74,649	$306,239

Contractor: PolyCeramics, Inc.
Site: Alfred, Allegany County
Contract Duration: 1/96 - 8/97
Key Words: product development, university, process improvement, materials
Project Manager: Ed Kear (518) 862-1090, ext. 3269
Program: Industry
Subprogram: Materials Advancement
Contract No.: 4218-IABR-IA-96

-> Integrated High-Voltage/High-Temperature Power Electronic Modules

Develop and commercialize power electronic modules.

BACKGROUND

The commercially available high-voltage electronics such as actuators, resistors, capacitors, and power modules used in motors, engines, transmissions, and power-conditioning equipment are either located away from the source of heat or cooled externally. A remote location requires additional hardware, adding weight and volume, reducing payload, and increasing maintenance and life-cycle costs. The external cooling systems are energy-intensive. A potential solution would be high-voltage electronic devices designed to operate in a high-temperature environment. Custom Electronics, Inc. (CEI), founded in 1964, is a 75-employee New York State company that designs, manufactures, and sells high-voltage mica-paper capacitors, with an 80-percent share of this niche market.

OBJECTIVE

To develop, manufacture, and commercialize a number of high-voltage/high-temperature power electronic modules, including a resistor-capacitor (RC) class power module and a voltage-multiplier module, using New York State raw materials and components.

DESCRIPTION

The contractor, in collaboration with SUNY/Binghamton, will: (1) conduct a market analysis by documenting customer requirements; (2) identify and assess materials, components, and encapsulants; (3) design, assemble, and demonstrate a resistor-capacitor-type module prototype; and (4) plan for marketing and commercialization. A voltage-multiplier module will be developed in a subsequent phase.

BENEFITS

Incorporating integrated high-voltage/high-temperature power electronic modules in such systems as motors, engines, transmissions, and power-conditioning, heating, and cooling equipment will lead to higher energy efficiency. Weight, volume, and payload reductions will improve fuel efficiency and reduced cooling requirements will improve electronic system reliability. Power electronic modules are a natural evolution of CEI's current product line, with a high potential for near-term commercialization.

SCHEDULE AND STATUS

Marketing analysis has been completed. Design of a resistor-capacitor module is in progress.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	0	$197,839	$197,839
Custom Electronics, Inc.	0	217,482	217,482
Research Foundation of SUNY/Binghamton	0	62,540	62,540
Staffiere Consulting	0	3,000	3,000
TOTALS	0	$480,861	$480,861

Contractor: Custom Electronics, Inc.
Site: Oneonta, Otsego County, and Binghamton, Broome County
Contract Duration: 8/96 - 12/97
Key Words: product development, university, materials, power electronics
Project Manager: Nag Patibandla, (518) 862-1090, ext. 3301
Program: Industry
Subprogram: Materials Advancement
Contract No.: 4445-IABR-IA-96

-> Use of Recycled Glass and Fly Ash for Precast Concrete Products

Develop economical procedures for sorting recycled glass and for activating fly ash for use in concrete blocks.

BACKGROUND

Post-consumer glass represents a major component of solid waste because only a small fraction of the used glass is recycled. Disposal of waste glass is an acute problem for major metropolitan areas such as New York City, where some 70,000 tons of mixed-color glass was collected in 1994 and the tipping fee was $65 per ton. These numbers are expected to rise significantly. Another solid waste problem is the millions of tons of fly ash generated as a by-product at coal-fired electric power generation plants. Presently about 27 percent of fly ash is reused.

OBJECTIVES

To develop precast concrete products such as curtain wall panels, decorative blocks, park benches, waste containers, and tree planters containing sorted and crushed used/recycled glass in lieu of the high-priced specialty aggregate and activated fly-ash replacing portland cement. Specifically, to chemically activate the fly-ash and use it to replace 90 to 100 percent of the portland cement. In regular fly-ash concrete, only 10 to 25 percent of portland cement is replaced by fly ash, which acts as a filler. Also, to adopt and use procedures developed in another NYSERDA project to inhibit a chemical reaction between the alkali in the cement and the silica in the glass, known as alkali-silica reaction (ASR).

DESCRIPTION

The contractor will (1) evaluate economical feasibility and marketability of Glascrete products; (2) develop economical procedure(s) for sorting recycled glass by color, specific gravity, etc; (3) develop procedures for fly-ash activation to make it suitable for partial or full replacement of energy-intensive portland cement; (4) focus on extending the technology to products in which up to 100 percent of the aggregate is replaced by waste glass; and (5) fabricate glascrete masonry products containing activated fly ash or crushed glass.

BENEFITS

By replacing much or all of energy-intensive portland cement with fly ash, the project eliminates landfilling of the fly ash. The project finds a cheaper solution for using post-consumer mixed-color glass, developing marketable products from landfilled solid waste. This project is a complement of another NYSERDA project, "Use of Recycled Glass as Aggregate for Concrete Masonry Blocks" (4113-IABR-BR-95).

SCHEDULE AND STATUS

A patent application covering the discovery that finely ground green glass acts as an ASR supressant has been filed. Technology licensing is being pursued.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$198,053	0	$198,053
Columbia University	50,000	$112,518	162,518
Dagostino Building Blocks	0	30,000	30,000
Drexel University	15,000	10,214	25,214
TOTALS	$263,053	$152,732	$415,785

Contractor: Columbia University
Site: New York, New York County
Contract Duration: 1/96 - 10/97
Key Words: product development, industry/university, solid waste materials, concrete, recycling
Project Manager: Nag Patibandla (518) 862-1090, ext. 3301
Program: Industry
Subprogram: Materials Advancement
Contract No.: 4291-IABR-IA-96

-> Biaxially Textured Substrate for High-Temperature Superconductor

Develop biaxially textured metallic substrate suitable for deposition of high-temperature superconductor.

BACKGROUND

Superconducting materials can carry electrical currents without any resistance. In 1986, the discovery of Y-Ba-Cu-O superconductors that operate at 77°K (liquid nitrogen temperature) was a major breakthrough in this field. The Y-Ba-Cu-O conductors exhibit properties (current density of 10^6 Amp/cm^2) suitable for use in electric-power applications such as fault-current limiters, large motors (>100 hp), generators (>100 MVA) SMES (>1.0 MWh), and transmission cable only when deposited on single-crystal substrates or on biaxially textured buffer layers. Both options require an inherently slow and high-cost ion-beam-assisted deposition (IBAD) processing step.

OBJECTIVE

To develop and use an economical and faster processing technology to fabricate biaxially textured substrates that would involve adoption of an industrially used cube texture method. The objective of this work is to fabricate nickel or nickel-based substrates with a high degree of cube texture that then will eliminate the intermediate IBAD step currently used to deposit the buffer layer.

DESCRIPTION

The initial task is to fabricate nickel or nickel-based substrates with a high degree of cube texture. In Task 1, the processing parameters will be optimized to achieve biaxial texture in the substrate that will be characterized in detail in Task 2. The substrates will be polished as described in Task 3 for deposition of a buffer layer that will protect the nickel substrate from oxidation and block the diffusion of nickel out of the substrate. An oxide-ceramic buffer layer with a degree of biaxial texture equal to or better than that of the substrate will be deposited using techniques outlined in Task 4. The degree of biaxial texture of the buffer layer will be characterized in Task 5. A layer of high-temperature superconductor will be deposited and characterized in Task 6. Finally, a cost estimation to demonstrate the feasibility of this process will be undertaken in Task 7.

BENEFITS

The biggest hurdle in commercialization of Y-Ba-Cu-O superconductors is the processing cost. The cube texture method eliminates the use of expensive, energy-intensive vacuum-deposition technique (IBAD) used to lay down the buffer layer. The proposed approach has the potential to yield the best-performing superconducting tape of any kind at the lowest price.

SCHEDULE AND STATUS

The project is under way. Subcontracts have been signed.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	0	$64,990	$64,990
Intermagnetics General Corp.	0	64,996	64,996
TOTALS	0	$129,986	$129,986

Contractor: Intermagnetics General Corporation
Site: Latham, Albany County
Contract Duration: 2/97 - 5/98
Key Words: product development, materials, superconductors, substrates
Project Manager: Nag Patibandla (518) 862-1090, ext. 3301
Program: Industry
Subprogram: Materials Advancement
Contract No.: 4466-IABR-IA-97

Produce high-temperature superconductors for energy applications.

BACKGROUND
Because high-temperature superconductors have no electrical resistance below the critical temperature, they have enormous potential to improve the efficiency of energy-related devices.

OBJECTIVE
To develop energy-conserving, energy-producing technologies based on high-temperature superconductivity.

DESCRIPTION
The Institute sponsors three interdependent programs. The Superconductor Characterization and Fabrication Facility provides extensive laboratories for fundamental and processing studies of high-temperature superconductors. The Industrial Superconductivity Research Consortium allows industrial firms to access Institute facilities and research projects. The Superconductivity Research Program sponsors a broad range of high-quality research at universities and industries across the State. These programs are structured to promote technology transfer by allowing industrial participants to work in tandem with government and university scientists.

BENEFITS
The Institute will accelerate the development of high-temperature superconductivity for energy-conserving, energy-producing technology. Superconductivity holds the promise of zero electrical resistance, resulting in enormous energy-efficiency improvements in electric power generation, transmission, and use.

SCHEDULE AND STATUS
Three patents, four patent disclosures, and 58 research projects have resulted to date. The Institute continues to focus on fabricating and characterizing long wires and tapes made from high-temperature oxide superconductors. Silver-sheathed superconducting tapes up to 90 meters in length have been fabricated and characterized with the objective of achieving 1000-meter-long conductors. A ring furnace to process long lengths of wire has been developed.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA			
Petroleum Overcharge Funds	$8,895,600	0	$8,895,600
TOTALS	$8,895,600	0	$8,895,600

Contractor: SUNY/Buffalo
Site: Buffalo, Erie County
Contract Duration: 11/87 - 3/99
Key Words: university, product development, superconductivity, materials
Project Manager: Nag Patibandla (518) 862-1090, ext. 3301
Program: Industry
Subprogram: Materials Advancement
Contract No.: 1118-EEED-IEA-90

-> Chemical Mechanical Polishing of Metal Organic Chemical Vapor-Deposition Copper Films

Develop processes for improving copper metallization to enhance speed and reliability of integrated circuits.

BACKGROUND

Copper (Cu) metallization enhances the speed and reliability of integrated circuits (IC). Metal Organic Chemical Vapor-Deposition (MOCVD) of copper also provides energy and environmental benefits over the presently used aluminum-alloy-based processes. Successful commercialization of MOCVD Cu-deposition technology for metallization of advanced ICs requires that two critical processing elements be developed in parallel. These are high-aspect-ratio gap-fill to metallize interconnects and chemical-mechanical polishing to pattern them. Clarkson University has experience in a wide range of thin-film deposition and material-characterization technologies, particularly MOCVD of Cu and chemical-mechanical polishing. CVC Products, Inc. has extensive experience in MOCVD of Cu and the design, construction, and operation of some of the most advanced integrated-process tools being developed for semiconductor manufacturing. This project is related to an ongoing NYSERDA project that involves this team in developing an emissions-control system for the MOCVD Cu process.

OBJECTIVE

To improve MOCVD Cu gap-fill from the current state-of-the-art aspect ratio of about two to the three to four required by the next generation of sub-0.50μm integrated circuits, and to improve the Cu-to-SiO_2 removal ratio from the current state of the art of 10:1 to the required minimum of 100:1.

DESCRIPTION

A series of experimental investigations will be conducted at CVC and Clarkson. Most of the MOCVD Cu gap-fill work will be done at CVC Products, while most of the CMP work will be done at Clarkson.

BENEFITS

ICs made with Cu interconnects will be able to run faster, cooler, and with less energy. The MOCVD Cu process requires less energy than the current aluminum processes and has environmental advantages, specifically the elimination of ozone-depleting emissions. CVC will benefit in its effort to remain competitive by developing next-generation processing equipment. New York State will benefit from the continuing development of an indigenous semiconductor industry.

SCHEDULE AND STATUS

The project was late in getting started, but is now under way.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$99,515	0	$95,515
CVC Products, Inc.	44,208	0	44,208
Clarkson University	41,500	0	41,500
Center for Adv. Materials Processing	12,000	0	12,000
TOTALS	$197,223	0	$197,223

Contractor: CVC Products, Inc.
Site: Rochester, Monroe County, and Potsdam, St. Lawrence County
Contract Duration: 6/96 - 12/97
Key Words: product development, university, process improvement, materials
Project Manager: Ed Kear (518) 862-1090, ext. 3269
Program: Industry
Subprogram: Materials Advancement
Contract No.: 4220-IABR-IA-96

-> Improved Particles for Chemical-Mechanical Polishing Slurries

Develop aluminum-oxide-based slurries for chemical-mechanical polishing.

BACKGROUND

Development of smaller and faster microprocessors and memory devices is inevitable. Chemical mechanical polishing (CMP) is a necessary processing step that enables preparation of planerized surfaces. CMP is similar to traditional ornamental polishing used to selectively remove asperities and high points from the surface being polished e.g., silicon wafer. The process involves moving a wafer across a microporous, elastomer pad in the presence of a colloidal, aqueous slurry containing submicron abrasive particles. The Transelco Division of Ferro Corporation a leading producer of fine abrasive powders, suspensions, and colloids.

OBJECTIVES

To develop and evaluate submicron-sized aluminum oxide and other similar oxide particles of different shapes, sizes, and hardness in order to assess the role of these characteristics on dispersion, scratching, surface quality, and induced defects; to prepare and test slurries containing these particles with appropriate chemical accelerants and surfactants by polishing multiple silicon wafers; and performing the required post-polish characterizations. The project involves production of kilogram quantities of abrasive particles in optimized sizes and shapes.

DESCRIPTION

The contractor and the subcontractor will optimize the characteristics of aluminum-oxide-polishing particles as CMP slurries. The tasks include: (1) market analysis through documentation of customer requirements, (2) preparation of abrasive particles via precipitation techniques, (3) particle and slurry characterization, (4 CMP slurry formulation, (5) wafer-polishing trials on eight-inch silicon wafers, and (6) wafer characterization for defects.

BENEFITS

Use of improved CMP slurries could lead to shorter cycle times and better wafer yields. The oxide abrasive particles will be grown via precipitation techniques to eliminate energy-intensive grinding. Unlike other similar processes, CMP is a low-energy-consuming, environmentally acceptable non-capital-intensive process. High yields are expected to result in substantial energy savings in units of kWh per working chip. The energy savings could accrue from both reduced power consumption by IC chips, estimated at 10.5 million kWh for New York State for the year 2000, and reduced IC processing energy costs, estimated at $30,000 per year for a typical fabrication facility.

SCHEDULE AND STATUS

The project is under way. Subcontracts have been signed.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	0	$100,000	$100,000
Ferro Corp/Transelco Div.	0	104,688	104,688
Clarkson University	0	23,320	23,320
TOTALS	0	$228,008	$228,008

Contractor: Ferro Corporation/Transelco Division
Site: Penn Yan, Yates County, and Potsdam, St. Lawrence County
Contract Duration: 3/97 - 8/98
Key Words: product development, materials, particles, microelectronics
Project Manager: Nag Patibandla, (518) 862-1090, ext. 3301
Program: Industry
Subprogram: Materials Advancement
Contract No.: 4467-IABR-IA-97

-> Thermally Conducting, Electrically Insulating Aluminum Nitride Polymer-Matrix Materials

Develop aluminum nitride-filled polymers suitable for use in applications requiring high thermal and low electrical conductivity.

BACKGROUND

Materials with high thermal and low electrical conductivity are needed in applications that require heat dissipation and electric insulation. These requirements are particularly severe in high-density electronic packages and underground cables. Aluminum nitride (AlN) polymer-matrix materials could provide a better cost/performance ratio than currently used materials.

ACCOMPLISHMENTS

Various polymer-matrix composites made from combinations of AlN whiskers, AlN particles, and silicon carbide (SiC) whiskers, mixed with polyvinylidene fluoride (PVDF), silicon or epoxy, were tested for thermal conductance and dielectric constant and mechanical properties, such as strength and ductility.

FINDINGS AND CONCLUSIONS

Thermally conducting but electrically insulating polymer-matrix composites can be fabricated with thermal conductivity 95 times higher and a dielectric constant 1.5 times that of the neat polymer. A thermal conductivity of 11.5 W/mK and a dielectric constant of 9.8 was achieved using a combination of AlN whiskers and powder with PVDF.

REALIZED OR ANTICIPATED BENEFITS

This project has developed critical information needed to advance the use of polymer-matrix composite materials, particularly in packages for CPUs where heat dissipation has proven to be a major design constraint. Advanced Refractory Technologies, Inc. (ART) will benefit from the development of a potential new market for its AlN and SiC whiskers and powders. New York State's electronic component manufacturing industry will benefit from the availability of materials with improved performance over those currently used.

TECHNOLOGY TRANSFER ACTIVITIES

ART is using the information gained during this project in its continuing effort to market its products. In addition, papers have been published in technical journals.

FUNDING	TOTALS
NYSERDA	$200,000
ART, Inc.	60,000
SUNY/Buffalo	60,544
TOTALS	$320,544

Contractor: The Research Foundation of the State University of New York on behalf of SUNY/Buffalo
Site: Buffalo, Erie County
Contract Duration: 5/93 - 9/96
Key Words: product development, university, industrial, composite materials
Project Manager: Ed Kear (518) 862-1090, ext. 3269
Program: Industry
Subprograms: Materials Advancement, Petroleum Overcharge Program
Contract No.: 1937-EEED-POP-93

-> Plasma-Sprayed Coatings for Internal Combustion Engines

Develop ceramic coatings to improve engine efficiency and reduce wear.

BACKGROUND

Plasma-sprayed ceramic coatings for various components of automotive engines can allow improvements in operation efficiencies (resistance to high operating temperatures) and durability. Swain Technology of Scottsville, NY, has developed coatings that have been proven to provide benefits in racing engine applications. Tecogen manufactures gas-engine-driven systems for cogeneration, air-conditioning, compressed air, and irrigation pumps.

ACCOMPLISHMENTS

The research effort evaluated thermal barrier coatings for reduced thermal loading on valves, head, and pistons, and low-friction, high-load coatings for application on highly loaded components such as cams and piston wrist pins. Coated parts were compared with uncoated components of test engines following thousands of hours of high-load testing. The testing program documented the improvements in engine power, efficiency, and life that can be achieved using high-compression-ratio engines with plasma-sprayed coated parts.

FINDINGS AND CONCLUSIONS

Coated pistons were found to provide a measurable improvement in hydrocarbon emissions at the same pressure ratio as uncoated pistons. Test also showed that coatings used in critically stressed areas subject to failure in conventional engines achieved significantly longer life at higher compression ratios.

REALIZED OR ANTICIPATED BENEFITS

Coatings have been the key to achieving improved performance at a high compression ratio (12.2/1) in automotive-derived natural gas engines. At a 12.2/1 compression ratio and an engine speed of 3600 RPM, engine power increased by 18% and efficiency by 13.5%, compared to the production engine at 9.2/1 compression ratio. The NOx and CO emissions decreased by 13.8% and 15.8%, respectively.

TECHNOLOGY TRANSFER ACTIVITIES

A limited number of copies of the final report will be published. Technology transfer will occur though commercial application of the technology.

FUNDING	TOTALS
NYSERDA	$394,688
Gas Research Institute	302,488
Brooklyn Union	16,000
Tecogen	264,102
TOTAL	$977,278

Contractor: Tecogen
Site: Scottsville, Monroe County, and Waltham, MA
Contract Duration: 6/93 - 3/97
Key Words: product development, gas, materials, ceramic coatings, natural gas engine, plasma deposition
Project Manager: Richard Drake (518) 862-1090, ext. 3258
Program: Industry
Subprogram: Materials Advancement
Contract No.: 1998-EEED-IEA-92

-> Optimizing a Preceramic Polymer for Low-Cost Ceramic-Composite Fabrication

Develop process for fabricating ceramic composites using liquid polymer precursor.

BACKGROUND

The fabrication of continuous and particulate reinforced SiC-matrix ceramic composites by polymer infiltration and pyrolysis (PIP) constitutes a promising potential technique for a wide range of structural, high-temperature parts such as those found in land-based gas turbines and other generation equipment, as well as porous ceramics for hot-gas filtration. The development of a viable PIP process has been limited, in part, by the lack of a commercially available preceramic polymer. Starfire had developed such a polymer, but work was needed to optimize the process.

ACCOMPLISHMENTS

Polymer synthesis yield per batch showed a greater than threefold increase and a decrease in processing time from three weeks to six days. The resulting cost of polymer manufacturing decreased from $10/g to $3/g. In addition, the ceramic yield after pyrolysis increased by 38 percent (from 60 percent yield to 83%).

FINDINGS AND CONCLUSIONS

This laboratory-based project developed an optimized polymer formulation and processing procedure that significantly reduced the cost and time of production, while increasing the usability/quality of the product.

REALIZED OR ANTICIPATED BENEFITS

The higher operating temperatures allowed by the use of composite ceramic materials would result in increased energy efficiency for gas turbines and other high-temperature systems such as heat-exchanger tubes, gas scrubbers, and radiant-burner tubes. New York State will benefit from the development of a ceramic-composite manufacturing base to augment its existing ceramics-related industries.

TECHNOLOGY TRANSFER ACTIVITIES

Several articles have been published and the final report is being distributed to potential industrial customers. In addition, Starfire Systems is working with a number of potential customers in an effort to introduce this technology.

FUNDING	TOTALS
NYSERDA	$99,841
Starfire Systems, Inc.	47,000
TOTALS	$146,841

Contractor: Starfire Systems, Inc./Rensselaer Polytechnic Institute
Site: Watervliet, Albany County, and Troy, Rensselaer County
Contract Duration: 6/94-6/96
Key Words: product development, university, industry/university, materials
Project Manager: Ed Kear (518) 862-1090, ext. 3269
Program: Industry
Subprogram: Materials Advancement
Contract No.: 4015-IABR-IA-95

-> Develop and Evaluate Whisker Coatings to Prepare Improved Composite Materials

Prepare and characterize titanium-nitride (TiN), boron-nitride (BN), aluminum-nitride (AlN), and titanium-diboride (TiB_2)-coated silicon carbide whiskers (SiCw) and coated SiCw-reinforced composite samples.

BACKGROUND

Using lighter metals in energy-related devices such as internal-combustion engines has significant benefits; however, most light metals are weaker than steels and other iron alloys. Reinforcing with ceramic whiskers improves strength without significantly affecting the and thereby component weight. For example, SiCw-reinforcement of aluminum has resulted in mechanical properties comparable to cast iron. Because SiCws are unstable in some matrix materials, particularly metals, they must be protected from degradation. A common method used to accomplish this is to apply a suitable interfacial coating to shield one material from another. For whiskers in a composite, the ideal way is to apply a coating to each whisker.

ACCOMPLISHMENTS

Previously developed methodologies to produce BN- or TiN-coated silicon carbide whiskers were adopted and scaled up. A new technique to deposit BN was discovered in the course of this project. This technique yielded superior BN coatings. Techniques to put down AlN and TiB_2 coatings also were developed. All coatings were characterized at various stages of the process to develop a better understanding of the coating processes. Specific attention was given to BN coatings.

FINDINGS AND CONCLUSIONS

Optimized BN coatings were of uniform thickness, crystalline, and pure. The optimized BN-coated SiCw materials were fabricated into aluminum- and alumina-matrix composites. The aluminum-matrix composites were fabricated via powder metallurgy techniques. The BN-coated SiCw tended to accumulate to uninfiltrated pockets of the composite. The alumina-matrix composites were fabricated via hot-pressing. They showed strengthening at the grain boundaries. The AlN coating work also resulted in high-purity coatings. Because of the excellent wettability of AlN by molten aluminum, it is possible to use wetting-assisted infiltration and reduced-pressure squeeze-casting techniques, which are highly desirable for fabricating larger or complex shaped parts.

REALIZED OR ANTICIPATED BENEFITS

Over the next few years, the cost of SiCw is expected to decrease to about $50/kg. This will encourage using coated SiCw in applications such as automobile engine components. The functional coatings developed in this project would impart stability to SiCw in several metal and ceramic matrices. Use of such composites in pistons can result in a smaller piston/cylinder gap region, which minimizes the volume of unburned hydrocarbons. Engineering estimates suggest that tighter tolerances can lead to a 40% decrease in hydrocarbon emissions. Another large market for coated SiCw is cutting tools for iron and steel. Economic benefits are expected to accrue from increased business opportunities for a New York State company.

TECHNOLOGY TRANSFER ACTIVITIES

Using the positive results of this project, ART has successfully won a Phase II SBIR grant to develop aluminum-matrix composite tank-track shoes. During the course of this program, ART and Clarkson University presented the project results at a number of conferences and also published several research papers in scientific and technical journals.

FUNDING	TOTALS
NYSERDA	$88,166
ART, Inc.	26,619
TOTALS	$114,785

Contractor: Advanced Refractory Technologies, Inc. (ART)/Clarkson University
Sites: Buffalo, Erie County, and Potsdam, St. Lawrence County
Contract Duration: 11/94 - 6/96
Key Words: university, product development, environmental, materials, coatings
Project Manager: Nag Patibandla (518) 862-1090, ext. 3301
Program: Industry
Subprogram: Materials Advancement
Contract No.: 4019L-IABR-IA-95

-> Advanced SiC Power Components

Develop and market conductive silicon carbide power components, such as high-voltage power resistors.

BACKGROUND

Sintered silicon carbide (SiC) is a widely used engineering ceramic material. Currently available SiC is not electrically conductive. Standard Ceramics, Inc. (SCI) recently developed and patented an electrically conductive (resistivity of 0.1 to 10 ohm-cm) sintered SiC material. Combining SiC's high strength at high temperatures and low resistivity makes this material especially useful for some special applications such as bulk-power resistors, ignitors, seals, and bearings. The contractor's SiC can be used to make high-energy-density power resistors (megawatt-sized) usable in electronic equipment for transportation, industrial process-control, and utility power-distribution equipment. HVR Advanced Power Components (APC), which currently sells low-power resistors, collaborated in commercialization and marketing.

ACCOMPLISHMENTS

The contractor has: (1) achieved the target resistivity of 0.1 - 10.0 ohm-cm; (2) established a processing parameter window for electrically conductive SiC of high density (>3.05 gm/cc) and functional relationships and process-control factors; (3) optimized composition and processing variables; (4) adopted mass-production techniques, such as free-flow spray drying; (5) prepared and characterized prototype components; (6) developed a marketing plan; and (7) prepared literature outlining the benefits of SiC power components for use in marketing.

FINDINGS AND CONCLUSIONS

Electrically conductive SiC was formulated and processed via mass-production routes. Prototype power-resistors with resistivities in the targeted 0.1-10.0 ohm-cm range were fabricated and characterized. Marketing of these resisters is being pursued.

REALIZED OR ANTICIPATED BENEFITS

The project has demonstrated the feasibility of high-strength and high-temperature SiC power resistors suitable for high-voltage/high-power applications. These SiC power resistors can operate at higher power and higher frequency and thus increase the efficiency of systems in which they are used. SCI's power resistors are expected to cost less on a per-watt or per-joule basis. The project helped a New York State business develop marketable ceramic power resistors from a patented invention. The global power resistor market is about $45 million annually.

TECHNOLOGY TRANSFER ACTIVITIES

A preliminary marketing plan was completed for specific targeted applications such as grid-type resistors, water-cooled tube resistors, and high-voltage resistors. The contractor is spending about $27,000 per year to promote the SiC resistors.

FUNDING	TOTALS
NYSERDA	$90,674
Standard Ceramics, Inc	362,697
TOTALS	$453,371

Contractor: Standard Ceramics, Inc.
Site: Niagara Falls, Niagara County
Contract Duration: 2/95 - 2/97
Key Words: product development, materials, processing, power components, resistors
Project Manager: Nag Patibandla (518) 862-1090, ext. 3301
Program: Industry
Subprogram: Materials Advancement
Contract No.: 4096-IABR-IA-95

-> Development of Diamond Coatings for Energy Efficiency

Develop and commercialize diamond-coated ferrous-metal-cutting tools and components for energy-related devices.

BACKGROUND

A diamond coating can impart exceptional hardness, thermal conductivity, and wear and friction characteristics to any material. Common ferrous-alloy components can be made into high-performance cutting tools, valves, nozzles, injectors, and lubrication-free bearings using a diamond coating. Diamond-coated cutting tools allow higher cutting speeds and need fewer passes, leading to significant energy savings in cutting-tool operations. Using diamond-coated components in pumps, turbines, automobiles, and aircraft engines improves their energy efficiency.

ACCOMPLISHMENTS

The contractor has: (1) identified several physical and chemical modification steps to improve the diamond-coating adhesion to ferrous substrate surfaces; (2) prepared and characterized samples with suitable intermediate layer(s); (3) modeled stress in the diamond coating by using atomistic modeling methods and by monitoring delamination behavior; (4) made prototype tool bits and components; and (5) conducted a preliminary marketing study on commercialization of diamond-coated ferrous alloy-cutting tools.

FINDINGS AND CONCLUSIONS

Adherent diamond coatings for ferrous-metal tools and components that specifically addressed the lack of chemical and mechanical compatibility between diamond and ferrous-alloy substrates leading to thermo mechanical mismatch and poor adhesion of the coating have been developed, deposited, and characterized.

REALIZED OR ANTICIPATED BENEFITS

The project has demonstrated the feasibility of low-cost, high-strength, lightweight diamond-coated ferrous tool bits with superior wear and friction characteristics. The cost of such a tool bit is estimated to be $10 and will reduce energy required to accomplish any given machining operation. Other applications for adherent diamond coatings developed in the project include low-friction bearings, valves, and nozzles used in abrasive slurries and coal-burning.

TECHNOLOGY TRANSFER ACTIVITIES

A preliminary market analysis focusing on specific targeted applications was undertaken and completed. The projected U.S. and global markets for diamond coatings are $80 and $250 million, respectively. A patent application covering several aspects of the diamond-coating technology is being filed.

FUNDING	TOTALS
NYSERDA	$199,997
C4 Technologies, Inc.	86,215
Ctr. for Atom. Simul. & Anal.	6,000
ART, Inc.	70,000
Ctr. Adv. Ceramic Tech.	20,000
ORNL (U.S. Department of Energy)	20,000
Syracuse U. NPAC	19,500
TOTALS	$421,712

Contractor: C4 Technologies, Inc.
Site: Wappingers Falls, Dutchess County
Contract Duration: 2/95 - 4/97
Key Words: product development, materials, diamond coatings, cutting tools
Project Manager: Nag Patibandla (518) 862-1090, ext. 3301
Program: Industry
Subprogram: Materials Advancement
Contract No.: 4103-IABR-IA-95

-> Five-Wire Distribution System

Demonstrate commercial operation of five-wire system for distributing electric power.

BACKGROUND

Five-wire power distribution offers the potential for eliminating or greatly reducing the problems associated with electromagnetic fields (EMF), high-impedance faults, and stray voltage on the current four-wire distribution system.

OBJECTIVES

To demonstrate a full-scale, operational five-wire distribution line in New York State Electric & Gas Corp.'s service territory by upgrading an existing four-wire, multigrounded wye distribution line.

DESCRIPTION

The contractor will conduct: (1) preliminary engineering, (2) detailed design and construction, (3) operation and monitoring, and (4) decommissioning.

BENEFITS

Adding a ground wire to the four-wire design presently used by utilities shows considerable promise to reduce EMF up to 60 percent, reduce stray voltage produced by the primary distribution system up to 80 percent, and successfully clear 95 percent of high-impedance faults that are now virtually undetected. Cost estimates indicate the five-wire system is only 10 percent more expensive than a similar four-wire multigrounded system.

SCHEDULE AND STATUS

Engineering is completed. All monitoring equipment has been installed and one year of baseline monitoring will take place, ending in spring 1998.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$200,000	0	$200,000
New York State Electric & Gas Corp.	250,000	0	250,000
ESEERCO	400,000	0	400,000
Electric Power Research Institute	295,000	0	295,000
U.S. Department of Energy	101,825	0	101,825
TOTALS	$1,246,825	0	$1,246,825

Contractor: Empire State Electric Energy Research Corp. (ESEERCO)
Site: Binghamton, Broome County
Contract Duration: 11/94 - 9/99
Key Words: environmental, electricity, utility
Project Manager: Barbara Caropolo (518) 862-1090, ext. 3266
Program: Industry
Subprogram: Energy Systems
Contract Nos.: 4000-IABR-IA-95

-> Rochester District Cooling

Evaluate technical and economic feasibility of building district-cooling system in downtown Rochester.

BACKGROUND

NYSERDA is joining with the Rochester District Heating Cooperative (RDH) and other downtown businesses to investigate the feasibility of building a district cooling system that could provide chilled-water space cooling to buildings in downtown Rochester.

OBJECTIVE

To assist the downtown Rochester community in developing a district-cooling system and complete all the tasks necessary to finance $30 million for system construction.

DESCRIPTION

The contractor will: (1) organize a district-cooling cooperative, (2) market district cooling to prospective cooperative members, (3) perform a technical analysis and preliminary design of the system, (4) complete all regulatory requirements, (5) conduct an economic analysis, (6) obtain firm prices for key system components, (7) arrange for financing to build the system, (8) monitor the system after it is operational, and (9) report on the above. If the project proves feasible, a cooling cooperative (RDC) will be created to build and operate the system.

BENEFITS

Members of RDH and RDC are expected to reduce their energy costs by between $850,000 and $1.4 million annually for 20+ years. Rochester also would avoid chiller replacement or retrofit issues involving the use of chlorofluorocarbon refrigerants targeted for phase-out by the Montreal Protocol of 1987 and the Clean Air Act Amendments of 1990. The City of Rochester and surrounding region would benefit from the economic development and jobs created by short-run construction activity and longer-run strengthening of the commercial real-estate market. Rochester Gas and Electric Corp.'s summer peak demand (1,374MW) would be eased by displacing 7.5MW in a critical, congested downtown area.

SCHEDULE AND STATUS

The feasibility and engineering tasks for the project are completed. Marketing the cooling concept to potential customers, and negotiations with financiers are under way. Ninety percent of the minimum required chilling load has been committed.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$400,000	0	$400,000
RDH/RDC	784,500	0	30,000,000
Xerox Corp.	40,000	0	40,000
Chase Manhattan Bank	20,000	0	20,900
Monroe County	65,000	0	65,000
City of Rochester	30,000	0	30,000
TOTALS	$1,339,500	0	$30,555,900

Contractor: Rochester District Heating Cooperative
Site: Rochester, Monroe County
Contract Duration: 6/95 - 1/98
Key Words: assist business, municipal, district cooling
Project Manager: Ed Kear (518) 862-1090, ext. 3269
Program: Industry
Subprogram: Energy Systems
Contract No.: 4162-IABR-IA-96

-> Effect of Stray Voltage on Dairy Cows

Study effect of short-duration, low-level stray voltage on dairy cows.

BACKGROUND

Dairy farming is a major industry in New York. Management and milking of dairy cows is a complicated process that involves mechanical, electrical, and biological systems. Stray voltages can cause undesirable behavior in dairy animals and lower milk production.

OBJECTIVES

To examine characteristics of short-duration electrical phenomena that are present on dairy farms and the effect of mitigating devices on short-duration electrical activity, the effect of short-duration electrical phenomena on dairy cows, and the combined effect of contact voltage and predisposition to mastitis to determine if contact voltage can influence the extent to which cows react to mastitis-causing bacteria.

DESCRIPTION

This project will evaluate the effect of short-duration low-level voltages on dairy cows. The contractor will: (1) develop test procedures and test equipment, (2) collect data on dairy farms, (3) test stray voltage-mitigating devices, (4) develop impedance model of cows, (5) measure sensitivity of cows to transient voltages, and (6) conduct experiments to determine whether voltages effect disease.

BENEFITS

Major beneficiaries are New York's utilities and its dairy industry, which will be provided scientific information on the effects of transient voltage that will have an impact on milk production and costs, as well as efforts by utilities and farmers to deal with stray voltages.

SCHEDULE AND STATUS

Characterization of isolation devices is complete and a peer review paper will be prepared. Potential farms have been identified for long-term monitoring. Sensitivity testing of BST and non-BST cows continues. To date, no difference has been observed between BST and non-BST cows. Instrumentation for the long-term monitoring has been finalized and is being tested.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$150,000	0	$150,000
ESEERCO	147,545	0	147,545
New York State Electric & Gas Corp.	100,000	0	100,000
Cornell University	88,350	0	88,350
NYS Center for Advanced Technology	60,000	0	60,000
Rochester Gas and Electric Corp.	25,000	0	25,000
Consumers Power (Michigan)	15,000	0	15,000
TOTALS	$585,895	0	$585,895

Contractor: Empire State Electric Energy Research Corporation (ESEERCO)
Site: Ithaca, Tompkins County
Contract Duration: 11/94 - 9/97
Key Words: university, agriculture, utilities
Project Manager: Barbara Caropolo (518) 862-1090, ext. 3266
Program: Industry
Subprogram: Energy Systems
Contract Nos.: 4001-IABR-IA-95

-> Slotless "Pancake" Brushless DC Servo Motor

Develop, design, and manufacture energy-efficient slotless DC brushless motors.

BACKGROUND

Market research and current market demand indicate a need for brushless DC motors that provide full-range power at reduced power-input levels. Currently available DC brushless motors all tend to follow a common design philosophy, with similar thermal and power performance. The PMI Division of Kollmorgen Corporation, which is at the leading edge of innovation, has recently conceptualized the next-generation DC brushless motor. By eliminating iron losses from within the motor, efficiency is greatly improved. In addition, this "slotless" technology offers zero cogging and a low-profile "pancake" design.

OBJECTIVE

To develop, design, and manufacture energy-efficient, low-profile, high-performance slotless DC brushless motors. Five frame sizes will be developed and brought to market with various power ranges per frame size.

DESCRIPTION

The contractor will: (1) perform a design review, (2) design and develop the motor, (3) develop prototypes; (4) build and test the pilot motor, (5) initiate and evaluate beta-test sites and determine product readiness, and (6) release the product to the market. Each task will conclude with a review to assess progress, problems, and solutions, and to ensure the project's strategic goals and objectives are being met.

BENEFITS

Current brushless DC motor technology's inherent disadvantages compared to the slotless technology include the motors being much longer and heavier, having iron laminations that cause cogging, and requiring airflow to maintain energy-efficient thermal performance. Due to its improved thermal performance, the PMI pancake brushless motor's efficiency is estimated to range between 79 and 83 percent.

SCHEDULE AND STATUS

The project is complete; awaiting final report.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$150,000	$100,000	$250,000
PMI Motion Technologies	431,251	0	431,251
TOTALS	$581,251	$100,000	$681,251

Contractor: PMI Motion Technologies
Site: Commack, Suffolk County
Contract Duration: 2/96 - 6/97
Key Words: product development, industrial, motors
Project Manager: Barbara Caropolo (518) 862-1090, ext. 3266
Program: Industry
Subprogram: Energy Systems and Applications
Contract No.: 4332-IABR-IA-96

-> High-Temperature Superconducting Magnet for Monitoring of Food Processing

Design and assemble high-temperature superconducting (HTS) magnet for magnetic resonance imaging (MRI) monitoring system use in food processing.

BACKGROUND

The New York State Institute on Superconductivity (NYSIS) has successfully fabricated long (100-1000 meters), mono- and multifilament, silver (Ag)-sheathed Bi2Sr2CaCu2O8 (Bi-2212) superconductors with a uniform critical current along the length by tailoring the heat-treatment process to long-length conductors. The primary obstacle to obtaining a uniform critical current in long conductors was their sensitivity to the conventional partial-melt-growth (PMG) heat-treatment temperature. It was found that a variation of ±1.5°C in the PMG heat-treatment temperature was detrimental to the critical current. NYSIS developed an isothermal-melt-process (IMP) that reduced the temperature sensitivity by widening the heat-treatment temperature range from ±1.5°C to ±4.5°C. Also, to ensure identical heat-treatment temperature throughout the conductor length, a novel "ring-shape" furnace was designed and assembled. The furnace is capable of handling up to 1000 meters of the mono- and multifilament, Ag-sheathed Bi-2212 tape. This "ring-shape" furnace provides a cost-effective method for processing long-length conductors.

OBJECTIVES

To design and assemble the first HTS magnet of an MRI monitoring system in collaboration with Intermagnetics General Corporation, (IGC) of Latham. The magnet will be designed, made, and tested to the specifications necessary for use in food processing for precise detection and control of moisture content in frozen food.

DESCRIPTION

The contractor will: (1) manufacture sufficient quantities of Bi-2212 superconductor tapes via the isothermal melt process in the previously designed "ringshaped" furnace; (2) design and construct an MRI magnet operational at 0.5 Tessler and 20°K in conjunction with a cryocooler; (3) test the magnet for spatial homogeneity of the magnetic field, mechanical integrity, thermal stability, and heat-transfer characteristics; and (4) establish appropriate end-user interaction with a suitable New York State food processor.

BENEFITS

Long-term energy and economic benefits of superconductor technology are far-reaching. Applications such as very efficient power lines, highly efficient motors and power generators, and magnetically levitated trains can become feasible. In the near term, this project will lead to the development of a HTS magnet for highly sensitive MRI monitoring of food processing. Precise detection and control of moisture content in frozen food can prevent over freezing and damage, saving 20 to 30 percent of the energy used in the food processing.

SCHEDULE AND STATUS

Long lengths (kilometers) of Bi-2212 superconductor tapes have been made. An MRI magnet is being designed.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$175,181	$124,660	$299,841
NYSIS	75,182	96,441	171,623
IGC	50,000	49,659	99,659
TOTALS	$300,363	$270,760	$571,123

Contractor: Research Foundation of the State University of New York on behalf of SUNY/Buffalo
Site: Buffalo, Erie County and Latham, Albany County
Contract Duration: 4/94 - 12/97
Key Words: product development, university, electricity, superconductivity, MRI
Project Manager: Nag Patibandla (518) 862-1090, ext. 3301
Program: Industry
Subprogram: Materials Advancement
Contract No.: 3000BN-IABR-IEA-93

-> Modular Steam-Turbine Generator Pressure-Reduction System

Replace throttling valves with modular steam-turbine generator pressure-reduction systems to improve efficiency at industrial sites.

BACKGROUND

The Tecogen Division of Thermo Power Corporation (Tecogen) has conducted a market survey of commercial and industrial high-pressure steam-users in New York State and has been able to quantify a category of users who operate more than 70 hours a week and who have a steam demand that averages at least 6000 lb/hr. Tecogen has proposed to package and market a nominal-rated 100-kW, completely modular, steam turbine-generator set that can be used in parallel with a facility's existing pressure-reduction valves (PRVs). The expansion of the high-pressure steam os a lower pressure can be made more efficient if the pressure reduction is performed using a steam turbine instead of the PRV. This energy-conversion system would generate power only when the user has a steam demand for heating or cooling.

OBJECTIVE

To demonstrate the feasibility of applying small steam-turbine generators. at industrial sites and to help the manufacturers meet federal and State environmental requirements regarding exhaust-gas emissions. Carrier Corporation of Syracuse will be a partner and subcontractor, providing a demonstration site for the steam-turbine generator pressure-reducing system where it will be monitored and serviced by Tecogen for 12 months. Dresser-Rand Corporation will provide the steam turbine.

DESCRIPTION

The contractor will implement two basic engineering modifications of a state-of-the art steam turbine: (1) packaging inexpensive, standardized microprocessor-based controls and switchgear that include a remote-monitoring feature to allow unattended operation to facilitate automatic control of pressure in the turbine's nozzle block at varying loads; and (2) engineering the standardized packaging of the turbine, generator, and controls to reduce the assembled cost of the turbine equipment and to facilitate its installation in small work spaces.

BENEFITS

Tecogen estimates there are more than 450 potential users in New York State and 12,000 nationwide that could generate and thus save a total of 35 and 950 MWe, respectively. This represents an energy-cost savings of about $17.5 million per year for New York manufacturers. Also, a respective 1,250 and 91 tons-per-year reduction of NO_x and CO could be realized for New York State with 30,500 tons of NO_x and 2,200 tons of CO reduced per year nationwide.

SCHEDULE AND STATUS

The turbine is operational and is now being monitored.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$150,181	0	$150,181
Carrier Corp.	129,000	0	129,000
Dresser-Rand	51,000	0	51,000
Tecogen	27,501	0	27,501
Niagara Mohawk Power Corp.	5,000	0	5,000
TOTALS	$362,682	0	$362,682

Contractor: Tecogen Division, Thermo Power Corporation
Subcontractors: Dresser-Rand Corporation and Carrier Corporation
Site: Syracuse, Onondaga County, and Wellsville, Allegany County
Contract Duration: 9/95 - 9/97
Key Words: product development, industrial, electricity
Project Manager: Ed Kear (518) 862-1090, ext. 3269
Program: Industry
Subprogram: Energy Systems
Contract No.: 4230-IABR-IA-96

-> Thermal Acoustic Generator

Build and test proof-of-concept thermal acoustic generator.

BACKGROUND

Worldwide, there is commercial interest in small-scale (1-kW), inexpensive ($500), reliable electric power generation and cogeneration devices for recreational, residential, emergency, or remote applications. Applications exist for gas, biomass, and solar-fired devices. This project will combine thermal acoustic technology with a reciprocating alternator to develop a low-emission, low-noise, long-life, reliable, competitively priced, small, thermal electric generator.

OBJECTIVE

To demonstrate the integration of thermal acoustic and reciprocating alternator technologies and identify the most promising products, specifications, and secondary subsystems. The project also will develop essential components, conduct a worldwide marketing assessment, develop a business plan, and raise funding to complete product development and commercialization.

DESCRIPTION

The contractor will work with Los Alamos National Laboratory to build and test a proof-of-concept thermal acoustic generator. The contractor will: (1) design and analyze the device; (2) procure parts and materials; (3) assemble and test the device; (4) conduct marketing, business planning, and financing tasks; (5) develop essential components;, and (6) report on the results.

BENEFITS

This technology has the potential to result in clean, quiet, reliable, small, and economical generation and cogeneration products (and components) manufactured in New York State and sold worldwide. The products could make electric generation from gas, biomass, and solar more economic.

SCHEDULE AND STATUS

The project is under way.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	0	$214,209	$250,000
Clever Fellows	0	340,463	750,000
TOTALS	0	$554,672	$1,00,000

Contractor: Clever Fellows Innovation Consortium, Inc.
Subcontractor: Rensselaer Polytechnic Institute
Site: Troy, Rensselaer County
Contract Duration: 9/96-7/97
Key Words: product development, electricity, gas, biomass, solar
Project Manager: Ed Kear (518) 862-1090, ext. 3269
Program: Industry
Subprogram: Energy Systems
Contract No.: 4425-IABR-IA-97

-> Development of a Tele-Robotic System for Cleaning and Inspection of Crude Oil Tanks

Develop tele-robotic system to remove accumulated sludge, and homogenize and inspect large crude-oil tanks.

BACKGROUND

Sludge is formed continuously at the bottoms of crude and #6 oil-storage tanks by the precipitation of suspended particles, water, and other chemicals in the oil. Over time, the sludge condenses into an asphalt-like compound that adheres strongly to the bottom; supporting columns; and heating and cooling elements, pipes, and supports. Corrosive elements in the sludge deteriorate the surface preparations and eventually corrode the tank and other surfaces and seam welds. The buildup of the asphalt-type material up to several feet over a period of several years reduces the tank capacity and creates numerous cleaning and inspection problems. The material is not only difficult to remove, but also involves costly disposal and environmental problems. The project team has been working on a conceptual design since October 1993 with funding from Long Island Lighting Company.

OBJECTIVE

To develop an integrated robotic system that will almost entirely eliminate the build-up of sludge through regular homogenization, and clean and prepare the surface and weld lines for in-situ tank inspection. An additional subsystem also will be developed to perform the in-situ inspection.

DESCRIPTION

Conceptual designs and specifications were completed prior to this project. This project will involve the design, fabrication, and testing of a prototype system. Operational testing will be conducted in a mock-up #6 oil tank to be constructed on the SUNY/Stony Brook campus, and will involve testing both under water and in #6 oil.

BENEFITS

New York State will benefit from the ability to inspect oil tanks from the inside while in use so that defective tanks can be taken out of service prior to catastrophic failure. Tank owners and their customers will benefit from cost reductions for cleaning and waste disposal, which can be more than $500,000 for a single 300-ft. diameter tank.

SCHEDULE AND STATUS

This project is under way.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	0	$200,000	$200,000
Long Island Lighting Company	0	30,360	30,360
SUNY/Stony Brook	0	68,191	68,191
OmniTek, Inc.	0	40,187	40,187
Polytechnic University	0	69,091	69,091
TOTALS	0	$407,829	$407,829

Contractor: Polytechnic University
Site: Brooklyn, Kings County, and Stony Brook, Suffolk, County
Contract Duration: 9/96-9/98
Key Words: product development, university, utility, environmental, industrial waste, oil
Project Manager: Ed Kear (518) 862-1090, ext. 3269
Program: Industry
Subprogram: Energy Systems
Contract No.: 4222-IABR-IA-97

Characterize New York State energy efficiency industry in order to expand exports.

BACKGROUND

Markets for energy-efficient technology, including those in South America, Eastern Europe, and Southeast Asia, need to sustain economic growth while minimizing emissions from increased energy production. These countries lack manufacturing infrastructure, and must rely on imported technology, a situation that affords NYS manufacturers a good market. Recent trade missions have provided valuable market-assessment data for manufacturers considering export opportunities.

OBJECTIVES

To develop global NYS export-related activities compatible with NYSERDA's interests, and assist in developing better national and international marketing strategies for energy-efficient technologies. The State's specific indigenous strengths will be emphasized.

DESCRIPTION

Energy-efficient technologies will be defined by product, technology, and industry groups. Product and technology groups significant to the State's economy will be identified by assessing the industrial stock ranked by contribution to the State's gross product and employment base. A scoping study will assess the strengths and weaknesses of specific energy efficiency industries in NYS. The results will be the basis for developing a NYS Energy Efficiency Industry Export Business Directory. The Directory will identify specific businesses, while distinguishing between standard and energy-efficient versions of the same technology. The Directory will be distributed to domestic and international export agencies and businesses.

BENEFITS

The project will help expand markets; enhance economic development; and promote industry self-awareness that can be used for lobbying, technology transfer, and collaborative export marketing. NYSERDA's internal program-planning process will benefit from having highly specific demographic information.

SCHEDULE AND STATUS

The contractor has identified applicable NYS businesses, defined specific components of the energy efficiency industry, and assessed technology export opportunities. A survey of New York energy efficiency companies has been completed. An industry directory is being prepared.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$211,400	0	$211,400
Alliance to Save Energy	62,100	0	62,100
TOTALS	$273,500	0	$273,500

Contractor: Alliance to Save Energy
Site: Troy, Rensselaer County, and Washington, DC
Contract Duration: 3/94 - 9/97
Key Words: assist business, industrial, manufacturing, export
Project Manager: Bill Reinhardt (518) 862-1090, ext. 3257
Program: Industry
Subprogram: Energy Systems
Contract No.: 3106-EEED-IEA-93

-> Heatmap

Develop computer model to perform district heating and cooling prefeasibility studies.

BACKGROUND

Heatmap is a software tool developed by the Washington State University, Cooperative Extension Service, Energy Program (formerly Washington State Energy Office) that can provide a comprehensive simulation of proposed and existing district heating and cooling (DHC) systems.

ACCOMPLISHMENTS

Use of the program furnishes extensive technical, economic, and air-emission information about a DHC application. Program output may be used to evaluate existing system performance or model the effects of various potential alternative system strategies, including upgrades, expansion, or conversion from steam to hot water distribution. A major feature of the program is its ability to comprehensively analyze various parameters for both the supply and return elements of extensive piping distribution systems. Important features include the ability to determine reductions in air emissions that can result from DHC or central energy plant implementation, and the evaluation of environmental taxes on economics.

FINDINGS AND CONCLUSIONS

Heatmap was successfully developed and is available in both Windows (3.xx and 95/NT) and DOS platforms. The DOS platform permits multiple-phase analysis for optimizing capacity and distribution parameters of planned systems. The Windows version provides ease of data manipulation and simplifies procedures for performing comparative analysis of alternative scenarios and the acceptance of hourly consumer-load data. New and improved features of the Windows 95/NT version include: a graphical analysis package covering analytical procedures, metric capability, AutoCAD Release 13 compatibility, international currency units, use of ASHRAE-compatible temperature bin data, insertion of specific pump and valve-curve operation data, extensive report generation options, graphical diagnostics, and color plots of distribution system parameters.

REALIZED OR ANTICIPATED BENEFITS

Implementing a DHC system can provide a 20-30% life-cycle cost reduction versus buying a competing energy source. Using Heatmap to model a potential DHC system can reduce planning time by as much as 75%.

TECHNOLOGY TRANSFER ACTIVITIES

Heatmap is being marketed by Washington State University. Complete programs and associated user manuals are available. Two training sessions were held, one in Illinois and one at West Point Military Academy in New York State. Numerous technical articles have been published and Heatmap has been exhibited at various trade shows, including the International District Energy Association conference and annual meeting.

FUNDING	TOTALS
NYSERDA	$78,580
Washington State Energy Office	139,500
U.S. Department of Energy	50,000
SWEBEX/BFR	32,500
U.S. Navy	35,000
City of Chicago	7,500
TOTALS	$343,080

Contractor: Washington State University Cooperative Ext. Service
Site: Statewide
Contract Duration: 11/90 - 1/97
Key Words: product development, district heating, district cooling, emissions
Project Manager: Barbara Caropolo (518) 862-1090 ext. 3266
Program: Industry
Subprogram: Energy Systems
Contract No.: 1579-EEED-IEA-91

-> Six-Phase Transmission Demonstration

Demonstrate new technology that can increase power-transmission densities.

BACKGROUND
New techniques are needed to increase the power capacity of contemporary power-transmission corridors.

ACCOMPLISHMENTS
The contractor: (1) conducted analytical studies; (2) prepared a preliminary design and cost estimates; (3) prepared a detailed design; (4) procured equipment and components; (5) built the demonstration transmission line; (6) tested, operated, and maintained the line; (7) reported the results; and (8) decommissioned the line.

FINDINGS AND CONCLUSIONS
A six-phase line was successfully built, demonstrated, and tested. An existing substation was retrofitted, standard three-phase terminal equipment was used to connect the six-phase line to a three-phase substation, compact line structures were installed and the existing double-circuit terminal structure was modified for six-phase, and protective relaying was integrated using conventional equipment.

REALIZED OR ANTICIPATED BENEFITS
Six-phase operation provides a technique for reducing physical space for transmission of electric power. It also provides a technique for increasing the power-handling capacity of existing double-circuit lines. Ultimately, this will provide the ability to more effectively use existing rights-of-way, transmit more power along previously unusable or limited corridors, and optimize benefits-versus-cost while minimizing environmental impact.

TECHNOLOGY TRANSFER ACTIVITIES
A final report and several peer review papers have been published.

FUNDING	TOTALS
NYSERDA	$750,000
Petroleum Overcharge Funds	2,000,000
ESEERCO	2,500,000
New York State Electric & Gas Corp.	700,000
Electric Power Research Institute	2,500,000
U.S. Department of Energy	2,600,000
TOTALS	$11,050,000

Contractor: Empire State Electric Energy Research Corporation (ESEERCO)
Site: Binghamton, Broome County
Contract Duration: 10/90 - 12/96
Key Words: electricity, utility, high-phase-order power transmission, six-phase power transmission
Project Manager: Barbara Caropolo (518) 862-1090 ext. 3266
Program: Industry
Subprogram: Energy Systems
Contract No.: 1599, 1600M-EEED-IEA-91

-> Energy-Efficient Office Equipment

Sponsor activities aimed at developing and promoting energy-efficient office technologies.

BACKGROUND

The explosion in electronic office equipment, including personal computers, laser printers, fax machines, and photocopiers, represents a significant growth in electric load. Although performance vs. power consumption continues to improve for each successive generation, technologies exist that could further improve energy efficiency. Currently, no mechanism is in place to allow customers to include energy efficiency in their purchase decision. Under Phase I, the Office Equipment Efficiency Consortium sponsored a technology assessment, development of first-cut efficiency-testing procedures, development of procedures for determining operating profiles, development of a "Buyer's Guide" to efficient equipment, and an "Energy-Efficient Office Technology Workshop" that brought together major purchasers, manufacturers, users, and utilities

ACCOMPLISHMENTS

Over the course of this project, two conferences were held (one national and one international), a Buyer's Guide was published and then updated, a technology assessment of power supplies of the type used in home and office electronic equipment was conducted and its report published, and case-study sites were identified and case studies initiated.

FINDINGS AND CONCLUSIONS

This project formed the basic structure for the activities of the Office Equipment Consortium. In addition to those actions directly funded through this project, the Consortiums actions resulted in the development of the U.S. Environmental Protection Agency's "Energy Star" program, which as first introduces at the Consortium's first conference.

REALIZED OR ANTICIPATED BENEFITS

As a result of this project and associated activities of the Consortium, most personal computers, printers, and copiers today are Energy-Star compliant. The availability of more energy-efficient office technology benefits New York States business and residential users through lower electric consumption and operating costs with no increase in first cost.

TECHNOLOGY TRANSFER ACTIVITIES

Two conferences were held, two Guides were published, a power-supply assessment was published, and reports on the results of the case studies will be published.

FUNDING	TOTALS
NYSERDA	$150,000
Electric Power Research Institute, et al.	173,275
Con Edison	80,000
U.S. EPA	40,000
SCE	30,000
PG&E	15,000
Wisconsin Center for DSR	10,000
TOTALS	$498,275

Contractor: Electric Power Research Institute (subcontracts with American Council for an Energy-Efficient Economy, Massachusetts Institute of Technology, Power Electronics Applications Center, and Policy Research Associates, Inc.)
Site: New York City, New York County; Washington, DC; and Boston, MA
Contract Duration: 5/92 - 6/96
Key Words: product development, office equipment, technology assessment, university, industrial, utility
Project Manager: Ed Kear (518) 862-1090, ext. 3269
Program: Industry
Subprogram: Energy Systems
Contract No.: 1941-EEED-IEA-93

-> High-Temperature Superconducting Power Generator

Design high-temperature superconducting 100-megavolt-amperes generator.

BACKGROUND

Because high-temperature superconductors have no electrical resistance below the critical temperature, they have enormous potential to improve the efficiency of such energy-related devices as electric-power generators.

ACCOMPLISHMENTS

The contractor: (1) defined applications and requirements for a 100-MVA HTS generator, (2) defined a conceptual 100-MVA generator, (3) developed a preliminary generator design, (4) analyzed the generator's performance, (5) quantified the generator's energy and economic benefits, (6) fabricated a Bi-2223 powder-in-tube (PIT) conductor, (7) developed processes to make Tl-1223 and Tl-1212 conductors, (8) developed and fabricated an HTS test rotor coil, and (10) reported the results.

FINDINGS AND CONCLUSIONS

A 100-megavolt-amperes (MVA) generator with a high-temperature superconducting (HTS) rotor winding was successfully designed. Energy and economic benefit analyses were conducted and a prototype HTS coil was built.

REALIZED OR ANTICIPATED BENEFITS

This project has the potential to accelerate the development of high-temperature superconductors for use in power generators and other energy-conserving, energy-producing technologies. Superconducting generators could increase machine efficiency beyond 99 percent, producing energy savings, reduced pollution, and lower life-cycle costs. Various electrical characteristics of a superconducting generator also may improve the stability of the electricity grid.

TECHNOLOGY TRANSFER ACTIVITIES

A final report was written. The U.S. Department of Energy has elected not to fund the development phases and General Electric has decided not to pursue the technology further.

FUNDING	TOTAL
NYSERDA	$100,000
U.S. Department of Energy	2,335,823
General Electric Company	381,261
Intermagnetics General Corp.	247,906
Niagara Mohawk Power Corp.	50,000
Electric Power Research Institute	50,000
TOTALS	$3,164,990

NOTE: Additional related work conducted by various national laboratories under separate agreements with GE and DOE provided another $1 million.

Contractor: General Electric Company
Site: Schenectady, Schenectady County
Contract Duration: 10/93 - 6/96
Key Words: product development, electricity, high-temperature superconductivity, utility
Project Manager: Nag Patibandla (518) 862-1090, ext. 3301
Program: Industry
Subprogram: Energy Systems
Contract No.: 3000A-IABR-IEA-93

-> Industrial Control System

Design hardware, software, peripheral equipment, and input/output display for industrial control system.

BACKGROUND

The marketplace is flooded with dedicated programmable controllers that can be used in an industrial automation system; however, they are proprietary, expensive, hard to operate and limited in function, maintain a closed-system architecture, and are generally incompatible with each other. A better approach would be to use the existing inexpensive power of the IBM-compatible PC, which, with its open architecture and ever-expanding world of software and hardware, is always at the cutting edge and not instantly obsolete.

OBJECTIVE

To develop a control system based on the personal computer using commercially available peripherals and software. This system is intended to significantly reduce the cost of a commercially available controller, while greatly expanding its capabilities.

DESCRIPTION

The contractor will: (1) research existing technology for hardware, software, and peripheral equipment; (2) design the input/output display; (3) design the overall system; (4) build a prototype; (5) test and select components; (6) integrate components, test, and apply the system; (7) document the system's performance; (8) package and promote the system; and (9) conduct several field-tests.

BENEFITS

The proposed system will greatly increase the energy efficiency of companies that use it to automate manufacturing processes. It will cut labor costs and energy expenses while enhancing the accuracy of the manufacturing process. By automating a factory floor, companies can schedule high-energy operations for off-peak periods, stagger machinery operation to reduce demand-ratcheted peak-loads, and better use machinery to run only when required, thus reducing energy consumption.

SCHEDULE AND STATUS

Research into existing technology has been completed and the design portion of the project is under way.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$104,560	0	$104,560
Flair International Corp.	104,560	0	104,560
TOTALS	$209,120	0	$209,120

Contractor: Flair International Corp.
Site: Hauppauge, Suffolk County
Contract Duration: 3/95 - 12/97
Key Words: product development, industrial process
Project Manager: Barbara Caropolo (518) 862-1090 ext. 3266
Program: Industry
Subprogram: Control Systems
Contract No.: 4132-IABR-IA-95

-> Rapid-Charging System for Commercial Lawn-Care Products

Engineer, develop, and test commercial rapid-charge battery-powered lawn equipment.

BACKGROUND

Gasoline-powered lawn-care products, especially mowers and trimmers, are major contributors to air emissions. The Clean Air Act Amendments direct the U.S. Environmental Protection Agency to establish emission regulations for gasoline-powered two- and four-cycle "utility" engines rated at or below 25 HP. Pollution from gasoline engines is introduced into the atmosphere through incomplete combustion and refueling (evaporation/ spillage/leakage), and consists primarily of hydrocarbons (HC), carbon monoxide (CO), oxides of nitrogen (NOx), and particulate matter.

The vast majority of lawn-care equipment runs on either gasoline, corded-electric, battery-electric, or manual power. Efforts are under way to both reduce emissions for gasoline engines and improve storage density and operating cycles of battery-electric systems. Of all the evolutionary paths, the rechargeable battery-electric products are the most immediately promising for providing a solution to air-emission problems.

OBJECTIVE

Phases I and II developed the commercial, walk-behind, rechargeable battery-powered line trimmer and a transportable, rapid-charging system capable of recharging in one hour to 90 percent of full charge from a discharge of less than 20 percent. Phase III will take the model developed in phases one and two and create the necessary tooling and customized machinery to manufacture the trimmer and rapid-charger.

DESCRIPTION

Phase I included: (1) a scoping study, (2) the development of design specifications for the trimmer and the rapid-charge system, and (3) bench-scale testing and development of the concept model. Phase II included: (1) the development of the trimmer prototype models, (2) development of the rapid-charging system, (3) creation of preliminary user manuals, and (4) field-testing. In Phase III, the contractor will: (1) develop the commercial trimmer and rapid-charger manufacturing drawings, (2) assemble and test the trimmer and charger, (3) finalize the users manual, and (4) demonstrate the project at a New York City or Long Island location.

BENEFITS

If successful, the contractor expects to increase sales from $.5 million (1994) to $2 million over the next three years, and anticipates reaching $20 million (100,000+ units) and creating 200 jobs by 2000. In addition to their environmental benefits, electric products also eliminate the need to transport and handle petroleum products, reduce noise levels, are easier to start, reduce maintenance requirements, and contribute to utility-load growth during off-peak times.

SCHEDULE AND STATUS

Phases I and II are complete. Phase III is under way.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$93,753	$62,750	$156,503
Trim-A-Lawn Corp.	93,752	62,780	156,532
TOTALS	$187,505	$125,530	$313,035

Contractor: DC Power Products, Inc.
Site: Utica, Oneida County
Contract Duration: 8/95-6/97
Key Words: environmental, product development
Project Manager: Barbara Caropolo (518) 862-1090 ext. 3266
Program: Industry
Subprogram: Control Systems
Contract No.: 4227L-IABR-IA-96

-> Applicator Development for Top-of-Rail Lubrication in Railroads

Design and develop microprocessor-driven control system to automatically control railroad lubrication.

BACKGROUND

The most energy-efficient land-based mode of transportation is rail transport. By most standard measures, a ton of cargo can be moved by rail at one-third the number of Btu as with trucks. At the same time, rail transportation is a voracious consumer of energy. The most significant innovation for improving efficiency lies in the implementation of top-of-rail (TOR) lubrication. Railroad wheelsets do not roll straight down the track, which causes resistive friction, resulting in the wheelset oscillating. Recently, researchers at the Illinois Institute of Technology have demonstrated that by incorporating TOR into rail-lubrication strategies, it is possible to achieve major energy savings cost-effectively while meeting and exceeding the railroad's goals for reducing rail and wheel wear.

OBJECTIVE

To design and develop a locomotive-based microprocessor-driven control system to automatically control TOR lubrication for the purpose of reducing the primary source of resistive friction in train operation. The system will combine compactness, durability, and economy in order to achieve commercial success and provide energy savings.

DESCRIPTION

The three distinct project tasks are: (1) identifying and quantifying the inputs required to determine the optimum amount of lubricant, (2) developing a method for acquiring the necessary data in real time, and (3) building working prototypes for field-testing. Field-testing will be performed with the Research Laboratory of the Norfolk Southern Railroad to incorporate measurements of rail's the coefficients of friction before, during, and after automatic lubricant application in actual operating conditions.

BENEFITS

Overcoming wheel/rail friction uses 20-40 percent of the tractive effort of a locomotive. Preliminary testing has demonstrated that TOR lubrication can reduce resistive friction by up to 60 percent. TOR lubrication can result in overall energy savings of between 12 and 30 percent. At current consumption rates, this translates into 360 million gallons of diesel fuel annually, or a potential annual cash savings for railroads of more than $216 million.

SCHEDULE AND STATUS

The background research is complete; design of the controller and power supply is continuing. The determination of the lubricant and its applicator is still under investigation.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$225,000	0	$225,000
IEM	226,132	0	226,132
TOTALS	$451,132	0	$451,132

Contractor: International Electronic Machines Corp. (IEM)
Site: Albany, Albany County
Contract Duration: 12/95 - 12/97
Key Words: product development, industrial, rail
Project Manager: Barbara Caropolo (518) 862-1090, ext. 3266
Program: Industry
Subprogram: Control Systems
Contract No.: 4330-IABR-IA-96

-> Commercialization of Weld Controller - Phase II

Develop expanded product line for WeldComputer's adaptive control technology.

BACKGROUND

The WeldComputer technology, which can be retrofitted to existing industrial resistance welders, allows for monitoring and compensation of weld variations that may arise from the weld machine, the workpiece, or external sources. The controller's advantage compared to other weld-control devices is that it can identify correctly the source of the weld variation and take appropriate action. These features benefit the user by eliminating periodic destructive testing and overwelding, cutting energy use through reduced welds, and wasting less material. While the WeldComputer has been received favorably in some commercial markets, notably automotive, the price quite often limits acceptance.

OBJECTIVE

To develop an expanded product line for the contractor's patented adaptive control technology for resistance welding. Three new embodiments are envisioned for the WeldComputer to produce a lower-cost-per-head weld controller; a multiple-head controller; repackaging the WeldComputer without the enclosure, CRT display, and keyboard for situations where those enclosures already exist and the controller can be networked into current systems; and a scaled-down version of the existing system with fewer controls, targeted for specific markets.

DESCRIPTION

In Phase II the contractor will (1) perform a market analysis and create product specifications for three new models of the patented adaptive control technology for resistance-welding control, exhibiting a price/performance ratio acceptable to a larger portion of the market; (2) design and develop hardware and software; (3) construct prototype units;(4) conduct performance testing and product modification; (5) product commercialization. In addition, three current design units will be placed at selected manufacturers to gain feedback on developing optimized control strategies for the new version of the WeldComputer.

BENEFITS

The average number of welds per workpiece may be reduced by 20 percent. Industrial users in NYS and elsewhere will benefit through reduced manufacturing costs and greater productivity.

SCHEDULE AND STATUS

The Phase 1 work under this project has been completed. Phase II design work is complete, the technical papers and final report are anticipated to be complete by third quarter 1997.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$650,000	0	$650,000
WeldComputer	754,060	0	754,060
U.S. Department of Energy	100,000	0	100,000
Gilbert International	118,500	0	118,500
Keeweld, Inc.	74,500	0	74,500
Aerospace S&E	23,300	0	23,300
TOTALS	$1,720,360	0	$1,720,360

Contractor: WeldComputer Corporation
Site: Troy, Rensselaer County
Contract Duration: 2/95 - 8/97
Key Words: product development, microprocessor control
Project Manager: Barbara Caropolo (518) 862-1090, ext. 3266
Program: Industry
Subprogram: Control Systems
Contract No.: 1960L-EEED-IEA-93

-> Demonstration of a Refrigeration Optimization System

Improve energy-cost performance of commercial refrigeration system.

BACKGROUND

Upstate Milk Cooperative, Inc. (UMC) is a fully integrated milk processor owned by 520 dairy farmers. UMC has undertaken an aggressive program to become more competitive in the milk market, including modernizing its facilities with a view toward energy efficiency. Refrigeration equipment accounts for more than 40 percent of the total electrical requirements of dairy processing plants. These refrigeration systems often operate inefficiently, reducing capacity, increasing power consumption, or both, because they are designed for extreme climate and load conditions, but operate most of the time well away from this peak. Because most users also have spare capacity, these situations can persist for long periods without being detected. The MENTOR expert system seeks to optimize efficiency through computer controls that not only instruct the operators on adjusting operating parameters to use resources best, but also notify them when plant performance is below standards.

OBJECTIVE

To install and monitor the MENTOR computerized refrigeration expert system at UMC to improve refrigeration plant energy efficiency, identify plant inefficiencies, record operating performance, test the system's effectiveness under actual field conditions, and assess the system's applicability to other refrigeration plants.

DESCRIPTION

The project team will: (1) perform an operator survey, (2) gather data and evaluate the plant, (3) develop plant specifications, (4) develop Beta unit, (5) install Beta unit and instrumentation, (6) monitor and analyze Beta unit data, and (7) install and start up the final MENTOR version. The project team will prepare technical papers for relevant industry conferences and publications, as well as conduct a site tour at the end of the project for other suitable New York State manufacturing and processing sites.

BENEFITS

Cost savings would be achieved by improving the refrigeration plant's energy efficiency. Tests of the MENTOR system at other installations have demonstrated a reduction in electrical consumption of between 15 and 30 percent.

SCHEDULE AND STATUS

Monitoring of the base case began in February 1997. Software design is progressing.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	0	$90,000	$90,000
Rochester Gas and Electric Corp.	0	94,294	94,294
Upstate Milk Cooperative	0	12,561	12,561
Modern Energy Technologies Corp.	0	2,000	2,000
Veritech	0	6,572	6,572
TOTALS	0	$205,427	$205,427

Contractor: Upstate Milk Cooperative, Inc.
Site: Rochester, Monroe County
Contract Duration: 7/96 - 5/98
Key Words: product development, industrial process, refrigeration
Project Manager: Barbara Caropolo (518) 862-1090, ext. 3266
Program: Industry
Subprogram: Control Systems
Contract No.: 4408-IABR-IA-97

-> High-Power, Distortionless AC/DC Converter

Design, build, and test high-power, distortionless AC/DC converter.

BACKGROUND

With the increase in use of non-linear loads, such as AC/DC converters and adjustable-speed drives, the quality of electric-power supply has become an important source of concern. The number of non-linear loads is expected to further increase with the use of battery chargers for electric cars. Improving the performance of AC/DC converters, which may become the dominant type of non-linear load, is an important need. The main features of the new converter are almost-sinusoidal input current with near-unity power factor and low ripple on the DC side.

OBJECTIVE

To develop a novel converter using state-of-the-art insulated gate bipolar transistor (IGBT) switches. Phase I will cover the initial research and development of a low-power AC/DC converter intended for use as the power-supply unit for domestic battery chargers. This unit is also expected to be useful with PCs, TVs, and VCRs. Phase II will emphasize scaling-up and manufacturing high-power converter prototypes.

DESCRIPTION

Phase I and Phase II will overlap in time. Phase I will cover the following tasks: (1) literature search and commercialization assessment, (2) development of computer and simulation codes, (3) design guidelines, (4) development of single- and three-phase breadboard prototypes, (5) combined performance with loads analysis, and (6) project documentation. Phase II will: (1) design, build, and test high-power AC/DC converter prototype(s) with at least one electric-vehicle-battery-charging application; and (2) demonstrate single- and three-phase operation from standard, 120VAC single- and three-phase 60Hz power sources.

BENEFITS

This AC/DC converter has a number of important applications. It is well-suited for adjustable-speed drives and battery chargers, thus benefiting utilities by reducing load distortion. It also will contribute to significant power-quality improvement during peak hours. This will be accomplished by eliminating not only the out-of-phase current components, but also the harmonics generated by nonlinear loads with input rectifiers. These loads include most office appliances and computers. The benefit to utilities will be the near-elimination of VAR losses and heating, with consequent full restoration of the nominal rating of transformers, power lines, and generators.

SCHEDULE AND STATUS

The project is under way.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	0	$247,503	$247,503
Long Island Lighting Company	0	188,816	188,816
Polytechnic University	0	24,019	24,019
Sensor Systems Industries	0	34,700	34,700
TOTALS	0	$495,038	$495,038

Contractor: Long Island Lighting Company
Site: Brooklyn, Kings County, and Utica, Oneida County
Contract Duration: 7/96 - 11/98
Key Words: product development, electricity
Project Manager: Barbara Caropolo (518) 862-1090, ext. 3266
Program: Industry
Subprogram: Control Systems
Contract No.: 4379-IABR-IA-96

-> High-Power Diode-Pumped Solid-State Lasers

Design and develop diode-pumped solid-state lasers incorporating Uni-crystal technology.

BACKGROUND

Photonics Industries International, Inc. currently manufactures krypton-lamp-pumped solid-state lasers and laser systems. Lasers are categorized by the "active medium" used, (i.e., the basic materials used in the production of the laser energy). A laser may use solid-state crystals, such as YAG (Yttrium-Aluminum-Garnet) and YLF (Yttrium-Lithium-Floride). Most widely used solid-state lasers are made by doping Neodymium (Nd) into a variety of host materials such as YAG/YLF crystals. With a lamp-pumped laser, the laser rod is energized (pumped) by light from an electrical pump lamp; external water cools the laser rod and the lamp. Because substantial progress has been made in the availability and economics of laser diodes, it is now realistic to develop an efficient high-power diode pumped solid-state laser that will replace the lamp-pumped laser in high-power applications.

OBJECTIVE

To develop a high-power diode-pumped Nd:YLF laser that will offer better performance, minimum maintenance, and substantial energy savings. It will use no external cooling water and will be compact in size, at a manufacturing cost comparable to existing lamp-pumped lasers. Two 30-watt fiber coupled laser diodes (from Semiconductor Laser Int. Inc. in Vestal, NY) will be used to couple diode-pumping power to the laser crystal. A specially grown crystal will be used to simulate the contractor's existing laser's thermal lens characteristics in combination with a curved mirror.

DESCRIPTION

The contractor will: (1) design, characterize and test Uni-crystals of Nd:YLF; (2) purchase and test laser diodes, drivers, and controllers; (3) design the image optics, pumping cavity, and laser resonator, (4) perform continuous-wave and Q-Switch operation testing, and (5) design the laser package.

BENEFITS

The proposed product (>=20 watts output power) will save more than 87% in electricity and will use no external cooling water. This amounts to approximately $10,000 annual savings in utility cost for the average user and up to 2.6 million gallons of water saved. The contractor expects to hire a minimum of three new employees if the project is successful. This development effort would put the contractor in a leading position in terms of product output power as well as flexibility of repetition rates.

SCHEDULE AND STATUS

The project is under way.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	0	$143,735	$143,735
Photonics Industries International, Inc.	0	163,715	163,715
TOTALS	0	$307,450	$307,450

Contractor: Photonics Industries International, Inc.
Site: Stony Brook, Suffolk County
Contract Duration: 1/97 - 1/98
Key Words: product development, industrial, laser
Project Manager: Barbara Caropolo (518) 862-1090, ext. 3266
Program: Industry
Subprogram: Control Systems
Contract No.: 4509-IABR-IA-97

-> Light-Element X-ray Fluorescence Using Capillary X-ray Optics

Design optical system for light-element analysis on silicon semiconductor substrates using x-ray fluorescence.

BACKGROUND

Fabrication of semiconductor devices requires a precise control of trace contamination levels. The elemental contaminants with atomic weights higher than that of silicon can be monitored by a total reflection x-ray system (TXRF). However, light elements with atomic weights lower than that of silicon have poor fluorescence and the silicon signal dominates the spectra. Aluminum, sodium, and carbon are the primary light-element contaminants that need to be carefully controlled. Such elements are currently monitored through destructive analysis techniques.

OBJECTIVE

To design a novel system for light-element analysis with low-energy x-rays. The emphasis in Phase I will be on designing and constructing an optic to focus and thereby greatly intensify the x-ray beam onto a silicon semiconductor for determining low Z elements. Phase II involves developing and building a complete prototype light element XRF system and testing it in conjunction with users from the semiconductor industry and XRF equipment manufacturers.

DESCRIPTION

The first phase will include performing energy dispersive measurements on polycapillary fibers, comparing experimental data with ray-tracing simulations, designing an optic, building and testing a prototype multifiber optic, and evaluating the feasibility of the light-element XRF system. There will be a go/no-go decision point at the end of Phase I based on that phase's technical results and market requirements. The second phase will include: selecting the New York State test site; specifying the system design; designing, fabricating, and testing the system; comparing test results with the semiconductor industry association's roadmap and market requirements; and finalizing commercialization plans.

BENEFITS

The system will allow in-line detection of organic and light-element contamination in semiconductor manufacturing, leading to improved device yields and lower energy use per working device. The increase in production yield would translate into savings of $5 million per week for each microprocessor-fabrication facility. The in-line detection capability terminates further processing of contaminated batches, leading to reductions in energy and hazardous chemical use.

SCHEDULE AND STATUS

Phase I is complete and successful; and the Phase I final report is expected by 5/97.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	0	$200,000	$200,000
X-Ray Optical Systems, Inc.	0	242,237	242,237
TOTALS	0	$442,237	$442,237

Contractor: X-Ray Optical Systems, Inc.
Site: Albany, Albany County
Contract Duration: 9/96 - 4/98
Key Words: product development, industrial process
Project Manager: Barbara Caropolo (518) 862-1090, ext. 3266
Program: Industry
Subprogram: Control Systems
Contract No.: 4465-IABR-IA-97

-> Special Coatings Emission-Control System

Develop emission-monitoring system controls for HYDRID™ paint booths.

BACKGROUND

The Clean Air Act Amendments of 1990 require significant changes for users of industrial paints and coatings. In New York State, major coaters also are regulated under 6 NYCRR Part 228 surface-coating requirements. Both of these regulations force user of highly volatile coatings to apply for special permits and variances. Optimum Air Corp. is manufacturing and selling energy-efficient, environmentally compliant paint-booth systems (HYDRID™ system) to industrial users of waterborne paints and coatings. The system enables users to comply with the regulations, save energy and increase productivity through faster drying times. At present, these systems work well for waterborne coatings because they can handle the monitoring requirements for the two or three volatile organic compounds (VOC) still present, as well as filter out the low level of volatiles given off. Modifications need to be made to the filter system and an emissions-monitoring system needs to be developed to allow for the use of volatile coatings.

OBJECTIVES

To upgrade the HYDRID™ filter-system technology and develop a combination emissions-monitoring system to monitor the myriad compounds present in today's highly volatile coatings.

DESCRIPTION

In this project, the contractor and the project team will: (1) select subcontractors and a monitoring system and develop a marketing plan for Optimum Air, (2) develop specifications listing all VOCs likely to be monitored, (3) investigate existing logistical conditions at Goulds Pumps, (4) test the monitoring system, (5) install capture-source modules and HYDRID™ modules, (6) install and test-monitoring system controls, (7) conduct operations training, and (8) develop a commercialization plan. The project team will prepare technical papers for relevant industry conferences and publications, as well as conduct a site tour at the end of the project for other suitable New York State manufacturers that use volatile coatings.

BENEFITS

This project has significant benefits to both Goulds Pumps and Optimum Air. The major direct environmental benefit to Goulds and the surrounding community is the reduction of VOC emissions from as much as 12 tons/year from special coatings to less than 100 lbs/year. The Optimum Air equipment also allows for a marked reduction in natural gas and electrical consumption, approximately $6,500 annually per unit. The New York State Department of Environmental Conservation states that roughly 100 other NYS companies could benefit significantly from the development of this technology.

SCHEDULE AND STATUS

The project is under way.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	0	$250,000	$250,000
Goulds Pumps, Inc.	0	479,873	479,873
Optimum Air Corp.	0	157,760	157,760
TOTALS	0	$887,633	$887,663

Contractor: Goulds Pumps, Inc.
Site: Seneca Falls, Seneca County and Malta, Saratoga County
Contract Duration: 3/97 - 3/98
Key Words: product development, industrial process, emissions
Project Manager: Barbara Caropolo (518) 862-1090, ext. 3266
Program: Industry
Subprogram: Control Systems
Contract No.: 4508-IABR-IA-97

-> High-Efficiency Check-Valve Development

Develop and test new energy-efficient check-valve design for submersible-pump applications.

BACKGROUND

Underground sources of water are becoming increasingly important due to increases in the cost and complexity of treating surface-water sources. Submersible pumps offer maintenance and service advantages over line-shaft pumps in these deep-well applications. Each deep-well submersible pump requires a down-hole check-valve. The friction losses through these valves are typically high. Flomatic Corporation has developed a check-valve concept that has the potential to reduce the flow loss and significantly improve the energy efficiency of deep-well pumping.

OBJECTIVES

To develop a complete check-valve product line with sizes ranging from 12 inches down to four inches. The initial effort will complete the design and testing of a single 6-inch valve. This will be followed by design-test activities with other valve sizes.

DESCRIPTION

The project will include laboratory-testing of the prototype valves to optimize hydraulic efficiency and establish durability. It also will include field-testing of the valve to verify energy benefits in actual deep-well applications. Production-tooling will be developed for commercial manufacture of the valve. The results of the testing will be presented in technical papers. Marketing efforts will include product literature, a video, and trade shows.

BENEFITS

This high-efficiency check-valve has the potential to reduce the pumping energy requirements in water-well systems using submersible pumps. Improvements of two to three percent compared to systems using conventional check-valves are expected. Economic development benefits will accrue from the product being manufactured in New York State.

SCHEDULE AND STATUS

After some unanticipated delays, field-testing is under way.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$81,000	0	$81,000
Flomatic Corporation	128,012	0	128,012
TOTALS	$209,012	0	$209,012

Contractor: Flomatic Corporation
Site: North Hoosick Falls, Rensselaer County
Contract Duration: 5/93 - 12/97
Key Words: product development, municipal, pump, water system
Project Manager: Bill Reinhardt (518) 862-1090, ext. 3257
Program: Industry
Subprogram: Control Systems
Contract No.: 2032-EEED-IEA-93

-> Microprocessor-Controlled Radio-Frequency Induction Heating (Phase II)

Develop new line of more efficient radio-frequency induction-heating equipment for heat-treating applications.

BACKGROUND

Radio-frequency (RF) heating allows for the rapid application of heat to certain materials in a highly localized, controlled manner. This electrotechnology allows for higher throughput and tighter physical integration in today's manufacturing lines. Wherever industrial heat-treating occurs (metals fabrication, semiconductors, packaging, fiber optics, etc.), an opportunity for RF exists. The capacity of an RF unit is defined in terms of its kW power and Khz frequency output. The kW output depends on power electronics, which affect power-conversion efficiency, power factor, and harmonic distortion. The Khz frequency output is affected by the speed at which the signal-target interaction can be monitored and controlled. Generally, higher RF frequencies require high-speed tuning-control capability, with modern digital signal-processing (DSP) technology expected to play an important role. The extent to which Ameritherm, Inc. can develop and produce RF systems with higher kW power and Khz frequency outputs will dictate its ability to remain competitive in this market.

OBJECTIVE

To further advance features and capabilities of an RF heating system developed under Phase I of this agreement, allowing penetration into new markets and retention of market share by keeping ahead of the competition.

DESCRIPTION

The contractor will advance the capability of the products to the 60kW and +450 Khz range by: (1) developing in-house DSP microprocessor tuning-control capability; (2) transitioning to more advanced power electronics in the switch mode power supply to improve the power factor from 0.6-0.7 to 0.9; and (3) product-line planning, including mapping known heat-treating applications against kW-Khz RF system requirements to better define product-market segments and appropriate product-development evolutionary paths.

BENEFITS

Helping this New York State manufacturer of leading-edge RF heat-treating technology will provide general economic development benefits (jobs, multiplier effects) and promote an electrotechnology that offers higher energy efficiency and lower environmental emissions than fossil-fuel methods. The technology is also consistent with higher productivity and electricity-load-growth for New York State manufacturers.

SCHEDULE AND STATUS

Specification development is complete for the power supply, controller and agile tuner. The modules' functionality is being tested and prototypes will be produced by mid-1997.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$450,000	0	$450,000
Ameritherm, Inc.	909,308	0	909,308
TOTALS	$1,359,308	0	$1,359,308

Contractor: Ameritherm, Inc.
Site: Scottsville, Monroe County
Contract Duration: 12/95 - 12/97
Key Words: product development, industrial process, RF induction heating
Project Manager: Barbara Caropolo (518) 862-1090 ext. 3266
Program: Industry
Subprogram: Control Systems
Contract Nos.: 3124-EEED-IEA-94

Design and develop improved kiln technology

BACKGROUND

Firewood is a billion-dollar national industry. The national market for packaged firewood is growing and offers tremendous opportunities to those companies capable of meeting consumer demands. The packaged firewood industry has traditionally been served by small sawmills and other wood-products companies that treat firewood as a secondary product, resulting in poor product quality. The lack of quality standards resulted in suppliers producing toward the "lowest common denominator" and traditional packaged firewood was of extremely low quality. Firestix Industries has broken the mold with its Firestix® brand packaged firewood by addressing the three key elements of consumer demand: (1) clean, dry hardwood free of insects; (2) the means to start the fire; and (3) packaging that makes the product easy to handle and store. Kiln-drying of the wood is the key to product performance. "Traditional" kiln-drying technology cannot be used in the production of packaged firewood for two reasons. First, the production-cycle time is too long to manufacture the product in a cost-effective manner. Second, the temperatures in "traditional" kilns are too low to meet USDA standards for pest control.

OBJECTIVE

To design and develop an improved kiln/oven design that will offer significant benefits over the existing technology to dry cut, split hardwood for packaged firewood

DESCRIPTION

The contractor will: (1) evaluate the characteristics of the water molecules, (2) evaluate alternative heat-energy sources and current kiln/oven design, (3) evaluate existing high-performance kiln and oven designs, (4) perform a computer analysis of ideal arrangements of product and structure, (5) develop controls and instrumentation, (6) construct a prototype, and (7) perform testing and evaluation.

BENEFITS

Firestix is currently running a 450,000-Btu burner with monthly gas expenditures of $10,000 during peak production. The potential energy impact from the improved kiln design is an approximate one-third reduction of the plant's natural gas consumption. In addition the company could realize a significant manufacturing-cost savings; presently, kiln fuel accounts for 8% of Firestix's manufacturing cost. Also, Firestix is unable to keep up with demand for its product due to process constraints, and this improved technology will allow the company to dry wood faster and gain more throughput, thus improving profitability.

SCHEDULE AND STATUS

The project is under way.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	0	$76,255	$76,255
Firestix Industries, L.P.	0	76,255	76,255
TOTALS	0	$152,510	$152,510

Contractor: Firestix Industries, L.P.
Site: Ballston Spa, Saratoga County
Contract Duration: 3/97 - 11/97
Key Words: product development, industrial, heating
Project Manager: Barbara Caropolo (518) 862-1090, ext. 3266
Program: Industry
Subprogram: Control Systems
Contract No.: 4510-IABR-IA-97

-> Energy-Saving Motor Controller

Develop, demonstrate, and commercialize microprocessor-based control device for variable-load, alternating-current induction motors.

BACKGROUND

Many manufacturing operations use oversized, fixed-speed alternating-current (AC) induction motors that are subjected to loads for a small portion of their total operating time. Typical situations include punch presses and other high-inertial-storage systems. This situation represents an opportunity for saving electrical energy if motor voltage can be reduced during periods of inactivity and quickly restored when work is needed. Industrial Commercial Electronics (ICE) has developed a microprocessor-based controller that regulates motor voltage according to actual motor loading.

ACCOMPLISHMENTS

A prototype energy-saving controller applicable to 25-horsepower (HP) electric motors was developed. The device minimizes electrical power consumption in AC induction motors during low- and no-load conditions. Product engineering and manufacturing development were completed for motors up to 500HP. The Underwriters Laboratory and Canadian Service Association listings were obtained. Market research was conducted. A limited inventory was produced and used for beta-site testing.

FINDINGS AND CONCLUSIONS

Savings in kWh and demand charge of 5-30 percent were reported during beta-site testing. Greater savings are realized with significant idling time. The best applications are punch presses and reciprocating and screw compressors. The worst applications were beam pumps and injection-molding machines, where savings were less than 8 percent.

REALIZED OR ANTICIPATED BENEFITS

Realized benefits have been limited to results at beta-test sites and the sale of a few controllers. In New York State, the cost of industrial electricity usage by AC induction motors applicable to the controller is estimated at $598 million annually. About $1 million in reduced electricity costs are anticipated for each percentage point of market penetration by ICE.

TECHNOLOGY TRANSFER ACTIVITIES

ICE is marketing the product in targeted applications and industries based on its research. These opportunities include punch presses, ammonia compressors, air compressors and other high-HP motor applications with a high-starting-torque requirement.

FUNDING	TOTALS
NYSERDA	$114,834
Industrial Commercial Electronics	130,946
TOTALS	$245,780

Contractor: Industrial Commercial Electronics
Site: Buffalo, Erie County
Contract Duration: 8/93 - 6/96
Key Words: product development, microprocessor, motors
Project Manager: Barbara Caropolo (518) 862-1090, ext. 3266
Program: Industry
Subprogram: Advanced Control Systems
Contract No.: 1327-EEED-AEP-90

-> Flywheel Electromechanical Battery for Power-Quality Applications

Develop flywheel-based, electromechanical battery demonstrator for power-quality applications.

BACKGROUND

Electric power-quality problems, such as voltage sags, cause substantial productivity and financial losses to industry, as many industrial devices are sensitive to voltage sags and will malfunction or trip out adjacent equipment. For example, control relays will release, computers will stop, and motors will slow and lose synchronism with others in a process. Batteries and superconducting magnetic-energy storage (SMES) are two options when bulk power is needed to keep a plant or process operating. However, neither approach is optimal.

ACCOMPLISHMENTS

A preliminary design for the power-quality controller was developed, the controls and electronics were built and a 5-kW system was demonstrated.

FINDINGS AND CONCLUSIONS

The project successfully demonstrated the concept of using a high-speed flywheel system as an electromechanical battery. Significant effort is needed to reduce the cost of manufacture.

REALIZED OR ANTICIPATED BENEFITS

The advances in flywheel design resulting from this project will help further the development of this technology. Significant effort remains before a commercially viable flywheel system can be produced.

TECHNOLOGY TRANSFER ACTIVITIES

A final report was prepared.

FUNDING	TOTALS
NYSERDA	$506,979
Mechanical Technologies, Inc.	701,272
ESEERCO	200,000
TOTAL	$1,408,251

Contractor: Mechanical Technologies, Inc.
Site: Latham, Albany County
Contract Duration: 9/93 - 12/96
Key Words: product development, electricity, flywheel, power quality, utility
Project Manager: Ed Kear (518) 862-1090, ext. 3269
Program: Industry
Subprogram: Control Systems
Contract Nos.: 3094-IABR-IA-94

-> Energy-Optimization System for Large Industrial Sites

Develop and demonstrate energy-optimization system for large industrial site.

BACKGROUND

The productivity, reliability, and efficiency of most energy-intensive industrial equipment has evolved to the degree that only small incremental gains remain to be achieved through individual product improvement. The current industry thrust toward reducing energy costs is focused on the most efficient commitment and dispatch of equipment on a plant-wide basis. As the savings to be realized by using computerized dispatch software became known, more industries began looking toward this method for potential gains in efficiency. An area that offers potential additional savings in energy costs is the optimized commitment (selective start/stop) of equipment, combined with optimized dispatch (loading of each, once running). This program addressed that development through the cooperative effort of Power Technologies, Inc. (PTI) and Eastman Kodak (the industrial test site).

ACCOMPLISHMENTS

In Phase I, PTI developed a functional specification defining the capability of the solution algorithm and techniques necessary to complete the software development undertaken in Phase II. The work accomplished in Phase II demonstrated solutions of both unit commitment and dispatch for the 10 test cases presented by Eastman Kodak, to confirm the ability to handle varied equipment configurations and part-load commitments of various groups of refrigeration compressors. Solutions were written in FORTRAN to develop, demonstrate, and confirm the logic involved in the 10 cases and an illustrative core module was written in C++ to demonstrate the generic capabilities that would be used in commercial versions.

FINDINGS AND CONCLUSIONS

The program was successful at determining the proper loading and dispatch of nine out of 10 cases presented by Kodak. The 10th case involved a refrigeration load for which the program was not able to provide the proper economic loading. This project using the Kodak test site was extremely complicated and the number of generation possibilities was larger than the average industrial site; thus the program as it stands at the end of this project is quite capable of optimizing the majority of industrial generation sites in NYS.

REALIZED OR ANTICIPATED BENEFITS

This technology will give PTI the ability to assist industrial sites in analyzing and operating their energy supply system. Many industries where on-line optimization could yield high potential savings could benefit from the availability of this optimization program.

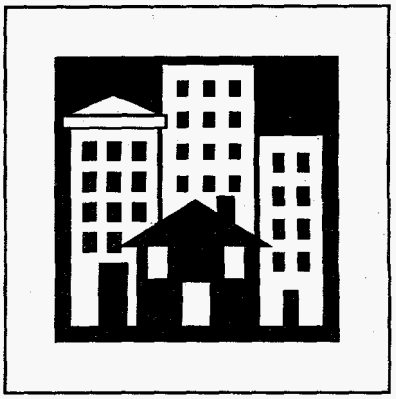
TECHNOLOGY TRANSFER ACTIVITIES

PTI made several technical presentations promoting this technology, including one at the American Society of Mechanical Engineer's Industrial Power Conference. Two courses were added to PTI's engineering training courses: Optimization of Plant Operations and Plant Monitoring for Improved Economics. PTI also is marketing the technology to other large industrial sites involved in generation.

FUNDING	TOTALS
NYSERDA	$135,113
Power Technologies, Inc.	60,114
Eastman Kodak	75,000
TOTALS	$270,227

Contractor: Power Technologies, Inc.
Site: Rochester, Monroe County, and Schenectady, Schenectady County
Contract Duration: 3/95 - 6/96
Key Words: product development, industrial process, optimization
Project Manager: Barbara Caropolo (518) 862-1090 ext. 3266
Program: Industry
Subprogram: Control Systems
Contract No.: 4122-IABR-IA-95

BUILDINGS



Benefits and Rationale

Residential and commercial buildings consume 49% of the energy (and 75% of peak electrical demand) in New York, considerably more than the national average, reflecting the State's large concentration of office buildings. Improved building envelopes and more efficient building equipment could conservatively reduce New York's $19-billion annual energy bill in the residential and commercial sectors by $3 billion, while providing significant economic and environmental benefits to the State.

With only 0.5% of sales from the buildings and construction sector going into R&D, considerably less than the national industrial average of 3.4%, this sector is ripe to expand R&D, innovation, and productivity. Several hundred manufacturers in New York produce energy equipment and systems for buildings, including products used for lighting, heating/cooling, and ventilation. These companies are primarily small businesses with limited resources to develop advanced energy technologies. Helping New York manufacturers respond to the expanding market for energy and environmental products will create new manufacturing jobs in New York.

Lighting accounts for approximately 5,000 MW of electric demand in New York State. Energy savings of 20% in lighting can be achieved over the next decade, amounting to an annual savings of approximately $400 million to New Yorkers. More than 5% of buildings are remodeled or rehabilitated each year, providing a good opportunity to cost-effectively install efficient lighting systems. NYSERDA's work in lighting has historically focused on information dissemination and testing. Our current and future efforts are focusing on developing a high-efficiency lighting industry in New York.

Space heating and cooling consume 60% of the energy used in residential and commercial buildings and also are prime candidates for energy efficiency improvements. More efficient technologies could reduce energy consumption for heating and cooling by 30%. Heating equipment with very low NOx and carbon monoxide emission levels also could reduce air pollution. The heating and cooling industry operates on an extremely tight profit margin and suffers from lack of R&D resources. NYSERDA has over the years helped build New York's heating and cooling industry and will continue with its successful industry partnerships to develop energy-efficient New York products.

Electrical and control systems are another area where efficiency improvements could produce significant savings for the consumer and product-development opportunities for New York manufacturers. Promising R&D areas include electrical and motion controls for equipment and systems (such as HVAC and lighting controls), energy management systems, and motors and drives. Electric motors alone consume more than half the nation's electrical output; in commercial buildings, electric motors that drive HVAC systems account for 50% of the total energy budget. Issues of cost reduction, power quality, packaging, and system architecture need to be addressed. Continued advances in microelectronics provide new opportunities for product development in this area. In addition, new markets are opening up as a result of the restructuring of the energy industry. NYSERDA's role will be to help the small companies take advantage of these technical advances and market opportunities and to objectively assess new technologies developed in this area.

Improving the *building envelopes* of new residential structures can reduce heating and cooling system requirements by up to 80%. NYSERDA's 1994 window technologies assessment estimated that, compared to using double-pane windows, advanced window technologies for new and existing buildings could save 2.5 TBtu of energy annually by 2010. Commercial and residential customers could save $100 million annually. Areas of emerging importance in this program area are ventilation and thermal distribution. Acceptable indoor air quality must be maintained through the use of innovative ventilation strategies that assure modern buildings are both efficient and healthy. Improvements in thermal distribution are also essential, as these systems can waste up to one-third of the heat produced by the heating system.

Several building technologies that use renewable energy, often termed "end-use renewables," are currently cost-effective, or have the potential to be cost-effective in the near term. These include earth-coupled and groundwater heat pumps, daylighting, passive solar heating, and solar heating of ventilation air and domestic water. These technologies require further research and need to be integrated into overall building system design.

New York has an estimated 550,000 units of publicly assisted *low- and moderate-income multifamily housing.* Many of the 500,000+ electrically heated dwelling units in New York are in this publicly assisted housing. Despite the State's annual expenditure of some $800 million to assist low-income residents, effective energy efficiency measures have been difficult to implement in this sector for a variety of reasons, including limited access to financing and various disincentives inherent to low-income sector housing for both owner investment and tenant conservation. The potential for improved energy efficiency in the public housing and low-income sector is estimated to range from 12-30%. Research is needed to assess the feasibility of new technologies for cost-effective conversion of electric-resistance space heating, and to identify promising new financing strategies for implementing energy efficiency measures.

As noted by NYSERDA's recent external review panel, the restructuring of the utility industry has the potential to significantly impact the low-income/multifamily sector in New York. NYSERDA's Buildings program will need to ensure that, within its limited resources, its research addresses any new needs in this sector that may result from utility restructuring.

The primary impact of the Buildings program will be measured in terms of annual sales of new, New York State-manufactured energy-efficient products; installations of energy-efficient products in New York; number of start-up companies initiated; energy saved; and emissions avoided; as well as continued contributions in providing objective information on new building products and systems for policy-makers and consumers in New York.

Goals

- Reduce consumer energy costs for residential and commercial buildings and address the special energy problems of the low-income housing sector.
- Improve building equipment performance to minimize environmental impacts and ensure energy efficiency and healthy indoor air.
- Develop energy and environmental products that can be manufactured in New York.
- Increase the use of renewable energy in buildings.

-> Lighting Research Center Partnership

Maintain and expand capabilities, scope, and usefulness of Lighting Research Center.

BACKGROUND

NYSERDA recognized the need for a Lighting Research Center (LRC) and, after a competitive process, selected Rensselaer Polytechnic Institute (RPI) as the site. The LRC conducts applied research, development, and demonstration projects to encourage the use of more efficient lighting systems and strategies in the State. The activities of the LRC include a broadly based technology-transfer and education program aimed at informing the lighting industry, the lighting-design community, and end-users of energy-efficient and productive lighting strategies. It also educates future lighting-system producers and designers about effective lighting.

OBJECTIVE

To provide support for the LRC Partnership Program.

DESCRIPTION

The contractor will engage in specific research projects, maintain the organizational structure for the LRC, plan and implement lighting research, and acquire technical, financial, and marketing support from national sponsors.

BENEFITS

In New York State, lighting accounts for as much as 30 percent of the electricity consumed. A reduction of 20 percent is attainable through developing and commercializing efficient lighting products. This program continues to support a center of excellence in lighting research that attracts research dollars to New York, generating economic development spin-offs as new products and services are developed.

SCHEDULE AND STATUS

The LRC is fully established and conducts a broad range of research, outreach and educational activities for the lighting industry on a continuing basis.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$1,450,000	$150,000	$2,550,000
Rensselaer Polytechnic Institute	180,000	0	180,000
Niagara Mohawk Power Corp.	1,435,000	50,000	1,535,000
Other co-funders	1,000,000	650,000	4,150,000
TOTALS	$4,065,000	$850,000	$8,415,000

Contractor: Rensselaer Polytechnic Institute
Site: Troy, Rensselaer County
Contract Duration: 3/88 - 12/99
Key Words: university, lighting, lighting research, commercial, residential
Project Manager: Marsha Walton (518) 862-1090, ext. 3271
Program: Buildings
Subprogram: Lighting
Contract No.: 1052A-EEED-BES-88

-> National Lighting Product Information Program

Research, develop, publish, and disseminate information about energy-efficient lighting products and systems.

BACKGROUND

This project was initiated in 1990 to collect manufacturer-specific performance and other information on a series of lighting products and systems, to evaluate this information, and perform independent testing on these products. The resulting information has been documented in a series of publications that include: Specifier Reports, with manufacturer-specific information; Lighting Answers, which addresses specific lighting problems; executive summaries; and special reports.

OBJECTIVE

To continue to support the National Lighting Information Program.

DESCRIPTION

The contractor will produce: (1) Specifier Reports on HID accent lighting systems, dimming systems for CFLs, occupancy sensors, photocell controls, dimmable electronic ballasts, electronic ballasts, exit signs, and screwbase CFLs; (2) Lighting Answers for energy management systems and power quality of CFLs; 3) two Product Guides to communicate the test findings to consumers; and 4) perform long-term testing of fluorescent lamp and electronic ballast combinations to determine their compatibility and reliability.

BENEFITS

In New York State, lighting accounts for as much as 30 percent of the electricity consumed. A reduction of 20 percent of this energy consumption is attainable through the development and commercialization of efficient lighting products. This project is the nation's primary source of objective information on efficient lighting products and is promoted by the U.S. EPA/DOE Green Lights Program and other programs.

SCHEDULE AND STATUS

The sixth year of research is complete; more than 20 publications have been produced on different lighting products and subject areas. NLPIP circulates 157,855 copies worldwide. The program will continue to add new publications to the series.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$625,000	$175,000	$925,000
U.S. Environmental Protection Agency	600,000	200,000	1,350,000
ESEERCO	300,000	100,000	400,000
Bonneville Power Authority	0	50,000	0
New England Utilities	200,000	0	200,000
The Energy Center of Wisconsin	150,000	50,000	200,000
Southern California Edison	100,000	0	100,000
Hydro Quebec	50,000	0	50,000
CINergy	100,000	50,000	200,000
U.S. Department of Energy	100,000	50,000	300,000
Northern States Power	200,000	50,000	250,000
Iowa Energy Center	100,000	50,000	200,000
Other co-funders	184,800	50,000	500,000
Electric Power Research Institute	0	100,000	200,000
TOTALS	$2,709,800	$925,000	$4,875,000

Contractor: Rensselaer Polytechnic Institute
Site: Troy, Rensselaer County
Contract Duration: 3/90 - 11/98
Key Words: university, lighting, commercial
Project Manager: Marsha Walton (518) 862-1090, ext. 3271
Program: Buildings
Subprogram: Lighting
Contract No.: 4010-IABR-BR-95

-> Lighting Evaluation Tools Development

Develop set of tool kits to evaluate lighting systems.

BACKGROUND

While many programs promote and install energy-efficient lighting in commercial buildings, there are no standardized or easy methods to evaluate the performance or effectiveness of lighting systems. This project is designed to develop tools and methodologies to measure the overall effectiveness of lighting installations, including evaluating different approaches to understanding the effects of and human responses to various lighting systems.

OBJECTIVE

To develop a usable method to evaluate the responses and relationships between lighting energy consumption and lighting levels.

DESCRIPTION

The contractor will develop standardized methods to evaluate the performance of lighting systems in different types of buildings and applications, and develop, use, test, and evaluate evaluation tools in the field. Using such tools will, for the first time, permit standardized evaluation of visual comfort and performance, in addition to energy performance. Included will be basic evaluation kits for commercial, retail and outdoor spaces; an advanced kit for commercial spaces; and a comprehensive evaluation kit with software component.

BENEFITS

In New York State lighting accounts for as much as 30 percent of the electricity consumed. The lighting evaluation tools developed under this project will promote more effective and efficient lighting usage.

SCHEDULE AND STATUS

The literature review, statistical background work, and basic and advanced tool kit and user manual for commercial spaces have been completed. Evaluation of an installation of commercially available metal-halide and high-pressure sodium lamps at the Schenectady County Community College parking lot has been completed, and a simple measurement for glare developed. A supplementary evaluation of an experimental metal halide lamp (EX) for use at low luminances typically found in parking lots was also completed at the Schenectady County Community College parking lot.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$440,000	0	$440,000
New York Power Authority	60,000	0	60,000
Energy Center of Wisconsin	50,000	0	50,000
TOTALS	$550,000	0	$550,000

Contractor: Rensselaer Polytechnic Institute
Site: Troy, Rensselaer County
Contract Duration: 4/93 - 6/97
Key Words: university, lighting, DSM, commercial
Project Manager: Marsha Walton (518) 862-1090, ext. 3271
Program: Buildings
Subprogram: Lighting
Contract No.: 4011-IABR-BR-95

-> New York Lighting Network

Develop computerized mailing list of lighting-related businesses in New York State and survey industry's research and technical assistance needs.

BACKGROUND

While New York State is recognized as a design center for lighting products, there is no centralized database or efficient method for connecting New York buyers and sellers of lighting products. This project is designed to develop a better understanding of the scope of New York's lighting-related businesses and their business assistance and technical information needs.

OBJECTIVE

To develop a computerized information base of lighting-related companies in New York State to better target NYSERDA's Lighting Program.

DESCRIPTION

The contractor will use commercially available mailing lists and conduct telephone and written interviews with New York lighting-related companies to develop the information base. The contractor also will survey a wide target audience with a potential interest in lighting (including manufacturers, lighting specifiers, building owners, medical and insurance professionals, electric utilities, energy service companies, and electronics and engineering companies).

BENEFITS

In New York State, lighting accounts for as much as 30 percent of the electricity consumed. Many demand-side management and other energy-efficient lighting programs implemented throughout New York State and the country over the last decade are being phased out in response to the electric industry's efforts to adapt to a more competitive business environment. The information developed under this project will assist New York's purchasers of lighting products by identifying goods and services available in New York, and will help NYSERDA remain abreast of the lighting industry's changing research and technical assistance needs.

SCHEDULE AND STATUS

The computerized listing of lighting-related companies in New York was completed and the surveys have been administered. The final report identifying key concerns and trends common to lighting manufacturers, distributors, ESCOs, and lighting consultants will be completed in early summer 1997.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$39,763	0	$39,763
TOTALS	$39,763	0	$39,763

Contractor: Rensselaer Polytechnic Institute
Site: Troy, Rensselaer County
Contract Duration: 3/96 - 8/97
Key Words: university, assist business, lighting, DSM, commercial
Project Manager: Marsha Walton (518) 862-1090, ext. 3271
Program: Buildings
Subprogram: Lighting
Contract No.: 4347-IABR-BR-96

-> New York State Excellence in Lighting

Design, specify, produce, and commercialize energy-efficient lighting in New York.

BACKGROUND

The project was originally funded in April 1994 as the Lighting Market Transformations Program, funded by NYSERDA, the U.S. Department of Energy (DOE), the U.S. Environmental Protection Agency (EPA), and Rensselaer Polytechnic Institute (RPI). The project worked with user groups, utilities, manufacturers, industry associations, researchers, government, and public-interest groups to achieve consensus on new energy-efficiency specifications for selected products. It developed new specifications and tested and evaluated specifications for exit signs, office lighting, high-intensity-discharge (HID) lamps, and occupancy sensors.

OBJECTIVE

To work directly with New York lighting manufacturers and specifiers to ensure New York products compete successfully with ENERGY STAR lighting products by equaling and exceeding ENERGY STAR specifications, and provide expert assistance to New York companies that may need help in making the requisite product improvements to qualify their products for the ENERGY STAR Program and federal procurement requirements.

DESCRIPTION

The contractor will host four seminars to introduce New York lighting manufacturers to the new and proposed ENERGY STAR specifications for exit signs, residential luminaires, task lighting, and HID/electronic ballast combinations. Lighting Research Center (LRC) staff will work with New York lighting manufacturers to ensure they are able to meet the energy-efficiency criteria for these products. The Excellence in Lighting Program will provide up to a day of LRC expert consultation to New York manufacturers on an as-needed basis, and showcase the lighting products developed by New York companies in collaboration with NYSERDA in two DELTA Snapshot publications. EPA, DOE, The Bonneville Power Administration, and RPI will continue to develop and evaluate new ENERGY STAR specifications for exit signs, residential luminaires, task lighting, and HID/electronic ballast combinations.

BENEFITS

Increased economic development will result from the manufacture and sale of these products, which will be up to 50 percent more energy-efficient than conventional products and operate in the top 10 percent of product efficiency levels.

SCHEDULE AND STATUS

Specifications have been prepared for exit signs and residential exterior luminaires. Office and residential luminaire, HID lamps, ballasts, and controls and other product specifications are being developed. A residential lighting roundtable, bringing together manufacturers, specifiers, designers, and users to identify market barriers to adoption of energy efficient lamps in residential markets was held. An exit sign roundtable is planned sometime during June 1997.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$225,000	$150,000	$425,000
U.S. Department of Energy	225,000	0	225,000
U.S. Environmental Protection Agency	225,000	240,000	840,000
Bonneville Power Administration	0	75,000	75,000
Rensselaer Polytechnic Institute	17,000	12,000	42,000
TOTALS	$692,000	$477,000	$1,607,000

Contractor: Rensselaer Polytechnic Institute
Site: Troy, Rensselaer County
Contract Duration: 4/94 - 3/98
Key Words: product development, university, lighting, lighting research, DSM
Project Manager: Marsha Walton (518) 862-1090, ext. 3271
Program: Buildings
Subprogram: Lighting
Contract No.: 3154-IABR-BR-94

-> Commercial Production of Solar Lighting Systems

Commercialize new solar lighting product that can be integrated with high-intensity discharge lighting system.

BACKGROUND

Under contract with NYSERDA, Synertech Systems, Corp. developed a unique concept for a solar lighting system that can be integrated with an artificial light source to provide backup power when solar power is insufficient or unavailable. Past efforts to commercialize solar lighting products have been unsuccessful due to both the high production costs and lighting's constant energy requirements. Lightron of Cornwall's lighting consultant, Artech, has developed a revolutionary new lighting system called the Multi-Beam System, which is being developed by Lightron under a separate contract with NYSERDA (No. 4298-IABR-BR-96), that requires a minimal amount of energy. This technology provides a unique opportunity to test the integration of a solar power option. Lightron is a well-established New York manufacturer of lighting products and will commercialize Synertech's product if this project indicates that it is technically and economically feasible.

OBJECTIVE

To develop an active solar collection system and a method for integrating it with Lightron's Multi-Beam System.

DESCRIPTION

The contractor will develop the tooling requirements, controls, performance ratings, and installation practices for a solar lighting/energy-efficient light-conveyance system and its interface with Lightron's Multi-Beam System. The contractor will prepare design specifications for the system's ultimate production by Lightron, and collaborate with Lightron on a demonstration of an integrated energy-efficient conveyance/solar lighting system at an appropriate facility. If technically and economically feasible, Lightron will manufacture the solar lighting system and market and sell it with or without the energy-efficient light-conveyance products.

BENEFITS

Combining solar lighting with Lightron's energy-efficient lighting system will achieve unprecedented savings in electrical energy. Commercializing the solar lighting system will result in a significant number of manufacturing jobs at Lightron's main facility in New Windsor, New York.

SCHEDULE AND STATUS

Specifications for a solar lighting prototype that comprises a complete system for transferring natural light into a light distribution system have been developed. Preliminary experimentation with the proof-of-concept model of the off-axis design has also been accomplished. The next task will be to create an optical interface, to be designed by Artech, between the solar lighting system and Lightron's Multi-Beam System.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$120,000	0	$120,000
Synertech	100,000	0	100,000
Artech	18,500	0	18,500
Ashley McGraw	1,500	0	1,500
TOTALS	$240,000	0	$240,000

Contractor: Synertech Systems Corp.
Site: New Windsor, Orange County, and Syracuse, Onondaga County
Contract Duration: 4/96 - 10/97
Key Words: product development, lighting, solar
Project Manager: Marsha Walton (518) 862-1090, ext. 3271
Program: Buildings
Subprogram: Lighting
Contract No.: 4297-IABR-BR-96

-> Commercial Production of Energy-Efficient Light-Conveyance Systems

Commercialize new integrated lighting product based on high-intensity-discharge (HID) bulbs and solar lighting components.

BACKGROUND

The National Energy Policy Act of 1992 requires states to have energy codes equivalent to the ASHRAE 90.1 standard, which limits retail unit lighting from 2.1 to 3.3 watts per square foot. This does not provide enough lighting power if incandescent sources are used. Although this standard provides enough lighting power if fluorescent lights are used, their output cannot be aimed efficiently for the purposes of display lighting and down-lighting from high-ceiling spaces. Lightron of Cornwall has developed a revolutionary new lighting technology that can address this problem for retail, commercial, and industrial markets. It is based on energy-efficient HID bulbs coupled with a system that directs light from HID sources into multiple beams for display- and down-lighting.

OBJECTIVE

To complete the work needed to specify the tooling requirements for making pre-production prototypes of Lightron's light-conveyance technology: the multibeam projector, the trackmold, and the wall washer.

DESCRIPTION

The contractor will finalize the design and production work to commercialize the Multi-Beam Light Conveyance System and integrate it with solar lighting system, developing controls, performance ratings, and installation practices for these integrated systems; and marketing and selling the lighting systems through a demonstration facility, brochures, catalogs, videos, and other promotional efforts. Lightron of Cornwall is responsible for coordinating the project and for manufacturing the integrated lighting products. Synertech Systems Corporation will develop the solar lighting system and method of interface with the Lightron system under a separate contract with NYSERDA (Contract No. 4297-IABR-BR-96).

BENEFITS

The project has significant economic development and environmental benefits, particularly for retail applications. The new technology is expected to deliver substantial savings in lighting costs.

SCHEDULE AND STATUS

Prototypes of the Multi-Beam Light Conveyance System (minus the solar lighting component) have been produced and installed in Penney's Department Stores in New York, Texas, and Maryland. Retooling for factory production, and final design work to miniaturize system components are being completed.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$130,000	0	$130,000
Lightron of Cornwall	130,450	0	130,450
TOTALS	$260,450	0	$260,450

Contractor: Lightron of Cornwall
Site: New Windsor, Orange County and Syracuse, Onondaga County
Contract Duration: 4/96 - 10/97
Key Words: product development, lighting, solar
Project Manager: Marsha Walton (518) 862-1090, ext. 3271
Program: Buildings
Subprogram: Lighting
Contract No.: 4298-IABR-BR-96

-> Developing Fixtures for Energy-Saving Metal Halide Lamp

Develop and commercialize family of fixtures for new energy-efficient PAR 30 metal halide lamps.

BACKGROUND

Merchandise in retail stores is typically lit by incandescent light sources. New federal regulations have banned the use of incandescent sources in many applications and, as a result, several new light sources are coming on the market, including the PAR 30 metal halide lamp. This project will develop a family of fixtures to optimize the use of this lamp.

OBJECTIVE

To develop a family of nine fixtures, "arclites," to apply the PAR 30 lamp to a series of end-use commercial retail applications.

DESCRIPTION

The contractor will complete the initial engineering to determine product features, design development and prototype testing, evaluate ballast/lamp compatibility, and develop final designs and specifications. Additionally, the contractor will design, test and put into operation the production line; develop final packaging and a marketing strategy; and undertake an initial pilot manufacturing run.

BENEFITS

A new family of energy-efficient light fixtures will be marketed by a New York State manufacturer, resulting in increased employment and revenues. Energy-efficient metal halide lamps will replace mostly incandescent lamps, greatly reducing energy use and minimizing environmental impacts associated with electricity use.

SCHEDULE AND STATUS

The initial engineering and design development work have been completed and prototypes have been constructed. Prototype testing and lamp/ballast compatibility testing has also been completed. The arclite Par 30 fixtures were exhibited at the April 1997 Lightfair at the Javits Center in New York City. Factory retooling is under way to manufacture the fixtures at the contractor's manufacturing facility in Long Island City, New York.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$150,000	0	$150,000
Edison Price Lighting Inc.	196,848	0	196,848
TOTALS	$346,848	0	$346,848

Contractor: Edison Price Lighting, Inc.
Site: New York, New York County
Contract Duration: 12/95 - 9/97
Key Words: product development, lighting
Project Manager: Marsha Walton (518) 862-1090, ext. 3271
Program: Buildings
Subprogram: Lighting
Contract No.: 4300-IABR-BR-96

-> Design and Production of Linear T5 Fluorescent Lamp Energy-Efficient Luminaires

Develop linear T5 fluorescent lamp energy-efficient luminaires.

BACKGROUND

Many new energy-efficient lighting products are being developed in the United States. However, most of these are lamps and ballasts, with few luminaires being developed to incorporate the new lighting technologies. Several new lamp products, such as the T5 fluorescent lamp, have been available in Europe for the last five years and produced more recently in the United States. T5 fluorescent lamps are an improvement over the standard energy-efficient T8 fluorescent lamps because they are more energy-efficient and their smaller diameter can achieve improved light focus in a lighting-fixture reflector. Luminaires for the T5 lamp are not presently available in the United States.

SCOPE

This project will analyze the market and the potential for a T5 fluorescent luminaire family, and produce and commercialize high-quality, energy-efficient luminaires for the T5 lamp.

RESEARCH EFFORT

SELUX Corporation and its consultant, Synergy Consultants, will perform market research and a technology assessment for T5 lamps and ballasts; define the design, develop prototypes and produce sales samples of T% luminaires; and manufacture and demonstrate the lamp/ballast/luminaire technology at an appropriate New York site.

BENEFITS

The T5 fluorescent lamp's high efficiency and narrow profile could result in significant energy savings and new opportunities for efficient lighting. SELUX will be the first U.S. manufacturer to produce a luminaire to accommodate the T5 fluorescent lamp with electronic ballast. If the new lamp technology replaces the T8 fluorescent lamp, SELUX's luminaires will enable specifiers and buyers to obtain appropriate luminaires in New York, creating jobs locally and saving U.S. dollars from being spent abroad.

SCHEDULE AND STATUS

The market research has been completed and prototypes of two designs were exhibited at the April 1997 International Lightfair at the Javits Center in New York City. Factory retooling is under way to manufacture the fixtures in Highland Falls, New York.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	0	$245,612	$245,612
SELUX Corporation	0	245,612	245,612
TOTALS	0	$491,224	$491,224

Contractor: SELUX Corporation
Site: Highland, Ulster County
Contract Duration: 5/96 - 11/97
Key Words: product development, lighting, energy efficiency
Project Manager: Marsha Walton (518) 465-6251, ext. 271
Program: Buildings
Subprogram: Lighting
Contract No.: 4325-IABR-BR-97

-> Demonstration and Evaluation of Lighting Technologies and Applications (DELTA)

Demonstrate, evaluate, and publish results of end-use lighting applications.

BACKGROUND

In 1990, the Lighting Research Center (LRC) performed a survey to determine the barriers and key initiatives that could be undertaken to stimulate the use of energy-efficient lighting in commercial buildings. One of the primary initiatives identified was the promotion of in-situ demonstrations that could be evaluated in a comprehensive, uniform, and comparative manner. To address that need, NYSERDA designed this project in cooperation with the LRC.

OBJECTIVE

To develop a portfolio of demonstration sites in the Northeast exemplifying good lighting practices for specific end-use applications. Demonstration sites will be documented in DELTA Portfolios (6-12-page evaluations) and DELTA Snapshots (2-page technology application descriptions).

DESCRIPTION

The contractor will analyze and evaluate each site for lighting energy performance and quality. Standardized evaluation and reporting will be used and a series of publications will be produced to make this information available to key audiences.

BENEFITS

In New York State, lighting accounts for as much as 30 percent of the electricity consumed. A 20-percent reduction is attainable through lighting research and technology transfer. This project will produce information that will promote informed decision-making about energy-efficient lighting alternatives by demonstrating efficient lighting in a series of end-use applications.

SCHEDULE AND STATUS

Six Portfolios and three Snapshots have been completed, and one Portfolio and three Snapshots are under way.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$300,000	0	$400,000
Northeast Utilities Service Co.	240,000	$97,000	400,000
Niagara Mohawk Power Corp.	5,000	0	50,000
Bonneville Power Administration	50,000	10,000	200,000
SONY	32,000	0	32,000
Con Edison	30,000	35,000	100,000
Rochester Gas and Electric Corp.	10,000	10,000	20,000
General Electric	0	12,000	12,000
Other co-funders	0	37,000	200,000
TOTALS	$667,000	$201,000	$1,414,000

Contractor: Rensselaer Polytechnic Institute
Site: Troy, Rensselaer County
Contract Duration: 4/95-4/98
Key Words: university, lighting, DSM, demonstration, commercial
Project Manager: Marsha Walton (518) 862-1090, ext. 3271
Program: Buildings
Subprogram: Lighting
Contract No.: 4084-IABR-BR-95

-> Energy-Saving Track Lighting

Design, test, produce, and commercialize energy-efficient track-lighting systems.

BACKGROUND

Most display- and flood-lighting of commercial retail spaces use inefficient incandescent lights. Recent technology developments in light sources and electronic ballasts provide the opportunity to replace these lights with efficient light sources.

OBJECTIVES

To design, engineer, manufacture, and market a variety of energy-saving track-lighting fixtures to make optimal use of a range of new compact fluorescent lamps and electronic ballasts.

DESCRIPTION

The contractor will complete all aspects of design optimization, development, testing, production set-up, and marketing for track-lighting fixtures dedicated to a series of differently sized and configured compact-fluorescent lamps. The research will include design and testing of optical, thermal, mechanical, and electrical properties of the fixtures for optimal performance, aesthetic appeal, and production-cost minimization. Production lines will be designed, value-engineered, and installed to manufacture the products. Marketing and training materials will be developed.

BENEFITS

These fixtures will be at least 60-percent more energy-efficient. The savings potential for using these fixtures is in the range of 50 megawatts in New York State, as these lights typically are used more than 12 hours a day, seven days a week.

SCHEDULE AND STATUS

The design, final engineering and tooling for the accent lighting luminaire for compact fluorescent systems have been completed. Marketing of the product series is under way. The product series was displayed at Lightfair in New York City in April 1997.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$300,000	0	$300,000
Genlyte/Lightolier	331,680	0	331,680
TOTALS	$631,680	0	$631,680

Contractor: Genlyte/Lightolier
Site: Fall River, Massachusetts
Contract Duration: 4/93 - 8/97
Key Words: product development, lighting, fixture design, commercial buildings
Project Manager: Marsha Walton (518) 862-1090, ext. 3271
Program: Buildings
Subprogram: Lighting
Contract No.: 2028-EEED-BES-92

-> Residential Lighting for the Elderly

Evaluate common-area lighting designs for senior housing.

BACKGROUND

The Lighting Research Center (LRC) is currently under contract to NYSERDA to design and evaluate residential lighting at South Mall Towers, a senior residential facility. This project will build on and complement the work that is currently under way.

OBJECTIVE

To: (1) design and evaluate common-area lighting designs for South Mall Towers, and (2) provide comprehensive lighting guidelines for renovation or new construction of senior housing. A light-therapy room will be designed and installed in part of the facility's community room. An evaluation will assess the impacts of light therapy on visual comfort and sense of well-being.

DESCRIPTION

Lighting specifications will be developed for common areas, including entryway and elevator lobby, community room, laundry room, and a connecting corridor. An evaluation and case study will document the success of the lighting designs. Data-collection will be accomplished through written and in-person interviews, photometric measurements, and light-loggers. A light-therapy room will be designed, installed, and evaluated to determine potential impacts of various lighting levels on elderly residents' well-being.

BENEFITS

The results of this project will be documented and published as an LRC Demonstration and Evaluation of Lighting Technologies and Applications (DELTA) Portfolio publication. This information will make an important contribution to addressing the special visual needs of the State's elderly.

SCHEDULE AND STATUS

Preliminary common area lighting designs should be completed in early May.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$140,000	$54,000	$194,000
Northeast Utilities Service Co.	100,000	0	100,000
Philips Lighting (in-kind)	0	17,500	17,500
Somaltow Housing Company	0	20,000	20,000
TOTALS	$240,000	$91,500	$331,500

Note: NYSERDA funds include $10,000 PO.

Contractor: Rensselaer Polytechnic Institute
Site: Troy, Rensselaer County; Albany, Albany County; and Simsbury, Connecticut
Contract Duration: 11/95 - 4/98
Key Words: product development, residential, lighting, elderly
Project Manager: Norine Karins (518) 862-1090, ext. 3211
Program: Buildings
Subprogram: Lighting
Contract No.: 4343L-IABR-BR-96

-> National Tuberculosis Coalition Project

Test germicidal ultraviolet irradiation to eradicate tuberculosis bacteria.

BACKGROUND

The health care industry could benefit from more efficient use of electricity. Through its Health Care Initiative, the Electric Power Research Institute is examining the use of ultraviolet germicidal irradiation (UVGI) as a potential method of air disinfection, specifically to deal with the resurgence of drug-resistant tuberculosis. This electrotechnology could produce benefits to utility end-use customers by providing a cost- effective supplement to current ventilation systems while providing potential disinfection of airborne disease. The National Tuberculosis Coalition has been formed to evaluate the effectiveness and safe application of UVGI as a supplement to ventilation.

OBJECTIVE

To install and test UVGI technologies at several different sites around the country, including five men's shelters in New York City: Crown Residence; Grand Central Drop-In Center; Project Find Drop-In Center; Olivieri Center; and Peter's Place Drop-In Center.

DESCRIPTION

The contractor will: (1) solicit competitive proposals to furnish and install UVGI equipment in the men's shelters, (2) conduct a field trial of the UVGI technology in the men's shelters, (3) summarize the state of the art of the UVGI technology for air disinfection, (4) provide interim guidelines on the application of UVGI technology, (5) refine the application guidelines based on the conclusions of the field trial, and (6) provide a technical report of the findings of the study.

BENEFITS

The field test of the UVGI technology will be a vital source of information to all health care and other organizations involved in treating tuberculosis and eradicating tuberculosis bacteria.

SCHEDULE AND STATUS

The competitive solicitations to procure and install the UVGI equipment have been issued and the contractors have been selected. The five shelters to be used in the New York City study have been selected, and the first shelter installation is scheduled to be completed shortly.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	0	$107,724*	$150,000
Con Edison	$75,000	300,000	900,000
ESEERCO	0	200,000	225,000
EPRI Health Care Initiative	0	50,000	950,000
Manhattan College	19,800	0	19,800
City of Birmingham, Alabama	0	0	50,000
Anonymous donors via St. Vincent's Hosp.	117,700	200	117,925
TOTALS	$212,500	$657,924	$2,412,725

*Purchase Order No. R2079 issued to Atlantic Ultraviolet Corporation for UVGI equipment $107,724; remaining $42,276 applied to Agreement No. 4233-IABR-BR-97 with EPRI.

Contractor: Electric Power Research Institute
Site: EPRI's Northeast Regional Community Environmental Center, Riverdale, Bronx County; and five shelters in New York City, New York County
Contract Duration: 3/97 - 11/98
Key Words: assist business, lighting, health care
Project Manager: Marsha Walton (518) 862-1090, ext. 3271
Program: Buildings
Subprogram: Lighting
Contract No.: 4233-IABR-BR-97

-> Incandescent Lamp Efficacy Improvement

Develop coatings and other techniques to increase tungsten filament efficacy.

BACKGROUND

Incandescent lamps consume approximately four billion kWh of electricity annually at a cost of about $400 million. A 20-percent improvement in these lamp's efficacy will save the State 800 million kWh of electricity and $80 million per year. Incandescent lamps operate at efficacies of from 14-20 lumens per watt and represent approximately 20 percent of lighting energy consumed. Processes developed in this project were designed to increase efficacies by 20 percent.

ACCOMPLISHMENTS

The contractor evaluated the optical physics, high-temperature material chemical vapor deposition, and metallurgy of increasing the operating efficacies of incandescent lamps while preserving lamp life. Two approaches were explored: roughening the tungsten surface and protecting it by a transparent oxide outer layer such as hafnium oxide (HfO_2) or zirconium oxide (ZrO_2), and treating the filament with high-visible emissivity coatings such as hafnium nitride (HfN) or hafnium carbide (HfC) on tungsten. The work included thermodynamic modeling of potential materials; depositing and evaluating candidate materials on tungsten; evaluating deposition rates and techniques; analyzing the efficacy effects and durability of the different materials; designing, building, and testing new deposition equipment; testing the new materials in true-to-life product environments; and conducting lamp-life tests with the new materials and processes.

FINDINGS AND CONCLUSIONS

Although the research found that coating the tungsten with HfN had the best potential for increasing efficiency, the contractor was unable to increase the efficacy of an incandescent lamp without significant loss of lamp life.

TECHNOLOGY TRANSFER ACTIVITIES

A final report was completed and distributed to a limited audience.

FUNDING	TOTALS
NYSERDA	$285,000
ESEERCO	275,000
Rochester Gas and Electric Corp.	150,000
Long Island Lighting Company	50,000
Electric Power Research Institute	100,000
New York State Electric & Gas Corp.	96,000
General Electric Company	285,000
TOTALS	$1,241,000

Contractor: General Electric Company
Site: Schenectady, Schenectady County
Contract Duration: 1/94 - 6/96
Key Words: product development, lighting
Project Manager: Marsha Walton (518) 862-1090, ext. 3271
Program: Buildings
Subprogram: Lighting
Contract No.: 3034-IABR-BR-94

-> Outdoor Lighting Pattern Book

Produce and distribute book detailing effective and energy-efficient outdoor lighting designs..

BACKGROUND

Outdoor lighting is important not only to the appearance of buildings, but also to people's safety, both at home and in public places. As such, the installation of energy-efficient and effective outdoor lighting in urban areas can help reduce crime and contribute to the revitalization of urban areas. Both homes and businesses can benefit from energy-efficient outdoor lighting.

ACCOMPLISHMENTS

The contractor worked with lighting product manufacturers, utility and government representatives, and commercial, industrial and residential facility managers to identify cost-effective state-of-the-art outdoor lighting technologies. The results were published in the "Outdoor Lighting Pattern Book." The work included: (1) a literature review of current outdoor and security lighting materials, (2) developing methods for evaluating and comparing the lighting options available, (3) soliciting input from potential users in a series of roundtable sessions (4) identifying 30 typical outdoor sites that could benefit from energy-efficient lighting, and (5) documenting the findings in a book.

FINDINGS AND CONCLUSIONS

Typically, installing energy-efficient lighting results in net energy savings to the customer. In the examples of the outdoor lighting case studies, the installation of effective, energy-efficient outdoor lighting resulted in net energy costs to the customer, both in terms of capital and operating costs in all but a few cases. This is because in almost all of the cases, the outdoor areas studied were insufficiently lit.

REALIZED OR ANTICIPATED BENEFITS

Community groups, business associations, building managers, utility representatives, and residential customers will be able to use the "Outdoor Lighting Pattern Book" as a reliable method to determine whether an outdoor lighting plan is likely to achieve its goals of security, efficiency, and efficacy.

TECHNOLOGY TRANSFER ACTIVITIES

The "Outdoor Lighting Pattern Book" was published by McGraw Hill and marketed through its Professional Books Division.

FUNDING	TOTALS
NYSERDA	$75,000
ESEERCO	75,000
Consolidated Edison	75,000
Niagara Mohawk Power Corp.	75,000
Northern States Power	75,000
Northeast Utilities	75,000
Lighting Research Center	85,000
TOTALS	$535,000

Contractor: Rensselaer Polytechnic Institute (RPI)
Site: Lighting Research Center, Troy, Rensselaer County
Contract Duration: 12/94 - 11/96
Key Words: assist business, lighting
Project Manager: Marsha Walton (518) 862-1090, ext. 3271
Program: Buildings
Subprogram: Lighting
Contract No.: 4374-IABR-BR-96

-> Window-Treatment Systems with Lighting and Drapery Controls

Develop and produce window treatments and controls for fully integrated window blind/lighting systems.

BACKGROUND

In 1988, DECOTEX, then Comfortex, received start-up funding from NYSERDA to manufacture window blinds and deployment systems for residential use. Phase I of this project designed, developed, and tested a window energy-management system, including optimum design and selection of a motorized blind-deployment system, controls, instrumentation, power-conditioning components, and an integrated optimized lighting system. A novel proprietary foam-injected window cornice to accommodate these systems also was produced.

ACCOMPLISHMENTS

The contractor: (1) developed designs for several foam-core cornice styles to house the lighting and control systems, (2) completed the tooling requirements, and (3) undertook the demonstration and marketing efforts needed to commercialize the Luminel Cornices.

FINDINGS AND CONCLUSIONS

The contractor produced a decorative product that is attractive to the customer from a design perspective and that offers convenient high-efficiency indirect lighting. Its largest market appears to be the hospitality industry.

REALIZED OR ANTICIPATED BENEFITS

The integrated window-treatment system optimizes interior ambient climate and lighting with minimum energy use and loss due to window thermal loads.

TECHNOLOGY TRANSFER ACTIVITIES

A final report was completed and the Luminel Cornice was displayed at several window-treatment and lighting trade shows.

FUNDING	TOTALS
NYSERDA	$334,000
DECOTEX	507,820
TOTALS	$841,820

Contractor: DECOTEX
Site: Cohoes, Albany County
Contract Duration: 2/96 - 2/97
Key Words: product development, commercial, residential windows, lighting
Project Manager: Marsha Walton (518) 862-1090, ext. 3271
Program: Buildings
Subprogram: Lighting
Contract No.: 4062-IABR-BR-95

-> Commercial-Sector Real-Time Pricing Demonstration

Investigate and demonstrate real-time pricing (RTP) with large commercial customers.

BACKGROUND
RTP is an innovative rate structure intended to encourage energy efficiency and peak-load shifting, and as such is a demand-side management (DSM) initiative.

OBJECTIVES
To assess, demonstrate, and evaluate the potential benefits of RTP in the large commercial sector and to develop new control software that can be used at other RTP sites in the country.

DESCRIPTION
In Phase I, the contractor will perform a technical and market assessment of the ability of one of Con Edison's largest commercial building customers to respond to RTP. Twenty-four-hour spot-price menus will be developed to evaluate the costs/benefits of RTP. A market survey, audits, and analyses will evaluate customers' willingness and ability to respond. The preliminary economics of RTP will be evaluated. In Phase II, 15 of Con Edison's largest commercial customers will operate under RTP. An upgraded Honeywell energy management system (EMS) will be installed at the New York City Marriott Marquis Hotel to implement optimal operation of the hotel's HVAC and lighting systems under RTP. Two cooling seasons will be monitored to determine energy and demand savings.

BENEFITS
This project will demonstrate and evaluate customers' response capability, potential benefits, and cost-effectiveness of implementing RTP in the large commercial sector. This approach is believed to have the potential to reduce utility peak loads, delay the need for new generation capacity, and use existing generation capacity more efficiently.

SCHEDULE AND STATUS
A Phase I final report has been completed. The Phase II effort to implement RTP with 15 Con Edison customers has been completed. Phase III demonstration of the system at the Marriott Marquis Hotel is continuing, with the RTP control system functioning as expected. Test data have been collected at the field-test site. The final data analysis is being conducted and the final report is being written.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$438,615	0	$438,615
Con Edison	727,204	0	727,204
Electric Power Research Institute	460,995	0	460,995
Honeywell	825,996	0	825,996
ESEERCO	333,000	0	333,000
Pacific Gas & Electric	90,000	0	90,000
TOTALS	$2,875,810	0	$2,875,810

Contractor: Consolidated Edison Company of New York, Inc.
Site: New York, New York County
Contract Duration: 12/88 - 8/97
Key Words: product development, DSM, utilities, real-time pricing, rate structures
Project Manager: Mary Ann Bowers (518)862-1090 ext. 3254.
Program: Buildings
Subprogram: Electrical Systems
Contract No.: 1141-IABR-BR-89

-> Commercialization of a Non-Intrusive Appliance Load-Monitoring System

Develop and commercialize monitoring system to identify and capture individual appliance load data.

BACKGROUND

Determining the energy consumption of individual end-use equipment traditionally has been both difficult and expensive. The technology for separating total residential energy consumption into its constituent parts without costly intrusion into the home did not exist. As a result, this type of load research is not available in sufficient quantities to meet utility needs. Through work done at the Massachusetts Institute of Technology, under contract with the Electric Power Research Institute, a prototype load-monitoring device has been developed that is capable, without intruding into the home, of isolating and analyzing individual load signatures from the complex, overlapping signals generated by end-use equipment. The prototype, which uses pattern-recognition algorithms, underwent extensive field evaluation at Rochester Gas and Electric Corp. to verify its capabilities. Additional design work needs to be done so the product can be commercialized.

OBJECTIVES

To undertake product development to provide a fully commercialized end-use load-monitoring system for electric utilities based on the technology and prototype already developed.

DESCRIPTION

The contractor will: (1) develop functional design specifications, (2) develop and test prototypes, (3) evaluate first production-run units, (4) perform alpha and beta testing, and (5) develop and implement a commercialization plan.

BENEFITS

A major benefit of the project is simplifying the collection of end-use data for utilities for a multitude of uses, including developing and evaluating demand-side management programs, rate-setting, and marketing. Using the technology will result in lower equipment and staffing costs and greater data accuracy. In addition, the non-intrusive nature of the equipment should create better customer acceptance of utility load-research programs. New York State utilities have made commitments to purchase units. Economic development benefits include the manufacture of a new product offering by a small energy-products business in New York State.

SCHEDULE AND STATUS

Alpha testing has been completed. Beta testing is drawing to a close. Commercial introduction of the product began in August 1996 and units are currently being sold across the country.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$214,000	0	$214,000
Electric Power Research Institute	215,000	0	215,000
Others	419,000	0	419,000
TOTALS	$848,000	0	$848,000

Contractor: Telog Instruments, Inc.
Site: Victor, Ontario County
Contract Duration: 9/93 - 7/97
Key Words: product development, utilities, DSM, load monitoring, end-use metering, non-intrusive monitoring, appliance monitoring
Project Manager: Mary Ann Bowers (518) 862-1090, ext. 3254
Program: Buildings
Subprogram: Electrical & Control Systems
Contract No.: 3024-EEED-BES-94

-> Commercial Non-Intrusive Load Monitor

Design, develop, and test commercial version of Residential Non-Intrusive Load Monitoring System.

BACKGROUND

Non-intrusive load monitoring, an end-use monitoring technology, informs the customer and the utility about time-use consumption of large loads within the customer's premises by disaggregating the observed power supplied at the customer's meter. As appliances and other electrical equipment turn on and off they exhibit unique electrical signatures. Individual loads can be identified by using a patented algorithm. Much effort has been spent developing the Residential Non-Intrusive Appliance Load Monitoring System (NIALMS). Telog is under contract with the Electric Power Research Institute to commercialize NIALMS, with funding provided by NYSERDA and several New York State utilities. The technology is currently in the commercialization phase and is being alpha-tested successfully. Product introduction is expected in the fall of 1995.

OBJECTIVES

To design and develop a non-intrusive load monitor for use in commercial applications (C-NILMS) based upon the residential NIALMS.

DESCRIPTION

The contractor will (1) recruit a technical advisory committee; (2) perform hardware and software development; (3) manufacture and test prototypes; (4) conduct alpha and beta testing; and (5) develop a commercial product specification.

BENEFITS

There is a marked need for load research on an appliance-by-appliance basis. This technology allows this data to be obtained without entering the customer's building, which greatly reduces the cost of data-gathering and increases participation in load-research studies. Data previously not obtainable or obtainable only at a very high cost will now be gathered with increased accuracy at greatly reduced cost. This product also will provide growth opportunities for a New York State manufacturer.

SCHEDULE AND STATUS

Hardware design is nearing completion. Software design is ongoing. Alpha testing at three sites in Rochester Gas and Electric territory has begun. Beta testing preparation is under way.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$180,000	0	$180,000
Telog Instruments	60,000	0	60,000
ESEERCO	100,000	0	100,000
Rochester Gas and Electric Corp.	40,000	0	40,000
Con Edison	40,000	0	40,000
TOTALS	$420,000	0	$420,000

Contractor: Telog Instruments
Site: Victor, Ontario County
Contract Duration: 9/94 - 10/97
Key Words: product development, buildings, demand-side management, end-use metering, non-intrusive monitoring, commercial, utilities
Project Manager: Mary Ann S. Bowers (518) 862-1090 ext. 3254
Program: Buildings Research
Subprogram: Electrical & Control Systems
Contract No.: 4064-IABR-BR-95

-> Building Energy Monitoring System (BEMS)

Develop energy and power-quality monitoring system for commercial buildings.

BACKGROUND

Managers of small commercial buildings have traditionally avoided investing in building energy monitoring instrumentation because such systems are expensive and complex to operate, and the perceived benefits do not outweigh the costs. However, few managers of small- to medium-sized commercial buildings feel they have adequate information on their building's energy consumption other than that provided by the utility revenue meter. Therefore, building managers often are unable to make informed energy decisions about their equipment purchases and operation. A second growing need is for information about the power quality within the building's distribution system in real time. One reason for this need is that modern office equipment uses microprocessor controls, making them more susceptible to power-supply variations. Poor power quality can translate into expensive down-time. However, power-supply variations are not always caused by the utility. Instead, modern electrical controls and drives inject substantially higher levels of noise and harmonic disturbances back into the power-supply system. This combination of power-quality disturbance and susceptibility to its effects requires building managers to have adequate instrumentation and information resources to run their buildings effectively, but a cost-effective, integrated monitoring system for small- to medium-sized commercial buildings is currently unavailable.

OBJECTIVES

To develop a system to monitor and manage information on the quality and quantity of energy used in a commercial building. The BEMS will monitor the power at the point of observation, record all power disturbances and time use of energy, and provide interval data reports. The system will communicate information automatically from the recorder to a host computer at scheduled intervals.

DESCRIPTION

The contractor will (1) conduct a market study; (2) design and develop recorder hardware, firmware, and software; (3) conduct field-testing at customer sites in Rochester Gas and Electric territory; and (4) commercialize the product.

BENEFITS

The BEMS will provide commercial end-users with economic benefits that include lower equipment and installation costs, lower electric bills, and decreased plant down-time due to poor power quality. This product will provide information to customers that will enable them to achieve energy savings without expensive site assessments or equipment purchases. In addition, the BEMS can be a valuable tool for utilities to promote more efficient and effective use of power by their commercial customers.

SCHEDULE AND STATUS

A market research study has been completed. Product design is underway.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$137,275	0	$137,275
Telog Instruments, Inc.	118,735	0	118,735
Rochester Gas and Electric Corp.	25,000	0	25,000
TOTALS	$281,010	0	$281,010

Contractor: Telog Instruments, Inc.
Site: Victor, Ontario County
Contract Duration: 2/96 - 9/97
Key Words: product development, buildings, commercial, monitoring, power quality
Project Manager: Mary Ann S. Bowers (518) 862-1090 ext. 3254
Program: Buildings Research
Subprogram: Electrical & Control Systems
Contract No.: 4340-IABR-BR-96

-> Universal Data-Acquisition Product

Design, develop, test, and commercialize low-cost universal data-acquisition product.

BACKGROUND

EUA Day is the controls division of EUA Cogenex Corporation and provides temperature-control, metering, and automation systems. It has developed the Day 1 and 2 Measurement, Verification, and Control Systems for measuring and verifying savings of performance contracts using data-acquisition. All data-acquisition systems require a front end for data retrieval and storage. The current means of providing this front end for the Day 1/Day 2 product is to purchase a personal computer (PC), take it apart, remove unnecessary parts, and reassemble it in a NEMA-type enclosure. This is necessary because a PC's current packaging is not robust enough to serve reliably as a data-acquisition device in control rooms and other harsh environments. This ad hoc method of providing a front end for the Day 1/Day 2 product is labor-intensive and voids the manufacturer's warranty on the product. Currently, no products exist on the market that can meet the need for a robust, low-cost data acquisition board.

OBJECTIVE

To develop a low-cost data acquisition engine that consists of a printed circuit board that can be mounted in existing end-use metering equipment, in its own enclosure, or at a building communications center. The product will be LonWorks-compatible and will be integrated with the current Day 1/Day 2 system and also offered as a stand-alone product.

DESCRIPTION

The contractor will: (1) develop a test plan, (2) perform design and manufacturing planning, (3) manufacture prototypes, (4) test and demonstrate the product, and (5) commercialize the product.

BENEFITS

The product will be sold in volume for less than $300 per unit, which is 85 percent less than the cost of the current PCs being used. This will result in dramatically lowered cost and increased reliability and functionality of the Day 1 and Day 2 products, thereby greatly increasing their marketability as energy-management products. In addition, the product will be marketed to the rest of the data-acquisition and control and metering community, which is expected to greatly increase manufacturing and sales for EUA Day.

SCHEDULE AND STATUS

Product design has begun.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	0	$33,100	$33,100
EUA Day	0	49,650	49,650
TOTALS	0	$82,750	$82,750

Contractor: EUA Day
Site: Victor, Ontario County
Contract Duration: 1/97-9/97
Key Words: product development, buildings, commercial, energy management systems, load monitoring, data acquisition
Project Manager: Mary Ann Bowers (518) 862-1090, ext. 3254
Program: Buildings Research
Subprogram: Electrical and Control Systems
Contract No.: 4503-IABR-BR-97

-> Submetering Manual and Information Package

Design and develop submetering "how-to" manual and standard package of submetering information.

BACKGROUND

NYSERDA has been involved with submetering projects for more than 10 years. Several NYSERDA projects and other investigations showed that an immediate 20-25% energy savings was seen when a master-metered building converted to submetering. More recently, NYSERDA completed the Facilitating Submetering Implementation (3121-IABR-BR-94) project. This project identified and analyzed the many barriers to submetering and made recommendations for removal of barriers. One recommendation was for NYSERDA to develop a Submetering Manual and Standard Information Package that will fill the need for comprehensive and objective information.

OBJECTIVE

To develop a Submetering Manual for New York State encompassing the steps required to address technical questions, regulatory requirements, legal constraints, financial issues, and end-user concerns and to develop a Standard Information Package of materials that will encompass the educational requirements of various interested parties, including building owners, managers, boards of directors, regulatory and oversight agencies, vendors, and end-users and their representatives.

DESCRIPTION

The contractor will: (1) assemble educational materials and hold a kickoff meeting, (2) select a Review Panel, (3) design the Standard Information Package, and (4) design the Submetering Manual.

BENEFITS

The extremely complex and unique nature of submetering in New York City discourages many people from considering this energy-saving measure. The existence of a Submetering Manual and a Standard Information Package will provide much-needed objective and standardized information to potential submeterers. Currently, if a prospective submeterer needs comprehensive information the only way to obtain it is for them to contact multiple organizations, including NYSERDA, the Public Service Commission, Con Edison, Division of Housing and Community Renewal, U.S. Department of Energy, Housing and Preservation Development, etc. This project will provide unbiased submetering information and thereby eliminate a major barrier to submetering. The Manual and Package will help facilitate submetering because they will reduce confusion, misinformation, and time-consuming background research, and will help answer the many questions that arise when confronting this complex issue.

SCHEDULE AND STATUS

Materials for both the Standard Information Package and the Manual are being gathered and reviewed.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	0	$38,530	$38,530
TOTALS	0	$38,530	$38,530

Contractor: Applied Energy Group, Inc.
Site: Hauppauge, Suffolk County
Contract Duration: 2/97-7/97
Key Words: assist business, submetering, residential, multifamily, buildings
Project Manager: Mary Ann Bowers (518) 862-1090, ext. 3254
Program: Buildings Research
Subprogram: Electrical and Control Systems
Contract No.: 4483-IABR-BR-97

-> Radio-Frequency Thermostat for HVAC Control

Develop radio-frequency thermostat to control baseboard heat and room air conditioners.

BACKGROUND

Because many multifamily housing projects, particularly those receiving state and federal aid, were built with low first cost as a priority, many of them use baseboard electric heating with simple baseboard thermostat controls. These controls are imprecise by design, difficult to regulate, generally a nuisance to adjust, and are all too often set and left at a relatively high temperature, with occupants opening windows to control comfort levels. Considerable energy savings could be realized by retrofitting to new wall-mounted line-voltage thermostats, which can save as much as 24-30 percent in some applications. Unfortunately, the typical retrofit installation of this energy-saving technology requires the use of wiremold chased along floor boards and around doors to hard-wire the thermostat to each baseboard unit. This activity is labor-intensive, aesthetically undesirable, and expensive, with typical retrofit costs ranging from $500 to $800 or higher per apartment. Consequently, these retrofits are not performed on a widescale basis. With the advent of new communications technologies, wireless thermostat controls for baseboard heating and room air-conditioning units could result in significant cost savings.

OBJECTIVE

To develop a wireless, battery-run thermostat that will operate baseboard heating units and room air conditioners using LONWORKS communication technology and radio-frequency control.

DESCRIPTION

The contractor will (1) conduct design and manufacturing planning; (2) finalize a product design; (3) develop a test plan; (4) manufacture and laboratory-test a prototype; (5) perform pre-production manufacturing and testing; (6) manufacture the final product; and (7) market and commercialize the product.

BENEFITS

The proposed system will allow for quick, minimally intrusive installation that will result in substantial energy and cost savings. Also, each unit will measure its own power use, thereby providing direct evidence of its energy savings. The product will create substantial growth for the contractor, a small start-up company, and for energy service companies (ESCOs) in and out of New York State. The product, which will be manufactured at GC Controls in Greene, New York, will add to the State's manufacturing base.

SCHEDULE AND STATUS

Product specifications have been developed and product design has begun.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	0	$102,647	$149,738
ENERNET Corp.	0	14,974	14,974
New York State Electric & Gas Corp.	0	20,000	20,000
Brooklyn Union	0	0	114,516
TOTALS	0	$137,621	$299,228

Contractor: ENERNET Corporation
Site: DeWitt, Onondaga County, and Greene, Chenango County
Contract Duration: 3/96 - 10/97
Key Words: product development, buildings, thermostats, communications, HVAC
Project Manager: Mary Ann S. Bowers (518) 862-1090 ext. 3254
Program: Buildings Research
Subprogram: Electrical Systems
Contract No.: 4429-IABR-BR-97

-> Smart Controls and Diagnostics for Heating Systems

Design, develop, and commercialize intelligent heating-control system for multifamily buildings.

BACKGROUND

Very few manufacturers offer comprehensive personal-computer (PC)-based heating, ventilating, and air-conditioning management systems for large commercial buildings. These products are expensive and incorporate control strategies appropriate for commercial buildings with the corresponding occupancy profile. However, the apartment building heating systems' market has no similar products. In addition, most current energy-management systems use set-point controls along with function keypads and limited data-storage capacity. Such systems do not incorporate sophisticated energy-management and -control strategies. They also cannot store or analyze data for historical purposes and diagnosis due to a lack of computational and storage ability. US Energy Controls and others have offered products with such capabilities. However, recognizing the technological trend towards PC-based applications and the advantages of implementing advanced energy-management algorithms and intelligent control systems, US Energy Controls seeks to expand its product line.

OBJECTIVE

To design, develop, and commercialize a PC-based hardware and software system for intelligent control and diagnosis of multifamily building heating systems.

DESCRIPTION

The contractor will: (1) perform market research; (2) develop a test plan; (3) develop a conceptual product design; (4) perform control and diagnostic algorithm development; (5) develop hardware, instrumentation, and controls; (6) develop integrated software; (7) fabricate and field-test prototypes; and (8) commercialize the final product.

BENEFITS

This new product will upgrade US Energy Controls' existing aging product offerings, thus enabling it to remain competitive in the marketplace. The project is anticipated to generate jobs and to contribute significantly to the company's short- and long-term profitability. The project also will benefit the owners of multifamily buildings by reducing energy costs, providing maintenance information, and optimizing occupant comfort.

SCHEDULE AND STATUS

Product design tasks are being conducted.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	0	$104,162	$104,162
US Energy Controls	0	113,360	113,360
TOTALS	0	$217,522	$217,522

Contractor: US Energy Controls
Site: Flushing, Queens County
Contract Duration: 1/97-10/97
Key Words: product development, buildings, HVAC, multifamily, controls
Project Manager: Mary Ann Bowers (518) 862-1090 ext. 3254
Program: Buildings Research
Subprogram: Electrical & Control Systems
Contract No.: 4454-IABR-BR-97

-> Building Automation Software Development

Develop software for energy-management systems.

BACKGROUND

Energy-management systems can provide significant savings. Elemco Buildings Controls, Inc. offers a DOS-based energy-management system software product, Energy Executive II, that is compatible with several different controls systems. This allows building managers to design and retrofit energy-management systems with more flexibility. To continue the success of this product, Elemco needs to update the software.

OBJECTIVE

To update the Energy Executive II product to operate with more control systems and convert it to the Microsoft Windows operating environment.

DESCRIPTION

The contractor will (1) convert the Energy Executive II software to Microsoft Windows; (2) design new graphical user interfaces; (3) add new communication interfaces to make the software compatible with more control systems; (4) develop a software version that can operate control systems remotely over standard telephone lines; and (5) add the capability of monitoring and regulating indoor air quality to the software versions developed in the previous phases.

BENEFITS

This project will save energy in New York State by assuring the proper use of energy-management systems in new and existing applications. A New York State software company also will benefit through the increased sales of its product.

SCHEDULE AND STATUS

An alpha version of the software is being evaluated in the contractor's offices. A beta version of the software will be installed in an independent commercial building in the near future.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$198,472	0	$198,472
Elemco Building Controls, Inc.	198,473	0	198,473
TOTALS	$396,945	0	$396,945

Contractor: Elemco Building Controls, Inc.
Site: Hauppauge, Suffolk County
Contract Duration: 1/95 - 12/96
Key Words: product development, HVAC, lighting, energy management systems, building automation software
Project Manager: Bob Carver (518) 862-1090, ext. 3242
Program: Buildings
Subprogram: Electrical Systems
Contract No.: 4079-IABR-BR-95

-> Automated CO_2 and VOC-Based Control of Ventilation Systems Under Real-Time Pricing

Design, develop and demonstrate software for automated control of ventilation equipment in response to real-time pricing.

BACKGROUND

A number of prominent electric utilities throughout the U.S. are currently implementing real-time pricing (RTP) rate structures as a means to give their large customers an economic incentive to reduce their electric usage during periods when the utility's cost of providing power is high. Con Edison, Niagara Mohawk, and LILCO are among those utilities offering RTP rates to a select group of their commercial and industrial customers. In anticipation of RTP rates becoming more widely available, EPRI, Con Edison, ESEERCO, the Energy Authority, and PG&E started a project with Honeywell in 1992 to investigate automated control of commercial buildings in response to RTP because manual load shedding/shifting requirements were too labor intensive and operationally inefficient for wide-scale RTP implementation. Honeywell then developed a building control system that automatically sheds buildings loads in response to utility RTP prices. The RTP Supervisory Controller is currently being tested at the Marriott Marquis Hotel in Manhattan.

OBJECTIVES

To enhance the capability of the RTP Supervisory Controller system to include the shifting and/or shedding of load from ventilation equipment in response to RTP while optimizing CO_2/VOC levels in the building. h the demonstration of an advanced CO_2/VOC controller at two sites in New York City.

DESCRIPTION

The contractor will (1) conduct a site survey; (2) implement building automation and control; (3) perform system engineering and indoor air quality monitoring; and (4) conduct field monitoring and data analysis at the Marriott Marquis hotel and the World Financial Center in Manhattan.

BENEFITS

Benefits will include economic benefits to both the electric utility and the demonstration sites. The sites will incur significant energy savings from the automated control of loads while optimizing the indoor air quality of the buildings.

SCHEDULE AND STATUS

Equipment has been installed and data collection has been completed. A final report is being written.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$199,000	0	$199,000
Honeywell, Inc.	66,733	0	66,733
Electric Power Research Institute	100,000	0	100,000
Con Ed	225,000	0	225,000
ESEERCO	75,000	0	75,000
TOTALS	$665,733	0	$665,733

Contractor: Honeywell, Inc.
Site: New York, New York County
Contract Duration: 1/95 - 8/97
Key Words: product development, assist business, buildings, HVAC, commercial, real-time pricing
Project Manager: Mary Ann S. Bowers (518) 862-1090 ext. 3254.
Program: Buildings Research
Subprogram: Electrical Systems
Contract No.: 4073-IABR-BR-95

-> Automated Control of Thermal Energy Storage under Real-Time Pricing

Develop automated control algorithms for thermal energy storage under real-time pricing.

BACKGROUND

A number of prominent electric utilities are using real-time pricing (RTP) rate structures to give large customers economic incentive to reduce electric usage during periods when the cost of providing power is high. The Electric Power Research Institute (EPRI), Con Edison, the Empire State Electric Energy Research Corp. (ESEERCO), Pacific Gas & Electric (PG&E) and NYSERDA cosponsored a project with Honeywell to investigate automated control of commercial buildings in response to RTP. The RTP Controller at the Marriott Marquis Hotel in Manhattan is operating as designed, with the hotel having increased its load-shedding during high RTP periods to over 1.2 MW, a five-fold increase, over manual control. The hotel saved more than $100,000 in the first year without adversely affecting business. To further develop the RTP Controller, NYSERDA, Con Edison, EPRI, and ESEERCO cosponsored a project to enable shedding/shifting of ventilation load in response to RTP using a CO_2/VOC sensor manufactured by a small NYS company, Spence Associates. The enhanced RTP Controller was installed at the World Financial Center (WFC) in Manhattan in July 1995. TES systems have great potential to shift electric usage from typical afternoon peak periods to low night and morning periods, with significant additional potential for optimizing central chiller plants and using free cooling from river water. No integrated building-control system exists to automatically implement these strategies in response to RTP.

OBJECTIVES

To further enhance the RTP Controller to enable shifting of load from TES and central plant systems in response to RTP, and to evaluate advanced numerical and neural network techniques for forecasting hourly building cooling and RTP profiles.

DESCRIPTION

The contractor will (1) conduct a site survey and develop a controller requirement definition; (2) install automation and controls hardware; (3) perform control algorithm development; (4) conduct system engineering and field monitoring; and (5) perform a cost/benefit analysis.

BENEFITS

Developing this hardware and software should significantly enhance the savings realized by TES and central plant systems, and encourage customers who have not installed TES systems because of the long payback associated with its traditional application to consider such systems. Specific benefits will vary depending on building and HVAC characteristics, operating schedules, and other variables, but, conservatively, a 15-20-percent reduction in electricity costs could be realized using the enhanced Controller. The contractor's economic analysis indicates the WFC will realize $197,307 in additional cost savings and energy savings of 1.5 MWh annually.

SCHEDULE AND STATUS

Site visits and initial data collection are complete. Equipment installation has been completed. Optimization algorithms have been developed and are being implemented.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$446,075	0	$446,075
Electric Power Research Institute	525,000	0	525,000
Con Edison	525,000	0	525,000
ESEERCO	275,000	0	175,000
Honeywell	329,722	0	329,722
TOTALS	$2,100,797	0	$2,100,797

Contractor: Honeywell Home and Building Control
Site: New York, New York County
Contract Duration: 1/95 - 9/98
Key Words: product development, real-time pricing, thermal storage
Project Manager: Mary Ann Bowers (518) 862-1090 ext. 3254
Program: Buildings Research
Subprogram: Electrical & Control Systems
Contract No.: 4338-IABR-BR-96

-> Multifunction Digital Power Transducer

Design, develop, test, and commercialize state-of-the-art digital power transducer.

BACKGROUND

Transducers are devices used to monitor variables associated with power transmission and distribution. Manufacturing facilities rely on these devices to accumulate information regarding the energy consumption of processes, machines, and equipment. This information then is used to make informed energy and business decisions. Traditional monitoring techniques use single-function analog transducers to collect information for energy management, power quality, and process control. The limitations of these devices include increased wiring costs, reduced accuracy, single-measurement capability, limited output-signal range, and digital-device interface problems. Digital-transducer technology overcomes these impediments by offering reduced wiring costs, lower maintenance requirements, greater accuracy, RS232/485 communication support, and extended measurement range. Rochester Instrument Systems (RIS) is a 35-year-old manufacturer of electronic instrumentation that employs 225 people and has revenues in excess of $50 million. In the past, it had a strong business in analog transducers; however its market share is rapidly being eroded by competitors with digital offerings.

OBJECTIVE

To develop an innovative design for a digital power transducer that is technologically and functionally superior to competitors' products by using Digital Signal Processing and Application Specific Integrated Circuit technologies.

DESCRIPTION

The contractor will: (1) plan the product design and manufacturing, (2) design the product, (3) develop a test plan, (4) manufacture prototypes, (5) test the product, and (6) commercialize the product.

BENEFITS

This digital product is expected to bring more than $24 million in new business to RIS over seven years. Developing a superior digital transducer will allow RIS to remain competitive in the transducer market, which has been its core business in the past. Transducers are a cost-effective energy-management tool that provide valuable power-consumption and quality information about critical equipment. The use of these devices will maximize machine efficiency and minimize repair and operating costs.

SCHEDULE AND STATUS

Hardware and software design has been started.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	0	$250,000	$250,000
Rochester Instrument Systems	0	455,064	455,064
TOTALS	0	$705,064	$705,064

Contractor: Rochester Instrument Systems, Inc.
Site: Rochester, Monroe County
Contract Duration: 12/96 - 3/98
Key Words: product development, industrial, HVAC, transducers, energy management
Project Manager: Mary Ann Bowers (518) 862-1090, ext. 3254
Program: Buildings Research
Subprogram: Electrical & Control Systems
Contract No.: 4504-IABR-BR-97

-> Interdrive Communications Bus

Develop general-purpose variable speed drive interface for ac and dc drives.

BACKGROUND

Harland Simon Control Systems is an engineering and manufacturing company specializing in the design and construction of coordinated alternative current/direct current (ac/dc) variable speed drive (VSD) systems. Harland Simon has not manufactured its own VSD for incorporation into new drive systems since the mid-1980s, but has used purchased VSDs. As new VSD technologies enter the marketplace, it has become increasingly difficult for Harland Simon to remain competitive. To assimilate each new VSD and its accompanying application software requires extensive retraining of Harland Simon's engineering personnel. Harland Simon has taken the following steps to reduce the impact of technological changes in the VSD market: (1) it has recently purchased the manufacturing rights to Robicon's digital dc drive line (5-14000 HP). Harland Simon will manufacture single-motor drive units, as well as use this product in its coordinated dc drive systems business and (2) Harland Simon's parent company, Spartec International, is completing development of a multitechnology variable speed product that also will be used in the company's coordinated drive systems business.

OBJECTIVE

To develop/upgrade four features for both drive products: (1) a high-throughput communications bus linking drive to drive, (2) a moderately high throughput communications bus linking each drive to external controllers such as programmable logic controllers and personal computers, (3) an onboard-drive application execution environment, and (4) an off-line drive application development environment.

DESCRIPTION

The contractor will: (1) develop a communications bus linking drive to drive and the drive to external controllers, (2) develop applications execution and development environments, (3) develop hardware and software documentation, (4) perform customer and staff training, and (5) commercialize the products.

BENEFITS

These products will enable Harland Simon to maintain its core business. Without these products, Harland Simon would no longer be able to do business cost-effectively in the long term. In addition, it will give Harland Simon an additional product to add to its product line, thereby increasing sales. The products themselves will make energy-efficient variable speed drives easier and more cost-effective to apply.

SCHEDULE AND STATUS

The project is under way.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	0	$188,000	$188,000
Harland Simon Control Systems	0	488,472	488,472
TOTALS	0	$676,472	$676,472

Contractor: Harland Simon Control Systems Inc.
Site: Baldwinsville, Onondaga County
Contract Duration: 4/97-12/98
Key Words: product development, buildings, variable speed drives, communications
Project Manager: Mary Ann Bowers (518) 862-1090, ext. 3254
Program: Buildings Research
Subprogram: Electrical and Control Systems
Contract No.: 4507-IABR-BR-97

-> Refrigerator Monitoring Devices, Phase II

Evaluate electricity use in residential refrigerators.

BACKGROUND

As part of a major public housing demand-side management initiative, the New York Power Authority (NYPA) will be replacing 180,000 inefficient refrigerators at New York City Housing Authority apartments with more energy-efficient models. This project will support the data-gathering and evaluation requirements of this initiative.

OBJECTIVE

To evaluate the energy performance of existing and replacement refrigerators at New York City Housing Authority complexes.

DESCRIPTION

The contractor will: (1) develop data-gathering and monitoring protocols, (2) measure in-situ energy performance of existing and replacement refrigerators, (3) evaluate the energy and economic savings attributable to the installation of energy-efficient, apartment-sized refrigerators, and (4) develop recommendations to encourage the participation of other housing authorities in NYPA's bulk-purchasing cooperative.

BENEFITS

Replacing the New York City Housing Authority's 180,000 refrigerators with super-efficient models is expected to save 70 million kWh and approximately $6 million annually.

SCHEDULE AND STATUS

A draft final report is expected in May. NYPA has initiated the second year of its refrigerator replacement initiative.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$248,939	0	$248,939
New York Power Authority	1,000,000	0	1,000,000
Electric Power Research Institute	55,121	0	55,121
Synertech Systems Corp.	42,163	0	42,163
TOTALS	$1,346,223	0	$1,346,223

Contractor: Synertech Systems Corporation
Site: New York, New York County
Contract Duration: 10/95 - 5/97
Key Words: refrigeration, DSM, multifamily
Project Manager: Norine Karins (518) 862-1090, ext. 3211
Program: Buildings
Subprogram: Low-Income Sector
Contract No.: 3015L-EEED-BES-94

-> Small High-Speed Centrifugal Compressors

Develop small (100 tons or less) high-speed direct-drive centrifugal compressor for HVAC and refrigeration applications.

BACKGROUND

The U.S. air-conditioning and refrigeration industry has grown and prospered in the past because of viable, practical reciprocating-piston compression technologies. However, six of the largest manufacturers in this industry are now located in other countries. This is mainly a result of new rotary-compression technologies that have largely replaced the reciprocating technology developed in the U.S. In order for the U.S. to regain its dominant position, new compression technologies need to be introduced that address government regulations, as well as customer and market requirements for these products. These requirements include reduced size and noise and increased compressor efficiency, zero refrigerant leakage, more compact heat exchangers, and new air-cleaning technologies. This project represents an opportunity to recover a leadership position in compressor technologies through compact, high-speed, centrifugal compressor technology integrated with various compact, heat-exchanger and air-moving technologies and new high-speed direct-drive motors.

OBJECTIVES

To design, develop, test, and construct prototypes of a high-speed centrifugal compressor system. Subcomponents to be designed or developed include: a compressor with mid-80-percent isentropic efficiencies; low-cost bearings capable of operating at 25,000 to 50,000 rpm; high-speed direct-drive, refrigerant lubricated motors with mid-to-high-90-percent efficiencies; low-cost, high-efficiency, high-frequency inverter drives with good power quality; and compact heat exchangers integrated with air-moving technologies.

DESCRIPTION

The contractor will (1) develop system specifications; (2) perform subcomponent design; (3) conduct system analysis and selection; (4) fabricate and test components; (5) perform subsystem assembly and testing; (6) conduct system laboratory and field testing; and (7) evaluate and analyze test data.

BENEFITS

Carrier's comprehensive performance and cost analysis shows that 10-15 percent annual energy savings are expected from rooftop units with that cost lowered even more by a 50-80-percent size and weight reduction and 50 percent fewer moving and total parts. Environmental benefits include hydrofluorocarbon refrigerant use and oil-less operation. In addition, if the project is successful, Carrier estimates that 400-1000 jobs will be created, about half of which will be in New York State, and that up to $500 million in new sales will be generated.

SCHEDULE AND STATUS

Product design is nearing completion. Dynamometer testing is scheduled for early spring.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$200,000	$200,000	$600,000
Carrier Corporation	320,000	300,000	765,000
National Institute of Standards & Tech.	1,021,000	1,084,000	3,200,000
Others	501,000	584,000	2,005,000
TOTALS	$2,042,000	$2,168,000	$6,570,000

Contractor: Carrier Corporation
Site: Syracuse, Onondaga County
Contract Duration: 10/95-1/99
Key Words: product development, HVAC, refrigeration, compressors, high-speed motors
Project Manager: Mary Ann S. Bowers (518) 862-1090 ext. 3254
Program: Buildings Research
Subprogram: Electrical & Control Systems
Contract No.: 4077L-IABR-BR-96

-> Commutation of Alternating Current Motors, Phase II

Develop controller using encoder technology for alternating current (AC) motors.

BACKGROUND

Low-hp AC electric motors, used in millions of applications worldwide, operate at much less than the 80- to 90-percent efficiency most motors are capable of, primarily because most are designed to be operated at a single speed at a single given voltage, current, or load. However, motor applications seldom function in such "optimal" single modes, but operate under varying conditions and demands, producing excessive energy losses recoverable by improving motor efficiency. Varying the motor speed, a very effective way to save energy often is accomplished using variable-speed drives. Such motor-speed control actually optimizes the energy needed for most applications and dramatically diminishes energy consumed and wasted for variable loads or conditions. Several types of variable-speed drives are used for fans and pumps. These drives often recoup their cost several times through energy savings. For many residential and commercial applications, however, these variable-speed technologies are not implemented, primarily due to complexity, cost, and size constraints. Phase I of this project, completed in January 1995, was successful in producing a working prototype that demonstrates energy savings in a variety of applications.

OBJECTIVES

To finalize the design and development of the product as well as the product packaging, pricing, and feature assessment, and to obtain a commercialization partner.

DESCRIPTION

The contractor will (1) recruit a technical advisory committee; (2) perform a market assessment; (3) develop a marketing plan; (4) perform encoder and amplifier design and development; and (5) conduct system integration and demonstration with a corporate partner.

BENEFITS

Benefits will include developing an energy-efficient, variable-speed motor-control technology that is low-cost, and easily manufactured and installed, with low maintenance requirements. The product will provide the energy savings associated with variable-speed control and will increase the efficiency of the motor. This product also will represent a significant new market opportunity for a small New York State company.

SCHEDULE AND STATUS

A Phase II prototype has been tested and completed. Product commercialization is under way.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$450,000	0	$450,000
Opto Generic Devices, Inc.	675,412	0	675,412
TOTALS	$1,125,412	0	$1,125,412

Contractor: Opto Generic Devices, Inc.
Site: Van Hornesville, Herkimer and Otsego County
Contract Duration: 9/95-8/97
Key Words: product development, motor controllers, drives
Project Manager: Mary Ann S. Bowers (518) 862-1090, ext. 3254
Program: Buildings Research
Subprogram: Electrical & Control Systems
Contract No.: 4078L-IABR-BR-95

-> Commercialization of Operative Temperature Sensor Technology, Phase II

Test, manufacture, and commercialize operative temperature sensor system.

BACKGROUND

Currently, dry-bulb temperature (DBT), or air temperature, is the only parameter used to control heating, ventilating, and air-conditioning (HVA)C systems. The use of air temperature alone does not take into consideration other thermal environment factors that affect the comfort of the occupant. Mean radiant temperature (MRT) is a measure of the radiant heat present in a space. Thermal comfort has been shown in studies by ASHRAE to be a function of both MRT and DBT. Operative temperature (OT) is defined as the average of these two temperature parameters. A thermostat based on OT has been shown in studies by the National Association of Home Builders (NAHB) to allow for more efficient use of energy and increased occupant comfort. OT sensing provides a method of reducing or eliminating the effects of the extremes of DBT and MRT that result when the system responds to DBT only. OT sensing provides a means of including MRT in building energy used. In addition, it can be used to control the operation of radiant heat-transfer equipment to provide occupant comfort without affecting DBT. In addition, an OT sensor (OTS) can sense the thermal effects of external conditions on internal conditions. This means that the OTS responds to passive-solar conditions long before existing DBT-only systems. In the first phase of this project, the Markel Heater Corporation developed and patented an OTS prototype system for which it holds the patent.

OBJECTIVES

To undertake final product design and development of the OTS and to test and commercialize the product.

DESCRIPTION

The contractor will: (1) perform beta-testing, (2) perform user evaluations, (3) conduct laboratory testing, (4) develop a marketing plan, (5) design pre-production prototype units, (6) use industrial partners to test the product, and (7) manufacture and commercialize the product.

BENEFITS

Studies by NAHB have shown that use of the OTS technology to control HVAC systems can result in a 33-50 percent reduction in energy use, resulting in considerable cost savings. In addition, the successful commercialization of this product will significantly increase profitability and employment at both Markel Heater and GC Controls. The market study conducted in the first phase indicated that, upon commercial release, the product will have no competition and will become the controlling sensor of choice.

SCHEDULE AND STATUS

Development of the hand-held meter has been completed and will be commercialized in June. Industrial partner testing began in the fall of 1996.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$385,772	0	$385,772
Markel Heater Corporation	217,926	0	217,926
GC Controls	55,375	0	55,375
Akers Associates	66,814	0	66,814
Industrial partners	110,000	0	110,000
TOTALS	$835,887	0	$835,887

Contractor: Markel Heater Corporation
Site: Buffalo, Erie County, and Greene, Chenango County
Contract Duration: 8/93-7/97
Key Words: product development, HVAC, operative temperature control, thermostats
Project Manager: Mary Ann Bowers (518) 862-1090, ext. 3254
Program: Buildings
Subprogram: Electrical & Control Systems
Contract No.: 3020L-IABR-BR-96

-> Modulating Burner Control Systems and Vent and Air Dampers

Develop burner controls and modulated vent and air dampers for oil- and gas-fired furnaces and hot water heaters.

BACKGROUND

Conventional oil- and gas-fired equipment for heating both water (boilers) and air (furnaces) use burners that can operate at only one capacity, or firing rate. Present-day burners can be equipped with various nozzles to vary firing rates, and some have air shutters that can manually change the ratio of fuel to air. However, neither nozzles nor air shutters can be changed during the firing cycle, and neither operates in conjunction with a control to determine the required firing levels. Recently, high/low burners have been developed that fire at two different rates, as well as a modulating burner that extends the high/low burner to allow multiple, or even infinite, steps in matching heat requirements and heat generation. While these are major technological advances, there is no realistic application for the product without an aquastat, thermostat, or other control system that can make the burner fire at the proper output. In addition, vent or flue-damper actuation to match burner output is also not possible at this time.

OBJECTIVES

To develop three individual components of an advanced control system for use with both oil and gas modulating burners. Objectives include development of (1) a control system that will determine the amount of heat required from a modulating burner and signal the burner (and on gas systems, signal the dampers) with a proportional or pulsed signal to operate at the proper level; (2) determining the relationship between burner output and the required flue size and convert damper blade rotation in degrees to approximate that flue size; (3) developing the electronic controls and adapt them to an existing electric vent or flue damper designed to accomplish an infinitely variable rotation of the vane in response to a proportional or pulsed signal; (4) adopting the design resulting from the previous objective to a combustion air damper; and (5) demonstrating, testing, and evaluating the efficiency of the system and compare it to conventional gas- and oil-fired systems.

DESCRIPTION

The contractor will (1) perform controller, flue and vent damper development; (2) perform system design; (3) construct prototypes; and (4) demonstrate and test the product.

BENEFITS

Using aquastat or thermostat control will generate energy savings when used in conjunction with a modulating burner, with gas systems achieving further savings through the use of a modulating damper and modulating combustion-air damper. The technologies will provide both energy savings and improved environmental performance, while raising the comfort level. If the project is successful, sales of the resulting products will substantially increase the profitability and employment of a New York State company.

SCHEDULE AND STATUS

Product design for the two-stage burner has been completed. Testing will begin in early spring.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$239,000	0	$239,800
Flair International	89,800	0	89,800
Brookhaven National Laboratory	75,000	0	75,000
Meitav Ltd.	75,000	0	75,000
TOTALS	$478,800	0	$478,800

Contractor: Flair International Corporation
Site: Hauppauge, Suffolk County
Contract Duration: 1/96 - 10/97
Key Words: product development, HVAC, buildings, control systems, dampers
Project Manager: Mary Ann S. Bowers (518) 862-1090 ext. 3254
Program: Buildings Research
Subprogram: Electrical & Control Systems
Contract No.: 4337-IABR-BR-96

-> Design and Development of a Direct-Reading Radon Monitor

Design, develop, and produce low-cost continuous radon monitor.

BACKGROUND

U.S. Environmental Protection Agency (U.S. EPA) radon-level guidelines, and laws requiring mandatory radon testing before a home sale in some states, have made radon a major concern for many homeowners and building managers. In an earlier NYSERDA project, Rad Elec, Inc. developed a radon monitor called the E-Perm™ that uses a permanently charged disk of teflon (called an electret) as the radon sensor. As the radon radiates, ions are generated and drawn to the surface, where they collect and cause the electret's surface voltage to decrease. The magnitude of this decrease can be correlated to the radon concentration in the air. The product is now available commercially and widely used by professionals. Its use by homeowners is limited, however, because reading the electret voltage requires off-site laboratory analysis or expensive professional equipment.

OBJECTIVE

To create a low-cost, easy-to-use monitor that will perform continuous radon-concentration measurement by combining the existing E-Perm™ product with readout equipment to produce a device that will monitor radon levels on a long- and short-term basis, with the ability to display real-time and historical results.

DESCRIPTION

The contractor will: (1) design, develop, fabricate, and calibrate laboratory and pre-production prototypes; (2) evaluate the precision and accuracy of the prototype operation over time; (3) perform field-testing by professionals and homeowners; (4) obtain U.S. EPA certification of the final prototype; and (5) develop and demonstrate the final commercial product.

BENEFITS

Real-time monitoring will allow mitigation systems to be turned on only when radon concentrations exceed certain preset limits. This avoids continuous operation of these systems, thereby providing energy savings. The project also will facilitate growth of a small New York State company.

SCHEDULE AND STATUS

Development work on the field sensor and controlling electronics has begun. A prototype model is being laboratory-tested.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$95,813	0	$95,813
Sensor Plus, Inc.	81,015	0	81,015
TOTALS	$176,828	0	$176,828

Contractor: Sensor Plus, Inc.
Site: Buffalo, Erie County
Contract Duration: 11/92 - 10/97
Key Words: product development, environmental, indoor air quality, HVAC, radon, monitoring
Project Manager: Mary Ann Bowers (518) 862-1090 ext. 3254
Program: Buildings
Subprogram: Electrical & Control Systems
Contract No.: 1952-EEED-BES-92

-> Microprocessor-Based CO_2/VOC-Makeup Air Controller

Design, develop, and demonstrate microprocessor-based ventilation-control device based on carbon dioxide (CO_2) and volatile organic compound (VOC) concentrations.

BACKGROUND

Many buildings have either completely eliminated using added air or only add outside air when it is required. Adding excessive outside air increases heating, ventilating, and air conditioning (HVAC) energy consumption, while too little can produce a "sick" building, due to high levels of CO_2 and VOCs in the building's interior work space. Recognizing that indoor air quality is the primary cause of sick buildings, the U.S. Environmental Protection Agency (U.S. EPA), American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE), and the National Institute for Occupational Safety and Health (OSHA) have issued guidelines for CO_2 and VOC levels in occupied work spaces.

OBJECTIVES

To design and develop the sensors and accompanying microprocessor controller and algorithms for a duct-mounted integral unit that will control outside ventilation according to measured levels of CO_2 and VOC.

DESCRIPTION

The contractor will (1) perform sensor and system research; (2) develop a microprocessor controller and algorithms; (3) conduct bench-scale demonstration and testing as well as field-testing; and (4) formulate and implement a commercialization plan.

BENEFITS

A major benefit is the projected energy savings that can be achieved by using the new control system. Energy savings will be achieved while maintaining the building's air quality to published standards and regulations. The system will increase worker comfort and productivity. Economic benefits will accrue from manufacture of the product in New York State.

SCHEDULE AND STATUS

Product development is completed. Testing of the units at the World Financial Center and the Marriott Marquis Hotel in Manhattan has been completed. Testing at American Express' offices in Manhattan also is under way. Product commercialization is expected in the latter part of 1997.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$119,953	0	$119,953
Spence Associates, Ltd.	123,332	0	123,332
TOTALS	$243,285	0	$243,285

Contractor: Spence Associates, Ltd.
Site: Saint James, Suffolk County
Contract Duration: 1/94-7/97
Key Words: product development, air quality, buildings, ventilation, VOCs, CO_2
Project Manager: Mary Ann S. Bowers (518) 862-1090, ext. 3254
Program: Buildings
Subprogram: Electrical & Control Systems
Contract No.: 3110-EEED-BES-94

-> Monitoring and Evaluation of 200kW Fuel Cell

Monitor and evaluate 200kW phosphoric acid fuel cell operating on anaerobic digester gas.

BACKGROUND

The ONSI PC25 phosphoric-acid fuel cell is the first commercially available fuel cell. Approximately 55 of these 200kW units have been sold throughout the world to various gas and electric utilities, providing economic development benefits to New York State because New York manufacturers provide approximately 29 percent of the dollar value of the fuel cell through subcontracts with ONSI. Three of these units were sold to New York State utilities. NYSERDA, in cooperation with the Gas Research Institute and the fuel-cell owners, developed a project to monitor the performance of each of these three fuel cells. Monthly data has shown that the units are very reliable in the field and each of the utilities is very pleased with their performance. This is a vast departure from the first generation of units, which was plagued with operating problems. In May 1995, the New York Power Authority (NYPA) issued a request for proposals for a fuel cell, using any of the technologies, to be installed at the Yonkers sewage treatment plant. In June 1995, ONSI responded with a proposal as the only bidder. NYSERDA also is co-funding the purchase of this fuel cell with NYPA under Contract No. 4314-ERTER-ER-96.

OBJECTIVES

To monitor the operation of the fuel-cell power plant, operating on anaerobic digester gas (ADG), for a one-year period, beginning approximately two months after initial unit start-up.

DESCRIPTION

The contractor will (1) perform a site survey; (2) develop a test plan; (3) install and commission instrumentation; (4) perform data collection and analysis; and (5) conduct emissions testing.

BENEFITS

The main benefit of this project is its research value. The application of the PC25"C" 200kW fuel cell for use with ADG has not been done before. Testing of the technical performance, especially in such areas as emissions and efficiency, will provide important information for others considering such an application. A successful application along with an independent monitoring effort will pave the way for other similar ADG or landfill sites. In addition, little objective data on the operation of the new PC25"C" units has been gathered to date.

SCHEDULE AND STATUS

The fuel cell has been installed and is undergoing start-up. Monitoring will begin in late spring.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$216,422	$114,900	$114,900
Brooklyn Union	45,609	0	45,609
National Fuel Gas Dist. Corp.	20,000	0	20,000
New York Gas Group	89,722	0	89,722
Gas Research Institute	50,000	0	50,000
Rochester Gas and Electric Corp.	45,609	0	45,609
TOTALS	$467,362	$114,900	$582,262

Contractor: Science Applications International Corporation
Site: Yonkers, Westchester County
Contract Duration: 3/96-8/97
Key Words: environmental, phosphoric acid fuel cells, monitoring, evaluation, cogeneration
Project Manager: Mary Ann S. Bowers (518) 862-1090 ext. 3254
Program: Buildings Research
Subprogram: Electrical & Control Systems
Contract No.: 4474-IABR-BR-97

Instrument, monitor, and evaluate lighting and motor retrofits.

BACKGROUND
Energy conservation retrofits were made by the former New York State Energy Office at two universities and four correctional facilities in New York State Electric & Gas Corporation's (NYSEG) service territory. As the cost of metering and monitoring all facilities would be prohibitive, a representative sample of these retrofits is being used to validate project savings.

OBJECTIVE
To verify the energy savings and demand reduction achieved by lighting and motor retrofits, with special emphasis on determining savings persistence.

DESCRIPTION
The contractor will verify savings through instrumenting, monitoring, and evaluating pre- and post-retrofit energy-use characteristics of lighting and motor installations. Pre-retrofit monitoring will be performed for a minimum of six months. Post-retrofit monitoring will be performed for a minimum of five years. Engineering estimates of demand and energy savings will be compared with metered results. Interim and final reports will be prepared and distributed.

BENEFITS
Energy and demand savings data will be compared with engineering estimates and will be used to verify and calibrate the Hybrid Statistically Engineering model. This model, and the information gained from investigating the persistence of savings, will help to guide utility DSM efforts.

SCHEDULE AND STATUS
Pre-retrofit monitoring began in August 1992 and continued through April 1993. Retrofits have been completed at Cornell and Binghamton. The post-retrofit period has begun and data collection is ongoing.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$374,456	0	$374,456
New York State Energy Office	200,000	0	200,000
TOTALS	$574,456	0	$574,456

Contractor: XENERGY, Inc., Dryden, Tompkins County
Site: Cornell University, Tompkins County, and SUNY/Binghamton, Broome County
Contract Duration: 4/92 - 4/98
Key Words: environmental, utilities, integrated resource planning, DSM, metering, lighting, motor, retrofits
Project Manager: Mary Ann Bowers (518) 862-1090, ext. 3254
Program: Buildings
Subprogram: Energy Policy Research
Contract No.: 1861-EEED-BES-92

-> Energy-Management System (EMS) for Wayne-Finger Lakes Board of Cooperative Educational Services (BOCES) - Phase II

Promote energy performance contracting.

BACKGROUND
There is great potential for energy savings in New York State schools. Energy performance contracting offers one approach to implementing energy improvements in the State's schools.

OBJECTIVE
To promote the use of energy performance contracting in the State's schools using a variety of mechanisms, including marketing, training, and technical assistance.

DESCRIPTION
Wayne-Finger Lakes BOCES will play a pivotal role in promoting energy performance contracting providing training and technical assistance to more than 21 school districts in western New York.

BENEFITS
Implementation of energy improvements in the State's schools can result in significant energy savings.

SCHEDULE AND STATUS
The project has been extended to allow Wayne BOCES to complete work with new school districts.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$221,993	0	$221,993
Rochester Gas and Electric Corp.	150,000	0	150,000
New York State Electric & Gas Corp.	150,000	0	150,000
BOCES and schools	160,170	0	160,170
TOTALS	$682,163	0	$682,163

Contractor: Wayne-Finger Lakes BOCES
Site: Stanley, Ontario County
Contract Duration: 2/88 - 6/98
Key Words: buildings, energy performance contracting, HVAC
Project Manager: Norine Karins (518) 862-1090 ext. 3211
Program: Buildings
Subprogram: Electrical Systems
Contract No.: 1114-EEED-AEP-89

-> Applying Submetering for Demand-Side Management

Promote submetering in electrically master-metered residential buildings in Con Edison's service territory.

BACKGROUND

Submetering is the measurement and billing of electric use in individual apartment units in a master-metered building. Approximately 300,000 dwelling units in New York City are master-metered. Studies have shown that electric consumption in submetered apartments is 18-26 percent lower than in master-metered apartments. Con Edison and NYSERDA began this project in 1991 with the goal of submetering 5,000 apartments. The primary objective was to promote electrical submetering in the New York City master-metered residential marketplace by providing financial incentives, technical services, and educational materials designed to facilitate submetering implementation.

ACCOMPLISHMENTS

As a result of this project, 1,999 apartments were submetered in eight buildings. Sites were monitored and energy-saving analyses were conducted. Additional accomplishments include development of general grievance procedures and guidelines for vendor selection, billing review, identification of submetering markets and candidates, and provision of assistance to buildings seeking submetering approval.

FINDINGS AND CONCLUSIONS

The original goal of 5000 submetered apartments was not reached because the financial, regulatory, legal, and political barriers to submetering were far more significant than first anticipated. The apartments that were submetered realized energy savings on the order of 10-23 percent.

REALIZED OR ANTICIPATED BENEFITS

Approximately 4,339 million Btu per year were saved by submetering eight buildings. Identifying the barriers to submetering was another major unanticipated benefit that led to additional work by NYSERDA and others to remove those barriers.

TECHNOLOGY TRANSFER ACTIVITIES

One major technology-transfer activity was the preparation of more than 80 feasibility studies for buildings throughout New York City. Additional technology-transfer activities included preparation of submetering articles and case studies, attendance at trade shows, presentations at Board Meetings, and development of promotional materials.

FUNDING	TOTALS
NYSERDA	$250,000
Con Edison	1,250,000
TOTALS	$1,500,000

Contractor: Consolidated Edison Company of New York, Inc.
Site: Con Edison service territory, New York City, New York County; Ossining, Westchester County
Contract Duration: 3/91 - 7/96
Key Words: buildings, submetering, DSM, utilities
Project Manager: Mary Ann S. Bowers (518) 862-1090 ext. 3254
Program: Buildings Research
Subprogram: Electrical Systems
Contract No.: 1507-EEED-BES-91

-> 200-kW Fuel Cell Monitoring and Evaluation Program

Evaluated technical and economic performance of three phosphoric-acid fuel cells.

BACKGROUND

International Fuel Cells and ONSI, its manufacturing subsidiary, are producing and selling the first commercial version of a phosphoric-acid fuel cell. The cells have negligible pollutant emissions and an overall efficiency of >80%, making them among the cleanest and most efficient fossil-fueled electric-generating systems available today. For market demand to be stimulated; however, detailed, accurate data-gathering and analysis are needed.

ACCOMPLISHMENTS

Three New York State fuel cell sites were monitored and evaluated for technical and economic performance: St. Vincent's Medical Center, Staten Island; Center for Integrated Manufacturing Studies, Rochester Institute of Technology; and Riefler Cement Company, Buffalo. Data was shared with three sites in Southern California Gas' service territory and with Consumer's Gas in Toronto.

FINDINGS AND CONCLUSIONS

Results showed that, in general, measured fuel cell output and efficiency values met the manufacturer's specifications. Fuel cell availability was very high, at 86.7%, during the monitoring period. This compares very favorably to an industry value of 84.8% for utility gas-fired generators. The electric efficiency, on average, was 33.8%, based on the input fuel's higher heating value. This efficiency is lower than the manufacturer's specification of 36%, but was reasonable given the age of the monitored units. Continuous power quality monitoring at two of the sites showed that harmonic distortion was within acceptable limits and that no power quality problems could be attributed to the fuel cell. Special testing to quantify fuel cell stack emissions showed them to be well below the levels estimated by the manufacturer.

REALIZED OR ANTICIPATED BENEFITS

Results of economic analysis using actual costs and savings values showed that none of the New York State sites were economically justified given the demonstrated savings and the costs actually incurred. This result was not unexpected given the high installation costs and operation of the fuel cells in an R&D environment. Life-cycle cost analysis using future cost estimates show potential payback periods of about six years compared to retail purchased power. This project provided the industry with independent performance data that can be used to mitigate the risk associated with the purchase of new technologies, thereby helping to stimulate market demand for fuel cells.

TECHNOLOGY TRANSFER ACTIVITIES

A paper on the interim results was presented at the 1996 International Fuel Cell Seminar. The final report will be widely distributed to a variety of fuel cell industry experts, including staff from the U.S. Department of Energy, Advanced Research Projects Agency, Electric Power Research Institute, and similar organizations in Canada, Japan, and Belgium.

FUNDING	TOTALS
NYSERDA	$216,422
Brooklyn Union	45,609
National Fuel Gas Dist. Corp.	20,000
Rochester Gas and Electric Corp.	45,609
Gas Research Institute	60,000
New York Gas Group	92,022
TOTALS	$479,662

Contractor: Science Applications International Corporation
Site: Staten Island, Richmond County; Rochester, Monroe County; and Hamburg, Erie County
Contract Duration: 4/93-1/97
Key Words: cogeneration, utilities, buildings, demonstration, phosphoric acid fuel cells, monitoring, evaluation
Project Manager: Mary Ann Bowers (518) 862-1090 ext. 3254
Program: Buildings Research
Subprogram: Electrical and Control Systems
Contract No.: 2045-EEED-BES-93

Identify and analyze institutional barriers to submetering and make recommendations for overcoming them.

BACKGROUND

NYSERDA has been involved with submetering projects for more than 10 years. Projects quantifying the potential savings showed an immediate 20- to 25-percent energy savings when a master-metered building converted to submetering. A 1989 follow-up in-house evaluation of the long-term benefits of submetering retrofits found that the average apartment-only consumption remained nearly 20 percent below pre-submetering consumption. Over time, it became obvious that serious regulatory, political, and financial barriers were impeding widescale implementation of submetering. This project's goal was to identify and analyze these barriers and to formulate recommendations and a strategic plan of action for barrier removal. Project objectives were to be met through extensive personal interviews, public forums, and legal and policy research.

ACCOMPLISHMENTS

The forums and published report fostered awareness of the complexity of the submetering issue and a desire by all the parties involved to participate in future submetering working groups. In addition, the Public Service Commission (PSC) has agreed to initiate the process to change the voting requirement for submetering approval in condos and co-ops from a majority of all shareholders to a majority of those voting. This rule change has been drafted and is currently out for public comment. Several financial barriers also are being considered for removal by other State and City regulatory agencies.

FINDINGS AND CONCLUSIONS

The PSC voting requirement was found to be the greatest barrier to submetering in the co-op and condo market, which was concluded to be the easiest to submeter at this time. Rental market barriers were identified including dispute resolution and rent reduction issues, and determined to be much more complex and difficult to overcome.

REALIZED OR ANTICIPATED BENEFITS

If the PSC voting requirement change is approved, a major barrier to submetering in the co-op and condo markets will be removed. Benefits include plans to form an ad-hoc committee to address unresolved barriers. A submetering manual and standard package of information will be developed and distributed by NYSERDA.

TECHNOLOGY TRANSFER ACTIVITIES

A final report has been completed and widely distributed. This report is a working document that contains a strategic action plan for removing barriers. Three forums were held during the project to build consensus and convey project results. Additional meetings on these issues are planned.

FUNDING	TOTALS
NYSERDA	$180,020
TOTALS	$180,020

Contractor: Applied Energy Group, Inc.
Site: Hauppauge, Suffolk County
Contract Duration: 12/93 - 6/96
Key Words: electricity, demand-side management, buildings, multifamily, submetering, utilities
Project Manager: Mary Ann S. Bowers (518) 862-1090, ext. 3254
Program: Buildings
Subprogram: Electrical Systems
Contract No.: 3121L-EEED-BES-94

-> Power Quality with Non-Linear Loads

Develop and test computer codes that include harmonic content for load-modeling.

BACKGROUND

Increasing use of equipment with non-linear characteristics and therefore a high harmonic content has caused utilities to be concerned with the quality of their power supply. Some loads with the highest harmonic content are energy-efficient equipment such as electronic ballasts and variable-speed drives. Utilities are struggling financially to operate a distribution system sized and built for linear loads only, which often means derating transformers and oversizing neutral wires. These costs, passed on to customers, eventually may discourage purchasing energy-efficient devices. Load-flow analysis for planning and evaluation does not consider the harmonic content of today's loads. Models that describe the effects of non-linear loads are needed.

ACCOMPLISHMENTS

An area substation load model that included the effects of harmonics was successfully developed. A method for incorporating the load models into existing utility load-flow programs was also developed and tested. A field test was performed at a LILCO customer site, MITEQ, Inc., that had a load characterized as containing high non-linear components. A database of non-linear loads and their associated harmonics was developed for a wide variety of end-uses.

FINDINGS AND CONCLUSIONS

Results indicate that by properly selecting the load composition, the utility can use the simulation program to predict the line current and bus voltage waveshapes at the customer site; and, conversely, from the knowledge of the current and voltage waveforms, the utility can deduce the load composition. Testing showed the accuracy of the developed model to be 95% or greater.

REALIZED OR ANTICIPATED BENEFITS

The computer model was successfully developed and is ready to be commercialized by software firms that serve the utility industry. To date, several firms have expressed interest. In a restructured electric utility industry, knowledge of customer load composition and identification of problematic loads are expected to be increasingly important to utilities. Customers are demanding higher-quality power and this tool allows utilities to obtain the information needed to provide it. In addition, identifying problematic loads before they come on-line can prevent customers from having to make large expenditures for harmonic distortion mitigation equipment, as well as prevent costly power quality outages.

TECHNOLOGY TRANSFER ACTIVITIES

The software models have been transferred to LILCO and ESEERCO for their use and distribution. Commercialization of the models is being pursued.

FUNDING	TOTALS
NYSERDA	$176,889
Long Island Lighting Company	196,140
TOTALS	$373,029

Contractor: Polytechnic University, Weber Research Institute
Site: Brooklyn, Kings County, and Hauppauge, Suffolk County
Contract Duration: 6/93-5/97
Key Words: university, electricity, power quality, load modeling, DSM, utilities
Project Manager: Mary Ann Bowers (518) 862-1090, ext. 3254
Program: Buildings Research
Subprogram: Electrical and Control Systems
Contract No.: 3149-IABR-BR-94

-> Advanced Data Loggers

Develop family of cost-effective, high-performance data loggers for power measurement.

BACKGROUND

Data loggers are used extensively for verifying building systems' functionality, environmental conditions, and computer building models; conducting energy efficiency studies; and retrofitting and commissioning buildings. In most cases, data loggers used for energy service work are inadequate in several ways. Traditionally, users have been forced to compromise on one of two broad categories of loggers. The first are expensive (typically in the $1,500-$4,000 range), cumbersome, labor-intensive to install, difficult to program and operate, and power-hungry. On the other hand, portable data loggers, while less expensive, suffer from inflexibility, thereby creating manual, error-prone, and labor-intensive data-tracking. An innovative solution is needed to merge the programmability and flexibility of the full-function data loggers with the cost-effectiveness, portability, and relative ease of use of portable battery-operated data loggers.

ACCOMPLISHMENTS

An independent market study was conducted to assess market potential for the family of advanced data loggers. Competitive, economic, and buyer behavior analyses were conducted. Utility, energy service companies, and consulting companies were surveyed.

FINDINGS AND CONCLUSIONS

The market study showed that the market for the proposed family of data loggers was not large enough to warrant funding a new product development effort; therefore the project was terminated.

REALIZED OR ANTICIPATED BENEFITS

Not applicable.

TECHNOLOGY TRANSFER ACTIVITIES

Not applicable.

FUNDING	TOTALS
NYSERDA	$9,800
TOTALS	$9,800

Contractor: Enernet Corporation
Site: Dewitt, Onondaga County, and Greene, Chenango County
Contract Duration: 7/96-3/97
Key Words: product development, data loggers, power measurement
Project Manager: Mary Ann Bowers (518) 862-1090 ext. 3254
Program: Buildings Research
Subprogram: Electrical and Control Systems
Contract No.: 4339-IABR-BR-96

Develop domestic hot water (DHW) sizing requirements.

BACKGROUND
Given the lack of data on heating and domestic hot water (DHW) systems in New York City multifamily buildings, this project will address the issues of heating plant and DHW systems' operations in selected multifamily buildings.

OBJECTIVE
To develop and analyze multifamily building operational energy-performance data for 30 New York City multifamily buildings, and to analyze DHW consumption data on a subset of buildings.

DESCRIPTION
The contractor will: (1) collect energy-performance and DHW consumption data, (2) develop operational profiles for each building, (3) develop models of DHW generation and storage systems, (4) determine the effects of seasonal efficiency and (5) determine the most efficient DHW generation system for multifamily applications.

BENEFITS
The results of this real-time energy performance monitoring project will contribute substantially toward reducing energy waste in this building stock.

SCHEDULE AND STATUS
An interim report has been received.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$146,268	0	$146,268
EMRA	110,065	0	110,065
TOTALS	$256,333	0	$256,333

Contractor: Energy Management & Research Associates (EMRA)
Site: New York City, New York County
Contract Duration: 2/91 - 8/97
Key Words: buildings, multifamily, low-income
Project Manager: Norine Karins (518) 862-1090, ext. 3211
Program: Buildings Research
Subprogram: Low-Income Sector
Contract No.: 1647-EEED-BES-91

-> Investigating Energy and Water Savings from Low-Flow Showerheads

Install low-flow showerheads to produce energy and water savings.

BACKGROUND

More than a decade ago, NYSERDA sponsored an investigation of the energy- and water-saving potential of low-flow showerheads in multifamily buildings. Because of inconclusive research results, NYSERDA is now reevaluating the efficacy of low-flow showerheads in 50 New York City apartment buildings.

OBJECTIVE

To quantify the energy and water savings achieved by installing low-flow showerheads.

DESCRIPTION

Remote-transmitting dataloggers, temperature sensors, and flow meters will collect data on domestic hot water (DHW) energy consumption and flow, and total water flow. Pre- and post-installation energy- and water-consumption data will be analyzed on a subset of 50 apartment buildings. The sample subset will consist of apartment buildings that received low-flow showerheads through the residential water survey and toilet rebate program conducted by the New York City Department of Environmental Protection. Flow and pressure measurements also will be taken in each building. Showerhead retention will be determined through tenant and building superintendent surveys.

BENEFITS

The project will be used to ascertain whether low-flow showerheads can reduce DHW consumption in multifamily buildings.

SCHEDULE AND STATUS

An interim report is under review.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$119,629	0	$119,629
NYC DEP	80,000	0	80,000
TOTALS	$199,629	0*	$199,629

*$7,740 provided to Xenergy, Inc. under Purchase Order No. R2024 to review and analyze the project's experimental design and final report.

Contractor: EME Group
Site: New York City, New York County
Contract Duration: 11/94 - 11/97
Key Words: buildings, multifamily, low-income, domestic hot water, showerheads
Project Manager: Norine Karins (518) 862-1090, ext. 3211
Program: Buildings
Subprogram: Low-Income Sector
Contract No.: 3142-IABR-BS-94

-> Converting Electrically Heated Buildings to Hot Water

Demonstrate energy and economic savings potential of electric-to-hot-water conversions.

BACKGROUND

Electric space heating generally entails a large waste of energy because the overall fuel-use efficiency for electric power generation, transmission, and distribution is about 30 percent. The annual fuel-use efficiency of gas- or oil-fired boilers for hot-water heating systems usually ranges from 70 to 75 percent. Converting from electric to hot-water heating can result in primary fuel savings of approximately 50 percent.

OBJECTIVE

To develop, implement, and monitor the conversion of multifamily buildings from resistive electric heat to hot-water space heating.

DESCRIPTION

A generic analytical model will be developed based on construction and performance data obtained from the demonstrations. The model will include routines to calculate conversion costs, electricity saved, heat input required, energy-cost reductions achieved, and anticipated payback period. The construction-cost routine will include building size, number and size of units, local construction labor rates and productivity factors, and how local climate could affect system design. The model also will consider whether district heating or boilers will provide the heat source.

BENEFITS

The cost of electric-resistance heating in New York is from $17 to $44 per million Btu of space-heating delivered. The cost of gas-based heating in the form of hot water is approximately $9 to $12 million per Btu of space-heating delivered. The cost of heat supplied by district heating systems ranges from $7.50 to $10 per million Btu; therefore, the economics and energy-savings potential of electric-to-hot-water conversions is very attractive.

SCHEDULE AND STATUS

Three conversions have been completed successfully. The draft final report is being prepared.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$150,000	0	$150,000
Jamestown BPU	169,800	0	169,800
Jamestown BPU (in-kind)	28,000	0	28,000
Joseph Technology Corp. (in-kind)	23,200	0	23,200
TOTALS	$371,000	0	$371,000

Contractor: Joseph Technology Corporation
Site: Jamestown, Chautauqua County
Contract Duration: 5/95 - 5/97
Key Words: environmental, buildings, district heating, multifamily
Project Manager: Norine Karins (518) 862-1090, ext. 3211
Program: Buildings
Subprogram: Low-Income Sector
Contract No.: 4144-IABR-BR-95

-> Marcus Garvey Village Feasibility Study

Convert electrically heated buildings to hydronic baseboard heat using innovative piping technologies.

BACKGROUND

Electric-resistance heat was installed in a vast number of the State's low-income housing complexes during the 1970s. To a considerable degree, electric baseboard heat also has been installed in new low-income construction as a means of reducing upfront costs. New energy-efficient technologies may offer a cost-effective alternative to this costly fuel source. This project will examine the use of Kitec® piping for converting electric heat to hydronic systems.

OBJECTIVE

To: (1) quantify the energy, economic, and health and safety effects of converting an electrically heated multifamily building to hydronic baseboard heat using innovative piping practices, and (2) evaluate the conversion's impact on energy consumption and related cost issues.

DESCRIPTION

A feasibility study will be conducted at Marcus Garvey Village, a 625-unit complex in Brooklyn. The apartments now have baseboard resistance panels, with domestic hot water supplied by a system of central gas-fired heaters. The study will: (1) evaluate all costs and benefits of replacing the existing system with hydronic baseboard heat, and (2) determine the feasibility of using Kitec® piping to reduce installation costs. Kitec® is a multipurpose pressure-piping system constructed of a plastic/metal laminate.

BENEFITS

The energy savings per dwelling unit are anticipated to be more than $300.

SCHEDULE AND STATUS

The project is under way.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	0	$24,058	$24,058
Brooklyn Union	0	24,058	24,058
R.Y. Management (in-kind)	0	1,566	1,566
TOTALS	0	$49,682	$49,682

Contractor: Energy Management & Research Associates
Site: Brooklyn, Kings County
Contract Duration: 1/97 - 8/97
Key Words: electricity, low-income, multifamily, buildings
Project Manager: Norine Karins (518) 862-1090, ext. 3211
Program: Buildings
Subprogram: Low-Income
Contract No.: 4499-IABR-BR-97

-> Ductless Heat-Pump Feasibility Study

Convert electric-resistance baseboard heat to ductless heat pumps.

BACKGROUND

Electric-resistance heat was installed in a vast number of the State's low-income housing complexes during the 1970s. To a considerable degree, electric baseboard heat also has been installed in new low-income construction as a means of reducing upfront costs. New energy-efficient technologies may offer a cost-effective alternative to this costly fuel source. This project will examine the use of ductless heat pumps to replace electric-resistance baseboard heaters.

OBJECTIVE

To: (1) evaluate the feasibility of installing ductless heat pumps to lower heating costs at the Ithaca Housing Authority's Southview Apartment complex, and (2) determine the feasibility of lowering the installed cost of ductless heat pumps in multifamily buildings by using the existing electric-baseboard heaters as backup heat.

DESCRIPTION

The study will examine all the costs and benefits of a conversion at Southview Apartments, including an analysis of each of the following: ductless heat pumps, with low-cost modifications; no change (retain electric baseboard heaters); central boiler with hydronic baseboard heating; and through-the-wall, gas-fired heaters. A small-scale pilot demonstration is then anticipated.

BENEFITS

If economically attractive, the ductless heat pumps would present a new option for reducing energy costs in all-electric multifamily buildings, specifically those for which other fuel-conversion options are neither feasible nor economically attractive. Heating energy-use reductions could be fairly significant.

SCHEDULE AND STATUS

The project is under way.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	0	$37,983	$37,983
Ithaca Housing Authority	0	38,170	38,170
TOTALS	0	$76,153	$76,153

Contractor: Taitem Engineering, P.C.
Site: Ithaca, Tompkins County
Contract Duration: 3/97 - 3/99
Key Words: electricity, low-income, multifamily, buildings, heat pumps
Project Manager: Norine Karins (518) 862-1090, ext. 3211
Program: Buildings
Subprogram: Low-Income
Contract No.: 4517-IABR-BR-97

Convert electrically heated buildings to gas-fired systems.

BACKGROUND
Electric resistance heat was installed in the State's low-income housing complexes throughout the 1970s. New energy-efficient technologies may offer a cost-effective alternative to costly electric heat. This project will evaluate the cost-effectiveness of two new technologies for selected complexes owned by the Albany Housing Authority.

OBJECTIVE
To: (1) quantify the energy and economic benefits of converting an electrically heated multifamily complex to direct-vent, gas-fired baseboard heaters and hot water/radiant convective panel systems; and (2) to determine the energy savings and costs related to such conversions.

DESCRIPTION
The feasibility study will include an evaluation of all costs and benefits of replacing the existing electric baseboard systems at selected Albany Housing Authority properties. Data collection will include historic energy consumption data, new equipment costs, installation costs, and start-up expenditures. Projected repair costs to the existing baseboard systems also will be used to evaluate the economics of a conversion. A small-scale pilot test will be conducted using the direct-vent, gas-fired baseboard heater and the hot water radiant/ convective panel systems. Performance will be monitored for six months.

BENEFITS
The Albany Housing Authority owns approximately 500 electrically heated residential units. It is anticipated that the new technologies will result in significant energy consumption and demand savings. Based on the results of the project, Albany Housing Authority may consider larger-scale conversions.

SCHEDULE AND STATUS
The project is under way.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	0	$75,000	$75,000
Joseph Technology Corp. (in-kind)	0	36,997	36,997
Albany Housing Authority	0	9,000	9,000
Albany Housing Authority (in-kind)	0	30,000	30,000
TOTALS	0	$150,997	$150,997

Contractor: Joseph Technology Corporation, Inc.
Site: Albany, Albany County
Contract Duration: 2/97 - 3/98
Key Words: electricity, multifamily buildings, low-income
Project Manager: Norine Karins (518) 862-1090, ext. 3211
Program: Buildings
Subprogram: Low-Income
Contract No.: 4521-IABR-BR-97

-> New Technologies Feasibility Study for Tall Oaks Apartments

Explore feasibility of converting electric resistance to gas-fired hydronic systems using various distribution configurations.

BACKGROUND
Electric-resistance heat was installed in the State's low-income housing complexes during the 1970s. New energy-efficient technologies may offer a cost-effective alternative to costly electric heat. This project will examine new distribution technologies.

OBJECTIVE
To determine the feasibility of converting the Tall Oaks multifamily complex from electric-resistance heat to gas-fired hydronics using innovative design and control strategies, and various distribution system configurations.

DESCRIPTION
A feasibility study will be conducted at Tall Oaks, a 150-unit multifamily complex in Middletown. Space heat is currently provided by electric resistance baseboards; domestic hot water is provided by three central gas-fired boilers. The feasibility study will include an evaluation of all costs and benefits of replacing the existing system with a hydronic system that uses innovative piping technologies such as microbore piping.

BENEFITS
It is estimated that energy costs can be reduced by two-thirds. In addition, it is anticipated that the small boiler system will consume roughly 20% less energy than the standard system. However, the most significant savings are projected to come from reduced installation costs as a result of the microbore piping.

SCHEDULE AND STATUS
Datalogging equipment and other instrumentation have been installed at the site. Data collection is under way.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	0	$64,778	$64,778
EME (in-kind)	0	20,000	20,000
Related Management*	0	26,000	26,000
TOTALS	0	$110,778	$110,778

*includes in-kind funding.

Contractor: EME Group
Site: Middletown, Orange County
Contract Duration: 2/97 - 11/97
Key Words: electricity, low-income, multifamily, buildings
Project Manager: Norine Karins (518) 862-1090, ext. 3211
Program: Buildings
Subprogram: Low-Income
Contract No.: 4522-IABR-BR-97

-> Development of a Refrigerator-Replacement Program

Replace energy-inefficient refrigerators in multifamily housing.

BACKGROUND

Refrigerators use approximately eight percent of the electric energy consumed in the United States, and account for about seven percent of the electric demand. Replacing energy-inefficient refrigerators in residential housing, particularly low-income housing where energy expenditures account for almost 25 percent of limited incomes, represents good public policy and prudent investment.

OBJECTIVE

To evaluate the cost-effectiveness of two pilot refrigerator-replacement programs in upstate and downstate New York.

DESCRIPTION

The contractor will: (1) develop protocols for refrigerator replacements, (2) monitor the energy performance of a sample of existing refrigerators in two utility territories, (3) assist in the development of replacement criteria, and (4) evaluate the cost-effectiveness of pilot refrigerator-replacement programs.

BENEFITS

Significant energy and cost savings can be achieved by replacing energy-inefficient refrigerators. In addition, the reduced demand for electricity is environmentally desirable.

SCHEDULE AND STATUS

The downstate program is under way. A draft final report is expected in June.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$113,474	0	$113,474
Petroleum Overcharge Funds	$50,000	0	50,000
Rochester Gas and Electric Corp.	50,000	0	50,000
Synertech Systems Corp.	32,239	0	32,239
TOTALS	$245,713	0	$245,713

Contractor: Synertech Systems Corporation
Site: Syracuse, Onondaga County; Rochester, Monroe County; Westchester County; New York County; Queens County; Kings County; Richmond County; Bronx County
Contract Duration: 9/95 - 1/97
Key Words: residential, refrigeration, electricity, multifamily
Project Manager: Norine Karins (518) 862-1090, ext. 3211
Program: Buildings
Subprogram: Low-income Sector
Contract No.: 4145-IABR-BR-95

-> Domestic Hot Water Recirculation System Control Strategies

Demonstrate low-cost domestic hot water (DHW) recirculation-control strategies.

BACKGROUND

Preliminary analyses of recirculation flows have shown that recirculation losses account for up to 25 percent of DHW energy consumption. DHW-recirculation systems in multifamily buildings usually operate with the recirculation pump set to run continuously. DHW data produced in a related research project showed that continuous operation may consume significant energy. Energy savings may be realized by cycling the recirculation pumps.

OBJECTIVE

To demonstrate and quantify the effects of four DHW recirculation-control strategies in multifamily buildings, and to quantify the impact of each on energy consumption.

DESCRIPTION

The contractor will: (1) equip six buildings with pump-control devices and monitoring equipment; (2) install an aquastat on the DHW return line in each building; (3) install appropriate meters and monitoring devices in each building; (4) collect DHW flows, recirculation flows, and other data points using the four control strategies; and (5) compare the effects of each control strategy with respect to DHW volume changes and system temperatures.

BENEFITS

A recirculation-control strategy that results in even a small savings would conserve millions of gallons of fuel annually.

SCHEDULE AND STATUS

Data analyses are under way. Preliminary findings have been received.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$78,271	0	$78,271
EMRA	24,688	0	24,688
Langsam Property Services	30,460	0	30,460
TOTALS	$133,419	0	$133,419

Contractor: Energy Management & Research Associates (EMRA)
Site: New York City, New York County; Brooklyn, Kings County; and Bronx, Bronx County
Contract Duration: 3/95 - 8/97
Key Words: buildings, multifamily, low-income
Project Manager: Norine Karins (518) 862-1090, ext. 3211
Program: Buildings
Subprogram: Low-Income Sector
Contract No.: 4142-IABR-BR-95

-> Effectiveness of Duct-Sealing and Duct-Insulation in Multifamily Buildings

Evaluate air leakage and conduction mitigation techniques.

BACKGROUND

New York State has a large multifamily housing stock. Approximately 410,000 apartments use ducted systems. Research on single-family homes indicates that large energy losses could be attributable to air leakage and to conduction losses through ducts. These losses can be mitigated by retrofit sealing and insulation.

OBJECTIVE

To assess the effect of duct-leakage and duct-conduction on multifamily building energy use, and to estimate the savings achievable by eliminating air leakage and conduction for accessible portions of the duct system, including the furnace box, heat pump airhandler box, and other duct segments.

DESCRIPTION

Twenty-four apartments will be tested in New York State. Research will include: (1) determination of airflows, leakage areas, and temperature in ducted systems, with and without sealing, and with and without insulation; (2) calculation of energy savings attributable to duct-sealing and duct-insulation; and (3) calculation of simple payback and life-cycle costing for typical duct-sealing/insulation jobs in multifamily buildings.

BENEFITS

Currently, single-family data indicate approximately 10 percent of heating energy can be saved annually by sealing and insulating ducts. With 3,300 to 4,400 apartments remodeled annually in New York State, 186,000 to 245,000 gallons of oil, or 264,000 to 352,000 ccf of natural gas, could be saved if sealing and insulation were used for every retrofit.

SCHEDULE AND STATUS

A draft final report has been received. The project should be completed in July.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$99,997	0	$99,997
U.S. Department of Energy	20,000	0	20,000
Steven Winter Associates	11,840	0	11,840
National Energy Management Inst.	3,500	0	3,500
TOTALS	$135,337	0	$135,337

Contractor: Steven Winter Associates
Site: Syracuse, Onondaga County
Contract Duration: 11/93 - 7/97
Key Words: buildings, multifamily, HVAC, low-income
Project Manager: Norine Karins (518) 862-1090, ext. 3211
Program: Buildings
Subprogram: Low-Income Sector
Contract No.: 2024-EEED-BES-93

-> Multifamily Buildings Retrofit Research

Develop protocols to deliver energy-efficiency services to multifamily buildings

BACKGROUND

Researchers have speculated that variables such as building size, construction, number of units, and heating systems may contribute to the varying energy savings achieved through weatherization in the multifamily sector. Protocols and corresponding investment strategies to achieve maximum cost-effective energy savings are lacking. This project will address these issues.

OBJECTIVE

To develop, demonstrate, and evaluate protocols and investment strategies that maximize the energy-savings potential of energy-efficiency measures in multifamily buildings.

DESCRIPTION

The contractor will: (1) select a sample of 50 New York City multifamily buildings for the demonstration; (2) instrument and monitor select variables on a subset of buildings; (3) collect pre- and post-retrofit energy consumption data on all buildings; (4) assess the impact of energy conservation measures on fuel and domestic hot water consumption and indoor air quality; and (5) develop weatherization protocols and investment strategies for future weatherization work.

BENEFITS

The new multifamily building protocols are expected to promote cost-effective energy savings within the New York State Weatherization Assistance Program, with energy saved expected to exceed the traditional 15-percent savings.

SCHEDULE AND STATUS

Preliminary findings were presented to the advisory committee. Data analyses will continue.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$220,582	0	$220,582
NYS Department of State	220,581	0	220,581
NYC AEA (in-kind)	41,022	0	41,022
ORNL (in-kind)	47,700	0	47,700
TOTALS	$529,885	0	$529,885

Contractor: Association for Energy Affordability, Inc.
Site: New York City, New York County
Contract Duration: 11/94 - 6/97
Key Words: buildings, multifamily, energy efficiency
Project Manager: Norine Karins, (518) 862-1090, ext. 3211
Program: Buildings
Subprogram: Low-Income Sector
Contract No.: 4047-IABR-BR-95

-> Building Energy Skills and Certification

Develop voluntary residential building industry energy standards, competency, assessments and certification.

BACKGROUND
Because no recognized competency assessments or certification exist in the residential building industry for new construction, remodeling, or weatherization, there is wide variation in knowledge, skills, and product quality. This project, with the participation of a diverse group of interested parties, will develop a system to assess competency and certify building professionals.

OBJECTIVE
To identify best practices and develop assessment strategies and certification standards for three job designations.

DESCRIPTION
A non-profit corporation (Building Performance Institute) will be created to oversee development of voluntary energy standards and best practices. The project will develop a process for certifying and recertifying individuals, and develop a framework for incorporating new practices and emerging technologies. Certification assessments will reflect best practices as defined by industry experts. A communications network will be established to help sustain the program after the pilot is completed.

BENEFITS
This project will begin the process of establishing one set of voluntary standards for residential building energy practitioners.

SCHEDULE AND STATUS
Forty-five candidates have been certified. Approximately five additional certifications will be conducted over the next several months.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$100,000	$9,872	$109,872
NYS DHCR (formerly NYSDOS)	160,000	125,000	285,000
Vermont Weatherization Program	0	19,000	19,000
TOTALS	$260,000	$153,872	$413,872

Contractor: Building Performance Institute.
Site: Glens Falls, Warren County
Contract Duration: 3/95 - 3/97
Key Words: buildings, residential, HVAC, certification
Project Manager: Norine Karins (518) 862-1090, ext. 3211
Program: Buildings
Subprogram: Low-Income Sector, Building Envelope Systems
Contract No.: 4115-IABR-BR-95

-> Performance Financing and User-Shared Savings

Demonstrate innovative method to obtain energy-efficiency financing for low-income properties.

BACKGROUND

Virtually every study of energy efficiency in low-income properties suggests that lack of access to financing is a principal barrier to project implementation. A new model to finance energy-efficiency improvements is being developed for institutions renovating, constructing, or managing low-income housing in New York. A complementary model is being developed to allow tenants and superintendents to share both the burden and the benefit of energy-saving improvements.

OBJECTIVE

To demonstrate an innovative energy-project-financing model that uses a variety of resources and mechanisms to overcome barriers to financing building energy improvements.

DESCRIPTION

The contractor will: (1) select six low-income properties for participation in the pilot demonstration, (2) establish energy-use baselines for each building (3) develop savings and user-shared savings systems, (4) provide financial services and training, (5) oversee implementation of energy improvements, (6) monitor energy performance of buildings, and (7) evaluate the project.

BENEFITS

With widespread lender acceptance of the models, as many as 16,000 low-income apartments could be affected by the end of the decade, resulting in a $12-million annual cost reduction for distressed multifamily properties.

SCHEDULE AND STATUS

The project is being revamped. A new project may be implemented which builds upon the work conducted by NYC Conserve to date.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$149,909	0	$149,909
NYS Department of State	240,760	0	240,760
Building Owners	323,000	0	323,000
SURDNA/NCLC Foundations	30,000	0	30,000
Utilities (in-kind)	19,500	0	19,500
TOTALS	$763,169	0	$763,169

Contractor: New York City Conserve, Inc.
Site: New York City, New York County
Contract Duration: 3/95 - 3/98
Key Words: residential, multifamily, HVAC
Project Manager: Norine Karins (518) 862-1090, ext. 3211
Program: Buildings
Subprogram: Low-Income Sector
Contract No.: 4141-IABR-BR-95

-> Domestic Hot Water Consumption and Efficiency Analysis

Quantify domestic hot water consumption in multifamily buildings.

BACKGROUND

The lack of reliable domestic hot water (DHW) consumption and demand data has contributed to controversy about the sizing of DHW systems. Consequently, DHW systems are sized according to the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) standards or by some rule-of-thumb calculations. As a result, many systems have been over- and under-sized, contributing to energy waste. This project was initiated in response to the need for additional DHW consumption and demand data in order to make informed decisions regarding DHW system sizing.

ACCOMPLISHMENTS

Approximately 50 New York City multifamily buildings were instrumented to collect DHW consumption and demand data for a one-year period. Buildings ranged from 20 to more than 200 units. In addition, three DHW generation systems were evaluated to determine efficiency and cost-effectiveness.

FINDINGS AND CONCLUSIONS

Key findings suggest: (1) the best predictors of consumption are the number of occupied apartments, building population, and the number of people home during the day on weekdays; (2) laundry facility configuration strongly affects overall consumption; (3) leakage can comprise a significant fraction of total consumption; (4) DHW consumption must be measured in Btus, not gallons; and (5) the ideal DHW system should have a reverse efficiency curve; all sources of loss, including circulation, on-cycle, off-cycle, and standing, must be reduced.

REALIZED OR ANTICIPATED BENEFITS

This project should make an important contribution in the area of DHW system design.

TECHNOLOGY TRANSFER ACTIVITIES

Interim findings were presented at ASHRAE's 1994 winter meeting. Final project findings were presented at the 1996 U.S. Department of Energy Conference on multifamily buildings.

FUNDING	TOTALS
NYSERDA	$203,334
Con Edison	40,000
Better Energy Group	2,500
TOTALS	$245,834

Contractor: EME Group
Site: New York City, New York County
Contract Duration: 1/93 - 12/96
Key Words: buildings, multifamily, heating, HVAC, domestic hot water
Project Manager: Norine Karins (518) 862-1090, ext. 3211
Program: Buildings
Subprogram: Low-Income Sector
Contract No.: 2021L-EEED-BES-93

-> Indirect- vs. Direct-Monitoring Control Systems in Multifamily Buildings

Assess boiler control systems in multifamily buildings.

BACKGROUND

A previous NYSERDA project analyzed approximately 442 New York City multifamily buildings, indicating that the average annual energy consumption for buildings using direct-monitoring control systems was 14.1 percent less than for buildings using indirect-monitoring control systems.

ACCOMPLISHMENTS

The goal of this project was to validate the energy savings figures obtained in the previous project through a demonstration that enabled and disabled boiler control systems in eight multifamily buildings. All eight buildings were equipped with direct- and indirect-monitoring control systems. Control systems were shut off during alternating two-week periods to compare fuel savings data for each of them. All buildings also were equipped with metering equipment to determine hot water consumption and other data.

FINDINGS AND CONCLUSIONS

The results of the investigation were inconclusive, and do not support the conclusions of the prior investigation. Tighter controls with respect to heating-system operations and data monitoring may have resulted in defensible data to support building owner investments in direct-monitoring controls.

REALIZED OR ANTICIPATED BENEFITS

While the findings from this project are inconclusive, they do point to the need for further study of boiler controls both from an economic and energy-savings perspective.

TECHNOLOGY TRANSFER ACTIVITIES

One technical workshop was conducted in New York City.

FUNDING	TOTALS
NYSERDA	$108,217
Heat-Timer Corporation	8,000
Building owners (in-kind)	64,000
TOTALS	$180,217

Contractor: EME Group
Site: New York City, New York County
Contract Duration: 10/93 - 6/96
Key Words: multifamily buildings, boiler controls
Project Manager: Norine Karins (518) 862-1090, ext. 3211
Program: Buildings
Subprogram: Low-Income Sector
Contract No.: 3123-EEED-BES-94

-> Investigating the Cost-Effectiveness of Steam-to-Hydronic System Conversions

Analyze fuel savings and comfort in steam-to-hydronic conversions.

BACKGROUND

The lack of recent information regarding the economic and energy savings associated with steam conversions provided the impetus for this project.

ACCOMPLISHMENTS

The project's objectives included investigating the cost to convert steam heating systems to hydronic systems in multifamily buildings, quantifying the energy savings associated with such conversions, and developing guidelines to help building owners and real estate brokers make informed decisions.

FINDINGS AND CONCLUSIONS

The feasibility analysis was intended to survey researchers, engineers, contractors, manufacturers, building owners, and industry organizations, in addition to reviewing the literature. The investigation was intended to focus on the latest cost-saving techniques and equipment, and review the role played by building configuration and conversion type. One case study was completed, but did not capture the data required to conduct a rigorous cost/benefit analysis.

REALIZED OR ANTICIPATED BENEFITS

Hydronic heating has several important advantages compared to steam heat, including lower distribution losses, more even heat distribution, and modular capability to respond to changing heat loads. Interest in steam-to-hydronic system conversions appears to be on the increase in New York State.

TECHNOLOGY TRANSFER ACTIVITIES

One case study report was received.

FUNDING	TOTALS
NYSERDA	$27,100
TOTALS	$27,100

Contractor: EME Group
Site: New York City, New York County
Contract Duration: 1/94 - 6/96
Key Words: buildings, hydronics, HVAC, multifamily
Project Manager: Norine Karins (518) 862-1090, ext. 3211
Program: Buildings
Subprogram: Low-Income Sector
Contract No.: 3141-EEED-BES-94

-> Database of Energy Efficiency Programs

Develop national database of energy efficiency programs.

BACKGROUND

Over the last five years, utilities throughout the United States made significant investments in demand-side management (DSM) programs to encourage their customers to save energy and shift demand to off-peak periods. The programs were evaluated and the results filed with state public service or utility commissions. The evaluations provide information about program energy-demand savings, customer-participation rates, and program costs.

ACCOMPLISHMENTS

This project developed a national database of information about DSM programs. The database contained both electric and gas DSM program information and was updated on a continuous basis. A series of "synthetic reports" synthesizing information contained in the database from multiple programs, also was generated. These reports focused on lessons learned about which technologies and delivery mechanisms for commercial and residential DSM programs do and do not work, and why.

FINDINGS AND CONCLUSIONS

The project compared savings for 40 of the largest 1992 commercial-sector DSM programs and found that DSM programs saved energy at a cost of 3.2 cents/kWh. The programs proved cost-effective when compared to the avoided costs faced by the utilities when the programs were developed. The evaluation of 10 residential new construction programs sponsored by investor-owned utilities in the United States found that many of the programs were at the point of being discontinued because only direct program effects were included in the evaluations, and not the indirect effects of promoting technologies and advanced building design practices that exceed state and federal standards and helping participants comply with existing state building codes. Because DSM programs have been drastically cut and discontinued across the country, the usefulness of the database has been greatly diminished.

REALIZED OR ANTICIPATED BENEFITS

By accessing the database information, utility DSM planners and evaluators were able to learn from others' experiences what delivery mechanisms work well and best practices for evaluating DSM program costs and benefits.

TECHNOLOGY TRANSFER ACTIVITIES

A series of technical reports was developed: "The Cost and Performance of Utility Commercial Lighting Programs"; "Where did the Money Go?"; "The Cost and Performance of the Largest Commercial Sector DSM Programs"; and "Residential New Construction Programs: Going Beyond the Code." These reports were distributed to a limited audience.

FUNDING	TOTALS
NYSERDA	$100,000
U.S. Department of Energy	550,000
Bonneville Power Administration	35,000
Electric Power Research Institute	25,000
Rockefeller Institute	25,000
The Energy Foundation	15,000
TOTALS	$750,000

Contractor: Lawrence Berkeley Laboratory
Site: Berkeley, California
Contract Duration: 3/94 - 6/96
Key Words: environmental, integrated resource planning, utilities
Project Manager: Marsha Walton (518) 862-1090, ext. 3271
Program: Buildings Research
Subprogram: Energy Policy Research
Contract No.: 1944-EEED-BES-91

-> Validating Demand-Side Management Evaluation Models

Validate mathematical methods to evaluate demand-side management (DSM) impacts with end-use metering.

BACKGROUND

In 1991, utilities invested $200 million in DSM resources. With this volume of program activity, it is increasingly important to quantify the actual savings. DSM impact-evaluation methodologies provide the tools to determine how much electricity is being saved by a program and the extent to which savings are persistent over time. Developing such tools is essential to document whether DSM is a reliable energy resource. Pursuant to orders by the NYS Public Service Commission, the utilities of the New York Power Pool established a Program Evaluation Task Force (PETF) that produced a Program Plan calling for the utilities to develop a Hybrid Statistical/Engineering Model (HSEM). HSEM is to be used to conduct impact evaluations of the utilities' commercial and industrial DSM programs. The Program Plan also called for NYSERDA to conduct an independent validation of the HSEM model.

ACCOMPLISHMENTS

Forty office-type buildings across New York State were monitored for a period of one year. End-use loads monitored were lighting and HVAC systems. The data were used to validate and calibrate the estimates of electricity use for the HVAC and lighting end-uses derived with the HSEM model.

FINDINGS AND CONCLUSIONS

Comparisons between the monitored load data and the HSEM estimates showed that there were significant differences between the two sets of load data. In general, the HSEM model did not perform as well as intended when put into practical application. At the same time work was proceeding on the development of the HSEM model, the widely used DOE 2 model was being refined to make it more user-friendly. Consequently, some of the advantages foreseen for the HSEM model in terms of ease of use as an hourly energy-simulation model have been eroded by the enhancements made to the DOE 2 model.

REALIZED OR ANTICIPATED BENEFITS

The independent validation effort served to successfully determine the accuracy and usefulness of the HSEM tool. This provides objective information about the model to the utility industry and allows utility staff to make informed decisions about what simulation model is best for their applications. In addition, the project produced 12 months of monitored HVAC and lighting data.

TECHNOLOGY TRANSFER ACTIVITIES

The report will be made available to interested utilities. The monitored load data were transferred to EPRI's Center for Electric End-Use Data (CEED) for inclusion in the Center's master database.

FUNDING	TOTALS
NYSERDA	$519,062
New York Power Pool	60,000
Long Island Lighting Company	15,000
New York State Electric & Gas Corp.	15,000
Niagara Mohawk Power Corp.	15,000
Orange and Rockland Utilities, Inc.	15,000
TOTALS	$639,062

Contractor: ADM Associates, Inc.
Site: 40 sites across New York State
Contract Duration: 1/93-5/97
Key Words: integrated resource planning, DSM, monitoring, engineering models, statistical models, hybrid statistical models, energy savings, utilities
Project Manager: Mary Ann Bowers (518) 862-1090 ext. 3254.
Program: Buildings Research
Subprogram: Energy Policy Research
Contract No.: 1979-EEED-BES-92

-> Evaluating Subscription Option Program Energy Audits

Evaluate detailed energy audits for major commercial and industrial (C&I) customers participating in Niagara Mohawk Power Corporation's Subscriptive Service Program and estimate potential energy savings.

BACKGROUND

The New York State Public Service Commission (PSC) conditionally approved Niagara Mohawk's Subscriptive Service Program in 1993, giving the utility's major C&I customers the opportunity to avoid a portion of demand-side management (DSM) program costs in their rates by conducting detailed energy audits of their facilities.

ACCOMPLISHMENTS

This project evaluated and validated the Subscriptive Service Program energy audits; estimated technical, economic, and achievable DSM potential for Niagara Mohawk's C&I customer class; communicated project results to the electric utility industry, interested parties, and regulators; and published five technical reports identifying cost-effective energy savings opportunities in the chemical, rubber, and plastics industry; the stone, clay, and glass products industry; the primary and fabricated metal products industry; and the food and kindred products industry.

FINDINGS AND CONCLUSIONS

The evaluation showed that Niagara Mohawk's largest C&I customers can cost-effectively eliminate more than 6.5 percent of their energy consumption (more than 650 GWh per year) by installing cost-effective energy conservation measures identified in their audits. Motors and drives are the most important source of energy savings, followed by process heating and cooling, and lighting.

REALIZED OR ANTICIPATED BENEFITS

The project evaluated an alternative method for identifying and installing energy efficiency measures in the absence and/or presence of utility DSM rebate programs.

TECHNOLOGY TRANSFER ACTIVITIES

Project results have limited current usefulness to policy makers and regulators, as competition in the electric industry is becoming a reality and DSM rebate programs are phased out. The technical reports have been distributed to interested parties.

FUNDING	TOTALS
NYSERDA	$161,208
Niagara Mohawk Power Corp.	161,208
TOTALS	$322,416

Contractor: Research Triangle Institute
Site: Research Triangle Park, North Carolina
Contract Duration: 3/94 - 6/96
Key Words: demand-side management, utilities, energy audits
Project Manager: Marsha Walton (518) 862-1090, ext. 3271
Program: Buildings Research
Subprogram: Energy Policy Research
Contract No.: 3157-IABR-BR-94

-> Subscriptive Service Program Technical Advisory Group Member

Provide independent expert review of Research Triangle Institute's evaluation of Niagara Mohawk Power Corporation's Subscriptive Service Program.

BACKGROUND

The New York State Public Service Commission (PSC) conditionally approved Niagara Mohawk's Subscriptive Service Program in 1993, giving the utility's major commercial and industrial commercial and industrial (C&I) customers the opportunity to avoid a portion of demand-side management (DSM) program costs in their rates by conducting detailed energy audits of their facilities.

ACCOMPLISHMENTS

This project provided an independent technical expert to participate in an advisory group that met periodically to oversee the evaluation of Niagara Mohawk's Subscriptive Service Program performed by Research Triangle Institute under a separate NYSERDA contract (#3157). The work involved technical review of the program evaluation and five reports that identified cost-effective energy-savings opportunities in the chemical, rubber, and plastics industry; stone, clay, and glass products industry; primary and fabricated metal products industry; and food and kindred products industry.

FINDINGS AND CONCLUSIONS

The evaluation showed that Niagara Mohawk's largest C&I customers can cost-effectively eliminate more that 6.5% of their energy consumption (more than 650 gWh per year) by installing cost-effective efficiency measures identified in their audits. Motors and drives are the most important source of energy savings, followed by process and lighting.

REALIZED OR ANTICIPATED BENEFITS

The project helped evaluate an alternative method to identify and install energy-efficient measures in the absence or presence of utility DSM rebate programs.

TECHNOLOGY TRANSFER ACTIVITIES

Project results have limited usefulness to policy makers and regulators, as the New York Public Service Commission, and other state utility regulators, are embracing competition in the electric industry and DSM rebate programs have become a relic of the past. However, the technical reports have been distributed to interested parties and a limited number will be made available to industries considering implementation of energy efficiency measures in their facilities.

FUNDING	TOTALS
NYSERDA	$10,000
Niagara Mohawk Power Corp.	10,000
Strategic Energy Technologies	3,750
TOTALS	$23,750

Contractor: Strategic Energy Technologies
Site: Acton, MA
Contract Duration: 3/94 - 7/96
Key Words: demand-side management, utilities, energy audits
Project Manager: Marsha Walton (518) 862-1090, ext. 3271
Program: Buildings
Subprogram: Energy Policy Research
Contract No.: 4067-IABR-BR-94

-> Advanced Thermal Fluid Heater

Develop and demonstrate advanced burner for gas-fired boilers and thermal-fluid heaters.

BACKGROUND
Heating-system manufacturers presently need to meet stringent regulations for equipment efficiency and emissions of nitrogen oxide (NOx) and carbon monoxide (CO).

OBJECTIVE
To develop and demonstrate an advanced-burner technology to achieve significant energy and environmental benefits in commercial-process heating applications. The burner will incorporate high-velocity combustion and a bluff-body flameholder. Phases I and II successfully developed a one-million-Btu/hr prototype that achieves high efficiency, with NOx and CO emission levels of approximately 20 ppm.

DESCRIPTION
This project will develop and demonstrate an advanced burner for gas-fired boilers and thermal-fluid heaters. This project will include field-installation and monitoring at demonstration sites in New York State.

BENEFITS
The final product will be a burner that can be manufactured and marketed by Fulton Thermal Corporation, Pulaski. Commercial- building owners and process-heating users would benefit by having an economical way to achieve high-efficiency natural gas use. Economic benefits also would be derived from manufacturing capital goods in the State.

SCHEDULE AND STATUS
A draft final report is being prepared. The burner is now being marketed and manufactured on a limited production basis to select customers.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$440,353	0	$440,353
Fulton Thermal Corporation	185,643	0	185,643
Fulton Thermal Corporation (in-kind)	215,000	0	215,000
TOTALS	$840,996	0	$840,996

Note: Includes funding under Agreement 1147

Contractor: Fulton Thermal Corporation
Site: Pulaski, Oswego County
Contract Duration: 3/89 - 6/97
Key Words: product development, environmental, gas, heating, industrial, power gas burners, emissions, NOx
Project Manager: Ray Albrecht (518) 862-1090, ext. 3253
Program: Buildings Research
Subprogram: Heating and Cooling Systems
Contract No.: 1821-EEED-BES-92

-> High-Efficiency, Low-NOx Boiler

Design, laboratory-test, and field-demonstrate innovative boiler that achieves both high efficiency and low levels of NOx and carbon monoxide emissions.

BACKGROUND

Heating equipment manufacturers are challenged to meet new U.S. Department of Energy (U.S. DOE) energy standards while reducing emissions of nitrogen oxides (NOx) and carbon monoxide (CO) to comply with expanding environmental regulations.

OBJECTIVE

To develop and demonstrate a high-efficiency, gas-fired boiler for residential and small commercial space-heating applications that produces low levels of pollutant emissions. The final product will be a boiler system capable of being manufactured and marketed commercially.

DESCRIPTION

This project will include the design, laboratory-testing, and field-demonstration of an innovative boiler that uses modern combustion technology to achieve both high efficiency and low levels (under 30 ppm) of NOx and carbon monoxide emissions to meet future U.S. DOE efficiency standards as well as environmental standards anticipated by 2000. A significant goal of the project is to reduce the manufacturing cost of the new boiler compared to currently available high-efficiency boilers.

BENEFITS

Large quantities of energy are consumed annually to heat buildings in New York State. Space-heating systems produce substantial emissions that contribute to such environmental problems as acid rain, ozone depletion, and global warming. Improved heating systems could significantly reduce energy consumption and emissions in the building sector.

SCHEDULE AND STATUS

Design work and prototype fabrication have been completed. Laboratory testing has begun.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$250,000	0	$500,000
Niagara Mohawk Power Corp.	150,000	0	300,000
Utica Boilers, Inc. (in-kind)	150,000	0	300,000
TOTALS	$550,000	0	$1,100,000

Contractor: Utica Boilers, Inc.
Site: Utica, Oneida County
Contract Duration: 9/91 - 6/98
Key Words: product development, environmental, gas, heating, gas-fired heating equipment, NOx
Project Manager: Ray Albrecht (518) 862-1090, ext. 3253
Program: Buildings Research
Subprogram: Heating and Cooling Systems
Contract No.: 1774-EEED-BES-92

-> High-Efficiency, Low-NOx Steam-Heating Boiler

Develop and demonstrate high-efficiency dual-fuel (oil-natural gas) boiler.

BACKGROUND
Heating equipment manufacturers must meet new U.S. Department of Energy (U.S. DOE) energy standards while reducing emissions of nitrogen oxides (NOx) and carbon monoxide (CO) to comply with increasingly stronger environmental regulations.

OBJECTIVE
To develop and demonstrate a high-efficiency, dual-fuel (oil/natural gas) low-pressure steam-heating boiler for large residential and commercial space-heating applications. The final product will be a boiler system capable of being manufactured and marketed commercially.

DESCRIPTION
This project will include the design, laboratory-testing, and field-demonstration of an innovative, low-pressure steam-heating boiler that uses modern combustion and heat-exchanger technology to achieve both high efficiency and low levels (under 30 ppm) of NOx and CO emissions to meet future U.S. DOE efficiency standards and environmental standards anticipated by 2000.

A significant goal of the project is to reduce the manufacturing cost of the new boiler compared to currently available high-efficiency steam-heating boilers.

BENEFITS
Large quantities of energy are consumed annually to heat buildings in New York State. Space-heating systems produce substantial emissions that contribute to environmental problems such as acid rain, ozone depletion, and global warming. Improved heating systems could significantly reduce energy consumption and emissions in the building sector. The success of this project will lead to a new product line for the contractor, a New York State manufacturer.

SCHEDULE AND STATUS
Design work is under way.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$250,000	0	$500,000
EASCO Boiler Corporation	448,633	0	1,000,000
TOTALS	$698,633	0	$1,500,000

Contractor: EASCO Boiler Corporation
Site: Bronx, Bronx County
Contract Duration: 9/95 - 9/98
Key Words: product development, environmental, gas, heating, gas-fired heating equipment, NOx
Project Manager: Ray Albrecht (518) 862-1090, ext. 3253
Program: Buildings Research
Subprogram: Heating and Cooling Systems
Contract No.: 4269-IABR-BR-96

-> Ultra-Low Emissions Ceramic Burner

Construct and laboratory-test ceramic burner for gas-fired heating equipment.

BACKGROUND

New York State is a major user of natural gas for heating, with approximately three million households (representing about one-half of the population) using natural-gas heat. Improved gas-fired heating systems offer the potential for significant energy and emissions savings. Several manufacturers of gas-fired heating systems also are located in New York State.

OBJECTIVE

To develop a new gas-fired ceramic burner technology with improved energy and environmental performance. The burner is expected to achieve NOx and carbon monoxide emission levels of under 20 ppm. The burner's multilayered design will increase flashback protection and modulation capacity compared to currently available ceramic burners.

DESCRIPTION

The project will include the construction and laboratory-testing of a ceramic burner for forced-draft/induced-draft gas-fired heating equipment. The project also will include a comprehensive field-testing and technology-transfer effort in cooperation with New York State manufacturers of gas-fired heating systems.

BENEFITS

The project will benefit consumers in New York State through the development of a new gas-fired burner technology. Economic development benefits also will be achieved through the manufacture of a new technology by a New York State company.

SCHEDULE AND STATUS

The laboratory testing of the ceramic burner is under way.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$192,895	0	$192,895
National Fuel Gas Dist. Corp.	0	$117,000	117,000
Hi-Tech Ceramics, Inc.	75,895	0	75,895
TOTALS	$268,790	$117,000	$385,790

Contractor: Hi-Tech Ceramics, Inc.
Site: Alfred, Allegany County
Contract Duration: 9/95 - 9/98
Key Words: product development, environmental, gas burners, NOx
Project Manager: Ray Albrecht (518) 862-1090, ext. 3253
Program: Buildings Research
Subprogram: Heating and Cooling Systems
Contract No.: 4270-IABR-BR-96

-> Commercial Ceramic Burner

Construct and test ceramic gas-fired burner for commercial heating equipment.

BACKGROUND

New York State is a major user of natural gas for heating, with approximately three million customers (representing about one-half the population) using natural gas heat. Improved gas-fired heating systems offer the potential for significant energy and emissions savings. Several manufacturers of gas-fired heating systems are located in New York State.

OBJECTIVE

To develop a new commercial ceramic gas-fired burner with improved energy and environmental performance. The burner is expected to achieve NOx and carbon monoxide emissions of under 25 ppm. The burner will have a modulating capacity of 200,000 to 600,000 Btu/hr to match actual heating loads in commercial buildings and to achieve seasonal efficiency improvements of 5 to 10 percent compared to conventional on/off gas-fired burners.

DESCRIPTION

Phase I of this project will include the construction and laboratory testing of a ceramic gas-fired burner for commercial heating applications. Phase II will include comprehensive field-testing, product certification, technology transfer, and commercialization.

BENEFITS

The project will benefit building owners in New York State through the development of a new, high-efficiency, low-emission, gas-fired burner technology. Economic development benefits also will be achieved through the manufacture of a new technology by a New York State company.

SCHEDULE AND STATUS

Fabrication of a prototype ceramic burner is under way.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	0	$125,275	$250,000
Heat Wise, Inc.	0	125,275	250,000
TOTALS	0	$250,550	$500,000

Contractor: Heat Wise, Inc.
Site: Ridge, Suffolk County
Contract Duration: 9/96-9/98
Key Words: product development, gas burners, NOx
Project Manager: Ray Albrecht (518) 862-1090, ext. 3253
Program: Buildings Research
Subprogram: Heating and Cooling Systems
Contract No.: 4458-IABR-BR-97

-> Gas-Fired Flame-Quality Indicator

Develop flame-quality indicator for gas-fired heating equipment.

BACKGROUND

New York State is a major user of natural gas for heating, with approximately three million households (representing about one-half of the population) using natural-gas heat. Improved gas-fired heating systems offer the potential for significant energy and emissions savings. Several manufacturers of gas-fired heating systems also are located in New York State.

OBJECTIVE

To develop a flame-quality indicator that will improve energy and environmental performance of gas-fired heating equipment. The indicator will use an optical sensor to monitor combustion spectral characteristics over long periods of operation. The indicator will show when combustion cleanliness has begun to deteriorate, enabling technicians to adjust heating equipment during installation or servicing. The indicator also will enable gas utilities and heating contractors to monitor heating-system performance and safety through remote telecommunications.

DESCRIPTION

The project will include design and testing of a microprocessor-based production-model flame-quality indicator, a market study, initial production of commercial units, and market introduction.

BENEFITS

The project will benefit consumers in New York State through the development of a new gas-fired equipment technology. Economic development benefits also will be achieved through manufacture of new products by a New York State company.

SCHEDULE AND STATUS

Design and laboratory testing tasks have been completed. Construction and field testing of a production model unit have begun.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$192,826	$100,000	$292,826
Insight Technologies, Inc.	33,940	104,000	137,940
Brooklyn Union	192,826	0	292,826
TOTALS	$419,592	$204,000	$723,592

Contractor: Insight Technologies, Inc.
Site: Bohemia, Suffolk County
Contract Duration: 9/95 - 12/98
Key Words: product development, environmental, gas burners
Project Manager: Ray Albrecht (518) 862-1090, ext. 3253
Program: Buildings Research
Subprogram: Heating and Cooling Systems
Contract No.: 4271-IABR-BR-96

-> Flame-Quality Indicator Oil Burner Control

Develop flame-quality indicator original-equipment manufactured oil burner control for new oil-fired heating equipment.

BACKGROUND

New York State is a major user of fuel oil for heating. Approximately three million households (some 50%) of the population in New York State use oil heat. New York State fuel-oil customers also represent 25% of the oil market in the United States. Improved oil-fired heating equipment offers the potential for significant energy and emissions savings in New York State, where several manufacturers of this equipment also are located.

OBJECTIVE

To develop and demonstrate a flame-quality indicator original-equipment manufactured (OEM) oil burner control that will improve the energy and environmental performance of new, residential and small commercial, oil-fired heating equipment. The control will replace conventional, cadmium sulfide cells and will be intended for direct integration into new oil burners and oil-fired heating systems during manufacturing. The control will monitor the quality of combustion in oil burners through multiple bandwidth, infrared, optical sensing. The control will provide early warning through remote telecommunications of any loss of safe and efficient combustion and will provide for burner shutdown if unacceptable performance occurs. The control will incorporate the design concept of the retrofit flame-quality indicator developed under Agreement No. 4072-IABR-BR-95 for existing oil-fired heating systems.

DESCRIPTION

Phase I of the project will include design and laboratory testing. Phase II will include field-testing and commercialization tasks.

BENEFITS

The flame-quality indicator OEM oil burner control will enable service technicians to directly tune oil burners for optimal performance during heating equipment installation without the multiple, iterative flue gas analyses previously required. The new control will reduce energy consumption and pollutant emissions.

SCHEDULE AND STATUS

Phase I is under way.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	0	$203,580	$400,000
Insight Technologies, Inc.	0	67,860	200,000
Others	0	161,000	400,000
TOTALS	0	$432,440	$1,000,000

Contractor: Insight Technologies, Inc.
Site: Bohemia, Suffolk County
Contract Duration: 9/96-12/98
Key Words: product development, oil burners, controls
Project Manager: Ray Albrecht (518) 862-1090, ext. 3253
Program: Buildings Research
Subprogram: Heating and Cooling Systems
Contract No.: 4459-IABR-BR-97

-> Advanced Oil-Burner Development and Demonstration

Develop and demonstrate energy-efficient, low-emission oil burner to be manufactured in New York State.

BACKGROUND

New York State is a major user of fuel oil for heating. Approximately three million households (representing about one-half of the population) in New York State use oil heat. New York State fuel-oil customers also represent 25 percent of the oil market in the United States. Improved oil-fired heating systems offer the potential for significant energy and emissions savings in New York State. Several manufacturers of oil-fired heating systems are located in New York State.

OBJECTIVE

To develop a new oil-burner technology with improved energy and environmental performance. A prototype model of the new burner has been developed by the Oil Heat Program at Brookhaven National Laboratory and uses fan pressure (instead of oil pressure) and recirculation of combustion gas to achieve atomization and vaporization of fuel. The prototype burner results in low NOx and carbon monoxide emission levels and should enable oil-fired heating systems to better maintain energy efficiency over long periods.

DESCRIPTION

Phase I of this project included the construction and laboratory-testing of a production-model fan-atomized oil burner. Phase II will include a comprehensive field-testing and technology-transfer effort with New York State manufacturers of oil-fired heating systems. This project will be conducted in parallel with Brookhaven National Laboratory (working under Agreement No. 3033-IABR-BR-95).

BENEFITS

The project will benefit consumers in New York State through the development of a new oil-burner technology. The new burner will allow the design of small-capacity furnaces suitable for modern energy-efficient homes. Economic development benefits also will be achieved through the manufacture of a new technology by a New York State company.

SCHEDULE AND STATUS

Field-testing of the new burner is under way.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$450,000	0	$450,000
Heat Wise, Inc.	129,420	0	129,420
TOTALS	$579,420	0	$579,420

Contractor: Heat Wise, Inc.
Site: Ridge, Suffolk County
Contract Duration: 9/94-9/98
Key Words: product development, environmental, oil burners, NOx
Project Manager: Ray Albrecht (518) 862-1090, ext. 3253
Program: Buildings Research
Subprogram: Heating and Cooling Systems
Contract No.: 4006-IABR-BR-95

-> Advanced Commercial Water Heater

Develop and demonstrate high-efficiency, low-emissions commercial water heater.

BACKGROUND
Commercial water heating offers the potential for significant energy savings in buildings located in New York State.

OBJECTIVE
To develop and demonstrate a high-efficiency, low-emissions commercial water heater that achieves significant energy and environmental benefits in the commercial building sector. The target efficiency for the water heater will be 95 percent with emissions of under 20 ppm for NOx and carbon monoxide. The water heater will minimize standby losses by having little or no water storage and will maximize combustion efficiency by using a high turn-down ratio burner rather than conventional on/off control.

DESCRIPTION
Phase I of this project will include the construction and laboratory testing of a prototype commercial-size water heater. Phase II of this project will include field installation and monitoring of a production model unit at a New York State demonstration site.

BENEFITS
The final product of this project will be a production-model commercial water heater that is capable of being manufactured and marketed by Fulton Boiler Works. The benefit to building owners will be the availability of an economical system for achieving high-efficiency use of natural gas. Economic benefits also would be derived from the manufacture of additional capital goods in New York State.

SCHEDULE AND STATUS
The prototype commercial water heater has been designed. Laboratory testing is under way.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$250,000	0	$ 500,000
Fulton Boiler Works, Inc.	273,775	0	500,000
Niagara Mohawk Power Corp.	150,000	0	300,000
TOTALS	$673,775	0	$1,300,000

Contractor: Fulton Boiler Works, Inc.
Site: Pulaski, Oswego County
Contract Duration: 10/93 - 12/97
Key Words: product development, environmental, water heaters, NOx
Project Manager: Ray Albrecht (518) 862-1090, ext. 3253
Program: Buildings Research
Subprogram: Heating and Cooling Systems
Contract No.: 3004-EEED-BES-94

-> Oil-Fired Heating System Development and Demonstration

Develop new oil-burner technology with improved energy and environmental performance.

BACKGROUND

New York State is a major user of fuel oil for heating. Approximately three million households (representing about one-half of the population) in New York State use oil heat. New York State fuel-oil customers also represent 25 percent of the oil market in the United States. Improved oil-fired heating systems offer the potential for significant energy and emissions savings in New York State. Several manufacturers of oil-fired heating systems are located in New York State.

OBJECTIVE

To perform the advanced development of a new oil-burner technology with improved energy and environmental performance. The new burner has been initially developed by the Oil Heat Program at Brookhaven National Laboratory and incorporates air-atomization (instead of pressure-atomization), recirculation of combustion gas to achieve vaporization, and mixing of fuel with air prior to combustion. The prototype burner produces very low NOx and carbon monoxide emission levels and should enable oil-fired heating systems to maintain better energy efficiency over long periods.

DESCRIPTION

Phase I of this project will include the construction and laboratory-testing of a production-model air-atomized oil burner. Phase II will include a comprehensive field-testing and technology-transfer effort with New York State manufacturers of oil-fired heating systems.

BENEFITS

The project will benefit consumers in New York State through the development of a new oil-burner technology. Economic-development benefits also will be achieved through the manufacture of new technologies by New York State companies.

SCHEDULE AND STATUS

Field testing of the production-model oil burner is under way.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$149,648	0	$300,000
Brookhaven National Laboratory*	5,000	0	10,000
TOTALS	$154,648	0	$310,000

*in-kind services

Contractor: Brookhaven National Laboratory
Site: Upton, Suffolk County
Contract Duration: 3/95 - 9/98
Key Words: product development, environmental, oil burners, NOx
Project Manager: Ray Albrecht (518) 862-1090, ext. 3253
Program: Buildings Research
Subprogram: Heating and Cooling Systems
Contract No.: 3033-IABR-BR-94

-> Oil-Fired Flame-Quality Indicator

Develop flame-quality indicator that will improve energy and environmental performance of oil-fired heating equipment.

BACKGROUND

New York State is a major user of fuel oil for heating. Approximately three million households, (some 50 percent of the population) in New York State use oil heat. New York State fuel-oil customers also represent 25 percent of the oil market in the United States. Improved oil-fired heating equipment offers the potential for significant energy and emissions savings in New York State, where several manufacturers of this equipment also are located.

OBJECTIVE

To develop a flame-quality indicator that will improve energy and environmental performance of oil-fired heating equipment. A prototype was developed by the Oil Heat Program at Brookhaven National Laboratory. The flame-quality indicator will use an optical sensor to monitor combustion spectral characteristics over long periods of operation. The indicator will indicate when combustion cleanliness has begun to deteriorate to an unacceptable level. The indicator also will enable technicians to adjust oil burners during installation or servicing.

DESCRIPTION

The project will include the design and testing of a production-model flame-quality indicator that is microprocessor-based. The project also will include a market study, initial production of commercial units, and market introduction.

BENEFITS

The project will benefit consumers in New York State through developing a new oil-fired equipment technology. Economic development benefits also will be achieved through manufacture of a new technology by a New York State company.

SCHEDULE AND STATUS

Laboratory testing has begun.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$132,401	0	$132,401
Davis Aircraft Products Co., Inc.	131,130	0	131,130
TOTALS	$263,531	0	$263,531

Contractor: Davis Aircraft Products Co., Inc.
Site: Bohemia, Suffolk County
Contract Duration: 9/94 - 12/97
Key Words: environmental, product development, oil burners
Project Manager: Ray Albrecht (518) 862-1090, ext. 3253
Program: Buildings Research
Subprogram: Heating and Cooling Systems
Contract No.: 4072-IABR-BR-95

-> Two-Stage Firing Rate, Oil-fired, Hydronic Boiler

Develop and demonstrate high efficiency, two-stage firing rate, oil-fired boiler for residential and small commercial buildings.

BACKGROUND

New York State is a major user of fuel oil for heating. Approximately three million households (representing about one-half of the population) in New York State use oil heat. New York State fuel-oil customers also represent 25 percent of the oil heat market in the United States. Improved oil-fired heating systems offer the potential for significant energy and emissions savings in New York State. Several manufacturers of oil-fired heating systems are located in New York State.

Conventional oil-fired heating systems often are several times larger in capacity than necessary for residential and small commercial buildings due to the previous minimum firing rate of approximately 0.75 gph that was required by oil burners. Excessive oversizing of heating equipment is known to result in frequent cycling with significant energy penalties. A new, fan-atomized, oil burner technology recently developed by Heat Wise, Inc., can operate at firing rates as low as 0.3 gph with low/high modulation.

OBJECTIVE

This project will include the development of a compact, two-stage firing rate, oil-fired, hydronic, steel boiler for residential and small commercial buildings. The new boiler will incorporate low thermal mass and low/high firing rate capability to better match actual heating loads. The boiler will use the new, fan-atomized oil burner developed by Heat Wise, Inc., and will operate between 0.35 and 0.8 gph capacity. The boiler will achieve significant energy savings through improved steady state efficiency and reduced off-cycle losses.

DESCRIPTION

Phase I of this project will include the design, construction and laboratory testing of a prototype boiler. Phase II will include a comprehensive field-testing and technology transfer effort by the manufacturer. This project will receive technical assistance from the Oil Heat Program at Brookhaven National Laboratory.

BENEFITS

This project will benefit consumers in New York State through the development of a new, oil-fired boiler that reduces energy costs for space and domestic water heating. Economic development benefits also will be achieved through the manufacture of a new technology by a New York company.

SCHEDULE AND STATUS

The initial system design has been completed and laboratory testing has been completed.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	0	$113,098	$300,000
National Combustion Co., Inc.	0	113,098	300,000
TOTALS	0	$226,196	$600,000

Contractor: National Combustion Co., Inc.
Site: Jamaica, Queens County
Contract Duration: 9/96-9/99
Key Words: product development, environmental, oil heat, NOx
Project Manager: Ray Albrecht (518) 862-1090, ext. 3253
Program: Buildings Research
Subprogram: Heating and Cooling Systems
Contract No.: 4456-IABR-BR-97

-> Low-Firing-Rate, Oil-fired, Warm-Air Furnace

Develop and demonstrate high-efficiency, low-firing-rate, oil-fired warm-air furnace for residential and small commercial buildings.

BACKGROUND

New York State is a major user of fuel oil for heating. Approximately three million households (representing about one-half the population) in New York State use oil heat. New York's fuel-oil customers also represent 25 percent of the oil heat market in the United States. Improved oil-fired heating systems offer the potential for significant energy and emissions savings in the State. Several manufacturers of oil-fired heating systems are located in New York.

Due to the minimum firing rate of approximately 0.75 gallons per hour (gph) formerly required by oil burners, conventional oil-fired heating systems are often several times larger in capacity than needed for residential and small commercial buildings. Oversized heating equipment results in frequent cycling, with significant energy penalties. A new, fan-atomized oil-burner technology recently developed by Heat Wise, Inc. can operate at firing rates as low as 0.3 gph with low/high modulation.

OBJECTIVE

To develop a compact, low-firing-rate, oil-fired, warm-air furnace for residential and small commercial buildings. The new furnace will eliminate the large, refractory combustion chamber found in traditional oil-fired warm-air furnaces. The furnace will use the new, fan-atomized oil burner developed by Heat Wise, Inc., and will operate in the 0.35 to 0.8 gph capacity range. The furnace will achieve significant energy savings through improved steady-state efficiency and reduced off-cycle losses.

DESCRIPTION

Phase I of this project will include the design, construction, and initial laboratory testing of a prototype furnace. Phase II will include comprehensive laboratory- and field-testing, certification, and technology transfer by the manufacturer. This project will receive technical assistance from the Oil Heat Program at Brookhaven National Laboratory.

BENEFITS

This project will benefit consumers in New York State by reducing energy costs for space-heating. Economic development benefits also will be achieved through the manufacture of a new technology by a New York company.

SCHEDULE AND STATUS

Phase I is under way.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	0	$250,000	$500,000
Utica Boilers, Inc.	0	256,860	500,000
TOTALS	0	$506,860	$1,000,000

Contractor: Utica Boilers, Inc.
Site: Utica, Oneida County
Contract Duration: 1/97-9/99
Key Words: product development, environmental, oil heat, NOx
Project Manager: Ray Albrecht (518) 862-1090 ext. 3253
Program: Buildings Research
Subprogram: Heating and Cooling Systems
Contract No.: 4457-IABR-BR-97

-> Efficient Non-Electric Flue/Vent D mper

Design, develop, demonstrate, and com rcialize non-electric vent damper for commercial and residential use.

BACKGROUND

Most residential gas water heaters do h ave flue/vent dampers. In the majority of lations, electric flue/vent dampers cannot be i d on gas residential water heaters because they r e an expensive electrical hook-up that is no rently required. Today's flue/vent damper is too expensive to justify common use, part ly in residential applications. In the comme sector, while dampers are standard equipment, th are costly and energy-intensive. Bi-metallic d mpers, a competing technology, can take as long as five minutes to open fully, dumping combustion products into the space around the appliance. Slow bi-metallic damper closing causes low efficiency.

OBJECTIVE

To design, develop and commercialize an efficient, low-cost non-electric flue/vent damper for use in commercial and residential applications.

DESCRIPTION

The contractor will (1) perform product design and development; (2) manufacture and test unit prototypes; (3) obtain product certification; (4) develop a marketing plan; and (5) engage in full-scale manufacturing and commercialization.

BENEFITS

The major benefit is energy savings projected at 20 percent of the energy normally consumed in the absence of a flue/vent damper, based on the manufacturer's tests on its own electrically operated dampers. Payback is expected to be one to two years. Also, manufactured cost will be reduced greatly and installation-cost savings will be approximately 80 percent. Economic benefits would accrue from growth of a New York State business. A positive environmental impact is expected because a reduction in energy consumed by the appliance is directly attributable to a reduction in burner firing time, thus reducing the amount of pollution generated by the heating appliance.

SCHEDULE AND STATUS

Product design tasks are nearing completion. Several prototype units have been built and are undergoing testing.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$162,465	0	$162,465
Flair International Corp.	167,465	0	167,465
TOTALS	$329,930	0	$329,930

Contractor: Flair International Corporation
Site: Hauppauge, Suffolk County
Contract Duration: 11/94 - 11/97
Key Words: product development, HVAC, buildings, residential, commercial, dampers
Project Manager: Mary Ann S. Bowers (518) 862-1090, ext. 3254
Program: Buildings
Subprogram: Heating and Cooling Systems
Contract No.: 4058-IABR-BR-95

-> High-Efficiency Indirect Water Heater

Develop and demonstrate high-efficiency, indirect water heater.

BACKGROUND
Residential and commercial water heating offers potential for significant energy savings in New York State buildings.

OBJECTIVE
The objective of this project is to develop and demonstrate a high-efficiency indirect water heater that achieves significant energy benefits in the residential and small commercial building sectors. The water heater will minimize standby losses by increasing jacket insulation and reducing thermosyphon heat losses.

DESCRIPTION
Phase I of this project will include the construction and laboratory-testing of a prototype indirect water heater with storage capacities of 40, 50, 60, 75, 90, and 115 gallons. Phase II of this project will include field installation and monitoring of six production-model units at New York State demonstration sites.

BENEFITS
The final product of this project will be a production-model indirect water heater that is capable of being manufactured and marketed by Stor-Ex New York, Inc. Building owners will benefit from the availability of an economical system for achieving high-efficiency water heating. Economic benefits also will be derived from the manufacture of additional capital goods in New York State.

SCHEDULE AND STATUS
The prototype indirect water heater is being designed. A laboratory test facility is under construction.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$214,500	0	$500,000
Stor-Ex New York, Inc.	214,500	0	500,000
TOTALS	$429,000	0	$1,000,000

Contractor: Stor-Ex New York, Inc.
Site: Ridgewood, Queens County
Contract Duration: 9/95 - 12/98
Key Words: product development, water heaters
Project Manager: Ray Albrecht (518) 862-1090, ext. 3253
Program: Buildings Research
Subprogram: Heating and Cooling Systems
Contract No.: 4272-IABR-BR-96

-> Venting System for High-Efficiency Heating Systems

Develop advanced venting system for high-efficiency gas- and oil-fired heating systems.

BACKGROUND

High-efficiency gas- and oil-fired heating systems produce low-temperature flue-gas exhaust. Low-temperature flue gases usually result in acidic condensate on the inside of the venting system. Masonry chimneys are not suitable for venting most high-efficiency heating systems due to deterioration of masonry blocks and mortar joints resulting from acidic attack.

Alternative materials have been developed for venting high-efficiency heating systems. High-temperature plastics initially were accepted, but have been discontinued by most users due to material deterioration and stress cracking. Stainless-steel materials also have been developed, but are expensive and have not demonstrated the level of corrosion-resistance desired by the heating industry.

OBJECTIVE

To develop an advanced venting system that achieves higher corrosion resistance at a lower manufacturing cost than currently available stainless-steel venting systems. The venting system will incorporate a new, longitudinal butt-welding process and integral connection components. The welding process will result in smooth tubing seams and is expected to show superior performance compared to the conventional, overlap seam approach used by other venting system manufacturers.

DESCRIPTION

The project will include a market survey, design, and fabrication of a prototype venting system and manufacturing process, laboratory-testing, product-certification testing, field-testing, and technology-transfer and commercialization.

BENEFITS

The new venting system will improve the economics of high-efficiency, gas- and oil-fired heating systems. Significant job creation could result in the new economic development zone in the south end of Albany.

SCHEDULE AND STATUS

Design, fabrication, and initial testing have been completed. An early production-model venting product is scheduled to be made during the second quarter of 1997. Development of a sealed-combustion version of the venting technology has begun

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	0	$276,554	$276,554
ProTech Systems, Inc.	0	229,523	229,523
Niagara Mohawk Power Corp.	0	0	150,000
TOTALS	0	$506,077	$656,077

Contractor: ProTech Systems, Inc.
Site: Albany, Albany County
Contract Duration: 8/96 - 12/98
Key Words: product development, HVAC, heating
Project Manager: Ray Albrecht (518) 862-1090, ext. 3253
Program: Buildings Research
Subprogram: Heating and Cooling
Contract No.: 4455-IABR-BR-97

-> Solar Domestic Hot Water-Heating Technology Evaluation

Assess and demonstrate solar domestic hot water (SDHW) systems in New York State.

BACKGROUND
New York State is placing new emphasis on developing renewable energy technologies to avoid the need for new electricity-generating facilities, minimize the impact of energy use on the environment, and reduce petroleum imports. These considerations make it necessary to assess and evaluate the current status of SDHW systems and their possible role in meeting the State's future energy needs.

OBJECTIVE
To determine the performance, cost-effectiveness, and demand-side management (DSM) value of SDHW systems in New York State.

DESCRIPTION
The contractor will (1) assess the technology of SDHW systems currently available to U.S. consumers; (2) perform detailed analyses of the most promising systems; (3) install at 12 single-family residences in New York State three samples of the four most promising systems; (4) monitor the hot water use, energy value of the solar-heated water, electricity use of the backup water-heating element, and parasitic electricity use of the SDHW systems for 12 months at each of the 12 sites; (5) use collected data to evaluate SDHW systems and determine the potential for utility DSM savings.

BENEFITS
If this project demonstrates that SDHW systems are cost-effective and provide a positive DSM benefit, this technology will provide economic opportunities for New York State manufacturers, retailers, and installers of solar equipment.

SCHEDULE AND STATUS
The final report is being prepared.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$463,894	0	$463,894
TOTALS	$463,894	0	$463,894

Contractor: Florida Solar Energy Center
Site: Shirley, Huntington Station, Lake Grove, and Southampton, Suffolk County; Mohegan Lake, Ossining, Yorktown Heights, and Croton-on-Hudson, Westchester County; Warwick and Florida, Orange County; Spring Valley, Rockland County
Contract Duration: 5/92 - 12/96
Key Words: renewable, solar, demand-side management, residential, domestic hot water
Project Manager: Bob Carver (518) 862-1090, ext. 3242
Program: Buildings
Subprogram: Heating and Cooling Systems
Contract No.: 1824-EEED-BES-92

-> Natural Gas Engine-driven Refrigeration Demonstration

Reduce electrical loads for commercial refrigeration with gas-fired cooling.

BACKGROUND
Natural gas engine-driven commercial refrigeration systems can reduce energy costs in supermarkets and cold storage warehouses.

OBJECTIVE
To demonstrate an innovative engine-driven, low-temperature refrigeration system. The final product will be a prototype system that can be manufactured and marketed commercially.

DESCRIPTION
The refrigeration system will be designed to serve the low-temperature refrigeration load at a cold storage warehouse demonstration site in Queens. This project will include engineering analysis and design of a system to meet the refrigeration load at the demonstration site, fabrication and installation of the system, and performance monitoring and evaluation for two years after installation.

BENEFITS
The system will reduce energy costs for refrigeration at the demonstration site and also will be applicable to other commercial refrigeration facilities in New York State.

SCHEDULE AND STATUS
System design and fabrication have been completed.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$250,000	0	$250,000
Brooklyn Union	375,000	0	375,000
TOTALS	$625,000	0	$625,000

Contractor: Brooklyn Union
Site: Brooklyn Union Service Territory
Contract Duration: 3/88 - 12/97
Key Words: product development, gas, cooling, engine-driven refrigeration
Project Manager: Ray Albrecht (518) 862-1090, ext. 3253
Program: Buildings
Subprogram: Heating and Cooling Systems
Contract No.: 1022-EEED-BES-88

-> Advanced Delivery-Truck Refrigeration System

Develop delivery-truck refrigeration system that uses thermal storage to maintain product temperature.

BACKGROUND
Conventional, diesel engine-driven systems for transport refrigeration often have poor efficiency and produce large quantities of emissions.

OBJECTIVE
To improve the energy efficiency and environmental performance of delivery-truck refrigeration systems using electric thermal storage instead of diesel engine-driven compressors.

DESCRIPTION
This project will develop a delivery-truck refrigeration system that uses thermal storage to maintain product temperature. The system will consist of a thermal-storage panel with integral circulating fans that is placed on the forward wall of a refrigerated truck. The panel will incorporate sufficient thermal-storage capacity to meet the required cooling load during daytime operating hours. The thermal-storage panel will be recharged overnight by a central, electrically-driven, refrigeration system located in the warehouse where the trucks are parked. The thermal-storage refrigeration system will be an alternative to truck-mounted diesel engine-driven compressor systems, the predominant type of equipment used in refrigerated transportation vehicles, which are designed for reliability rather than for energy efficiency and environmental performance.

BENEFITS
This project will address the dual issues of energy conservation and environmental performance. The proposed system will use electricity (mostly off-peak) instead of diesel fuel, with significant reductions expected for both energy consumption and engine-exhaust emissions. The system also will eliminate the substantial refrigerant leakage associated with engine-driven compressors.

SCHEDULE AND STATUS
Field-testing has been completed. A draft final report is being prepared.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$77,826	0	$77,826
Trans Refrigeration Int'l.	45,075	0	45,075
Lorenzo Foods (in-kind)	32,750	0	32,750
TOTALS	$155,651	0	$155,651

Contractor: Trans Refrigeration International
Site: Cazenovia, Madison County
Contract Duration: 9/90 - 6/97
Key Words: product development, environmental, refrigeration, thermal storage, transportation, transport refrigeration
Project Manager: Ray Albrecht (518) 862-1090, ext. 3253
Program: Buildings
Subprogram: Heating and Cooling Systems
Contract No.: 1584-EEED-BES-91

-> Evaporative Condenser for Supermarkets

Design, laboratory-test and field-demonstrate evaporative cooling system for supermarkets in northern climates.

BACKGROUND
The wholesale and retail food industry consumes four to six percent of the electricity used in New York State.

OBJECTIVE
To develop and demonstrate an advanced evaporative condenser system with improved energy performance and reduced manufacturing cost for supermarket refrigeration applications. The final product will be an evaporative- condenser system capable of being manufactured and marketed commercially.

DESCRIPTION
This project will include the design, laboratory-testing and field-demonstration of an evaporative cooling system for supermarkets in northern climates. The technology will incorporate several new features, including automatic drain-down and freeze-protection controls, enhanced condenser-tube surfaces, and non-chemical water-treatment techniques that would enable supermarkets to use high-efficiency, evaporative condensing in cold climates. New materials to reduce the manufacturing cost of the condenser system also will be investigated.

BENEFITS
Large quantities of energy are consumed annually for supermarket refrigeration in New York State. Most refrigeration systems in supermarkets use air-cooled condensers that contribute significantly to peak electrical-generating loads during the summer. Evaporative-condenser systems could reduce summer electrical demand and energy consumption in the supermarket industry.

SCHEDULE AND STATUS
Prototype fabrication has been completed. Field testing is under way.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$250,000	0	$250,000
ESEERCO	150,000	0	150,000
Con Edison	100,000	0	100,000
Niagara Blower Company	127,225	0	127,225
TOTALS	$627,225	0	$627,225

Contractor: Niagara Blower Company
Site: Buffalo, Erie County, and Greenburgh, Westchester County
Contract Duration: 12/92 - 6/97
Key Words: product development, refrigeration, HVAC, supermarket
Project Manager: Ray Albrecht (518) 862-1090, ext. 3253
Program: Buildings Research
Subprogram: Heating and Cooling Systems
Contract No.: 1996-EEED-BES-93

-> Optimized Variable-Speed Supermarket Compressor and Condenser-Fan Control

Develop and demonstrate more efficient variable-speed supermarket refrigeration system.

BACKGROUND

The wholesale and retail food industry consumes four to six percent of the electricity used in New York State. Optimized variable-speed refrigeration compressors and condenser fans offer significant potential energy savings compared to conventional variable-speed equipment.

OBJECTIVE

To develop and demonstrate a more efficient variable-speed supermarket refrigeration system. A new frequency inverter that incorporates voltage- and torque-control characteristics matched to the loads and operating characteristics of refrigeration compressors and condensers will be evaluated.

DESCRIPTION

This project will optimize the performance of combined inverter/motor/compressor and inverter/motor/fan systems at a Shop 'n Save supermarket in Glens Falls. This project will include designing and installing a modified compressor and condenser system; optimizing inverter, motor, and compressor/fan parameters; and monitoring system performance. The project will include reciprocating and screw-type compressors.

BENEFITS

More efficient variable-speed control of supermarket refrigeration systems will achieve energy savings and improved reliability and service life. The benefit to owners and consumers will be the availability of economical systems to reduce energy costs in the food industry. Economic benefits also will accrue from the manufacture of refrigeration equipment in New York State.

SCHEDULE AND STATUS

Field testing has been completed. A draft final report has been prepared.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$298,850	0	$298,850
ESEERCO	147,871	0	147,871
Shop 'n Save (in-kind)	179,960	0	179,960
Carlyle Division/Carrier Corp.	65,000	0	65,000
Control Techniques Worldwide	21,000	0	21,000
Castrol North America	7,900	0	7,900
Eastern Heating & Cooling, Inc.	6,000	0	6,000
TOTALS	$726,581	0	$726,581

Contractor: Aspen Systems, Incorporated
Site: Glens Falls, Warren County
Contract Duration: 11/94 - 6/97
Key Words: product development, refrigeration, variable-speed control
Project Manager: Ray Albrecht (518) 862-1090, ext. 3253
Program: Buildings Research
Subprogram: Heating and Cooling Systems
Contract No.: 4074-IABR-BR-95

-> Advanced Liquid-Desiccant System

Reduce electrical loads in buildings by using gas-fired cooling systems.

BACKGROUND
Desiccant dehumidification and cooling systems can replace conventional electrically driven compressor systems.

OBJECTIVE
To develop and demonstrate an advanced liquid-desiccant (glycol-based) cooling system with improved energy performance and reduced manufacturing cost for commercial space-cooling applications. The final product will be a desiccant system capable of being manufactured and marketed commercially.

DESCRIPTION
This project will include the design, laboratory-testing, and field-demonstration of an advanced liquid-desiccant system. The project will seek to develop a multistage regeneration technique with integral heat recovery to improve the efficiency of the desiccant system to 1.0 or above. New materials also will be investigated to reduce the manufacturing cost of the new desiccant system compared to currently available desiccant systems.

BENEFITS
Large quantities of energy are consumed annually to cool buildings in New York State. Most cooling systems for commercial buildings are electrically driven and contribute significantly to peak electrical-generating loads during the summer. Desiccant cooling systems can be operated with natural gas and could reduce summer electrical demand in the building sector.

SCHEDULE AND STATUS
Phase II (field-testing of production model unit) is under way at Dunkirk Ice Cream Company. An additional demonstration unit will be installed in Brooklyn Union during the summer of 1997.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$750,000	0	$750,000
Niagara Blower Company	576,200	0	576,200
Brooklyn Union	150,000	0	225,000
National Fuel Gas	0	$100,000	100,000
Dunkirk Ice Cream Co. (in-kind)	50,000	0	50,000
Brooklyn Demonstration Site Owner	0	0	100,000
TOTALS	$1,526,200	$100,000	$1,801,200

Contractor: Niagara Blower Company
Site: Buffalo, Erie County
Contract Duration: 9/91 - 6/98
Key Words: product development, gas, cooling, gas-fired cooling, desiccants
Project Manager: Ray Albrecht (518) 862-1090, ext. 3253
Program: Buildings
Subprogram: Heating and Cooling Systems
Contract No.: 1773-EEED-BES-92

-> Fluorescent Refrigerant Leak-Detection System

Develop and commercialize fluorescent leak-detection system for hydrofluorocarbon refrigerants.

BACKGROUND

Spectronics Corporation manufactures and markets a refrigerant leak-detection fluid (AR-GLO) for cooling systems that use CFC refrigerants and conventional lubricating oils. The product incorporates a fluorescent material in a mineral oil base. A small amount of AR-GLO is injected into a cooling system so leaks can be seen using an ultraviolet (UV) light, locating previously hidden leaks.

HFC refrigerants now are being used for medium- and low-temperature cooling applications, replacing CFC refrigerants in accordance with the Montreal Protocol. HFC cooling systems require polyalkylene glycol (PAG) or ester-based lubricating oils, however. Mineral oil-based leak-detection fluids cannot be used in HFC refrigeration systems due to chemical incompatibility with PAG and ester-based oils.

DESCRIPTION

To develop a product for systems that use PAG or ester-based lubricating oils developed for alternative (non-CFC) refrigerants.

DESCRIPTION

Spectronics will develop, test, and market AR-GLO 4PAG, a version of AR-GLO compatible with PAG lubricating oils, and AR-GLO 4E, a version of AR-GLO compatible with ester-based lubricating oils. The company also will develop, test, and market a plastic-infuser capsule to inject AR-GLO into a cooling system. Spectronics also will develop, test, and market a wafer technology for introducing the leak-detection fluid into new cooling equipment during manufacturing.

BENEFITS

Refrigerant leakage significantly decreases cooling efficiency, causing an estimated 20 trillion Btu (about 37 million barrels of oil) annual energy loss.

SCHEDULE AND STATUS

Laboratory- and field-testing of the new leak-detection fluids, infuser capsule, and wafer technology have been completed. A draft final report has been prepared. The products are now being manufactured and marketed by Spectronics Corporation.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$600,000	0	$600,000
Long Island Lighting Company	186,203	0	186,203
ESEERCO	186,000	0	186,000
Spectronics Corp.	892,607	0	892,607
TOTALS	$1,864,810	0	$1,864,810

Contractor: Spectronics Corporation
Site: Westbury, Nassau County
Contract Duration: 4/91 - 6/97
Key Words: product development, environmental, HVAC, refrigeration, leak detection, refrigerant, R-134a, PAG oil, ester-based oil, fluorescent
Project Manager: Ray Albrecht (518) 862-1090, ext. 3253
Program: Buildings
Subprogram: Heating and Cooling Systems
Contract No.: 1836-EEED-BES-92

-> Chlorofluorocarbon/Hydrofluorocarbon Refrigerant Separation Technology

Design, test, and commercialize an advanced separation technology for chlorofluorocarbon/hydrofluorocarbon refrigerant mixtures.

BACKGROUND

Recent U.S. Environmental Protection Agency regulations have banned the production of chlorofluorocarbon (CFC) refrigerants. Existing CFC-based air-conditioning and refrigeration systems must use banked or recycled CFC refrigerants for maintenance and repair. CFC shortages have begun to occur in the refrigerant market due to lower-than-expected recovery and recycling activities.

OBJECTIVE

To develop a new technology for separating mixed refrigerants. The new technology will use the liquid-extraction solvent technique to separate refrigerant mixtures that result from service errors in the field. Such errors customarily occur when cooling systems are not properly labeled or when refrigerant recharging of CFC-based cooling systems is performed with hydrofluorucarbon (HFC) refrigerants due to CFC shortages.

DESCRIPTION

Phase I will include the design and laboratory testing of an advanced refrigerant-separation technology. Phase II will include product certification and commercialization tasks.

BENEFITS

The new technology will achieve environmental and economic benefits by enabling more cost- and technologically effective recovery and reclamation of refrigerants. The technology also will achieve energy benefits in existing cooling systems that continue to use CFCs by making it more economical to maintain efficient refrigerant-charge levels. The technology will be applicable to all presently occurring and expected-to-occur refrigerant-mixture combinations during the transition from CFC and HCFC refrigerants.

SCHEDULE AND STATUS

System design is under way.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	0	$149,458	$250,000
Refron, Inc.	0	149,458	250,000
TOTALS	0	$298,916	$500,000

Contractor: Refron, Inc.
Site: Long Island City, Queens County
Contract Duration: 9/96-12/98
Key Words: product development, cooling, refrigerants, CFCs
Project Manager: Ray Albrecht (518) 862-1090, ext. 3253
Program: Buildings Research
Subprogram: Heating and Cooling Systems
Contract No.: 4460-IABR-BR-97

-> Innovative Refrigerant Circuit for Ground-Source Heat Pump

Evaluate refrigerant circuit for ground-source heat pump (GSHP) that provides space conditioning and domestic hot water.

BACKGROUND

Several GSHP manufacturers currently produce systems capable of providing both space-conditioning and domestic water-heating. These systems rely on a complicated series of controls and valves to direct the refrigerant for the various modes of operation. A new patented refrigerant circuit has been developed that minimizes the valves and controls required to direct the refrigerant for each of the operating modes, thereby improving system reliability and performance.

OBJECTIVE

To evaluate a new patented refrigerant circuit that allows GSHPs to provide both space-conditioning and domestic water-heating with simplified valving and controls.

DESCRIPTION

The contractor will (1) instrument five previously installed GSHP systems that use the patented refrigerant circuit; (2) monitor the systems for 12 months; (3) estimate the life cycle cost and seasonal and instantaneous performance and life cycle costs for the GSHPs and the refrigerant circuits; (4) perform a marketing analysis of competing GSHPs; (5) perform a manufacturing analysis to determine the most efficient method for producing the GSHP and refrigerant circuit; and (6) prepare a business plan for commercializing the GSHP and refrigerant circuit.

BENEFITS

The project will promote the use of a renewable technology that reduces the energy required for residential space-conditioning and water-heating. Homeowners will benefit by having lower energy bills and utilities will benefit by avoiding the need for new electricity-generating facilities. This project also will provide economic benefits by developing a new product for manufacture in New York State.

SCHEDULE AND STATUS

A business proposal and Final Report are being prepared.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$117,383	0	$117,383
Thermal Associates	117,384	0	117,384
TOTALS	$234,767	0	$234,767

Contractor: Thermal Associates
Site: Glens Falls, Warren County, and Saratoga County
Contract Duration: 11/93 - 12/96
Key Words: product development, HVAC, ground-source heat pumps, domestic hot water
Project Manager: Bob Carver (518) 862-1090, ext. 3242
Program: Buildings
Subprogram: Heating and Cooling Systems
Contract Nos.: 3019-EEED-BES-94

-> Air-Infiltration and Ventilation Demonstration

Test and evaluate various ventilation systems in New York State homes.

BACKGROUND

NYSERDA, the California Institute for Energy Efficiency, and Lawrence Berkeley Laboratory (LBL) have completed a project to identify and analyze the effectiveness and energy impacts of various ventilation approaches for residential construction. These analyses also studied the interactions among ventilation, combustion appliances, safety, and moisture build-up. The results of these analyses have identified the most promising systems for New York State and California homes. A guidebook discussing the issues associated with ventilation and the most appropriate systems for New York State homes was developed from the results of these analyses.

OBJECTIVE

To field-test promising ventilation systems identified by LBL to verify which best balance the needs for indoor air quality and energy efficiency.

DESCRIPTION

The contractor will: (1) select a sample of eight New York State homes in which the most promising ventilation systems identified by LBL will be installed; (2) perform detailed testing on each home to establish its baseline infiltration, ventilation, and energy usage characteristics prior to installing a system; (3) repeat testing after the systems have been installed to measure any resulting changes in the homes' characteristics; (4) correlate the measured results of this detailed testing with LBL's expected results for each system; (5) develop a manual outlining acceptable practices for designing and installing ventilation systems; and (6) verify the effectiveness of this manual by performing quick diagnostic tests on a sample of 18 homes in which ventilation systems were designed and installed using the manual.

BENEFITS

A manual will be developed to assist architects and heating, ventilating, and air-conditioning (HVAC) contractors in designing and installing ventilation systems. The manual also will help ensure that installed systems meet current American Society of Heating, Refrigerating and Air-Conditioning Engineers standards for ventilation without compromising the home's energy efficiency. This work also could create economic opportunities for HVAC contractors due to increased installation of ventilation systems.

SCHEDULE AND STATUS

Installation of systems and detailed monitoring in the first eight homes has begun.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$154,860	$100,000	$254,860
U.S. Department of Energy	50,000	0	50,000
TOTALS	$204,860	$100,000	$304,860

NOTE: Does not include $300,000 Phase I funding shown under agreement 1951-EEED-BES-93.

Contractor: Synertech Systems Corporation
Site: Syracuse, Onondaga County, and various locations in New York State
Contract Duration: 4/96 - 10/97
Key Words: product development, HVAC, buildings, residential, ventilation, infiltration, indoor air quality
Project Manager: Bob Carver (518) 862-1090, ext. 3242
Program: Buildings
Subprogram: Heating and Cooling Systems
Contract No.: 4413-IABR-BR-96

-> HFC Ductless Air-Conditioning System

Design, test, and demonstrate advanced commercial ductless non-chlorofluorocarbon air-conditioning system.

BACKGROUND

Recent U.S. Environmental Protection Agency regulations will restrict the use of hydrochlorofluorocarbon (HCFC) refrigerants in cooling equipment.

OBJECTIVE

To perform the design, laboratory-testing and field-demonstration of an advanced commercial ductless air-conditioning system that uses a hydrofluorocarbon (HFC) refrigerant. The system will seek to improve efficiency while eliminating the use of conventional HCFC-22 refrigerant. The project will investigate the use of counterflow heat exchangers to take advantage of the variable boiling/condensing temperature characteristics of certain HFC refrigerant mixtures.

DESCRIPTION

Phase I will include the design, construction, and laboratory-testing of a counterflow heat exchanger for use in the condenser and evaporator components. Phase II will include the development and laboratory/field-testing of a complete HFC ductless air-conditioning system.

BENEFITS

Certain HFC refrigerants have shown the potential to achieve efficiency improvements of 10 to 15 percent compared to the conventional HCFC-22 refrigerant. The project also will include establishing heat-exchanger manufacturing at EnviroMaster's plant and will generate significant additional employment.

SCHEDULE AND STATUS

System testing is under way.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$250,000	0	$500,000
EnviroMaster International Corp.	258,864	0	514,795
TOTALS	$508,864	0	$1,014,795

Contractor: EnviroMaster International Corporation
Site: Rome, Oneida County
Contract Duration: 12/95-12/98
Key Words: product development, cooling, refrigerants
Project Manager: Ray Albrecht (518) 862-1090, ext. 3253
Program: Buildings
Subprogram: Heating and Cooling Systems
Contract No.: 4295-IABR-BR-96

Promote energy efficiency to reduce operating costs for New York's public sector.

BACKGROUND
Recently, there has been renewed interest in energy performance contracting for public sector entities in both New York State and the nation as a whole. A manual that addresses the salient and complex issues of energy performance contracting and combines the cumulative experience of many organizations is the motivation behind this project.

OBJECTIVE
To develop a comprehensive energy performance contracting manual to provide technical assistance to New York State agencies, local governments and municipalities, schools and public authorities, interested in using performance contracting as a means of implementing energy-efficiency improvements in their facilities.

DESCRIPTION
The manual will include topics such as: designing, developing, and evaluating competitive solicitations; types of procurement instruments; evaluation criteria; types of agreements; guarantees; financing arrangements; and a discussion of applicable State and local statutes. Four regional workshops will be conducted to introduce the manual.

BENEFITS
It is expected that the manual will clarify many of the more complex issues involved in, and encourage the use of energy performance contracting throughout New York State. This will allow implementation of energy-efficient measures in the public sector by effectively harnessing private-sector resources.

SCHEDULE AND STATUS
Revisions to all chapters are being prepared. The manual is expected to be completed by the end of the summer.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$124,120	0	$124,120
TOTALS	$124,120	0	$124,120

Contractor: EUA/Citizens Conservation Services, Inc.
Site: Lowell, MA
Contract Duration: 12/95 - 7/97
Key Words: energy performance contracting, municipal
Project Manager: Norine Karins (518) 862-1090, ext. 3211
Program: Buildings
Subprogram: Heating and Cooling Systems
Contract No.: 4367-IABR-BR-96

-> Steam-Trap Failure-Sensing Device

Develop steam-trap sensing device.

BACKGROUND
Failure to detect faulty steam traps can be costly to multifamily building owners. Low-cost detectors may result in energy cost savings.

ACCOMPLISHMENTS
Five prototype devices were designed and laboratory-tested. Twenty devices were manufactured and field-tested at a New York City multifamily housing complex. Operational data were collected for one heating season.

FINDINGS AND CONCLUSIONS
The reliability of the device was hindered primarily by lack of access to material appropriate for the application. Test results showed a wide range of temperature activation points. In addition, the device often failed to activate at required temperature setpoints.

REALIZED OR ANTICIPATED BENEFITS
The low-cost device may become viable if the appropriate material can be acquired.

TECHNOLOGY TRANSFER ACTIVITIES
A press release was issued during the project's field test.

FUNDING	TOTALS
NYSERDA	$79,728
VTEC Labs (in-kind)	16,900
TOTALS	$96,628

Contractor: VTEC Laboratories, Inc.
Site: New York City, New York County
Contract Duration: 9/92 - 9/96
Key Words: product development, buildings, heating, HVAC, multifamily
Project Manager: Norine Karins (518) 862-1090, ext. 3211
Program: Buildings
Subprogram: Heating and Cooling Systems
Contract No.: 1929-EEED-BES-92

-> Energy-Efficient Electric Dehumidification

Develop and evaluate energy-efficient electric dehumidification system.

BACKGROUND

The high operating costs of conventional electric dehumidification have made gas-fired desiccant dehumidification technology attractive to building owners and managers. While desiccant dehumidification can control humidity below 30 percent relative humidity (RH), electrical dehumidification using a standard vapor-compression refrigeration cycle is more effective when humidity levels exceed 40 percent RH, as in many commercial and industrial applications such as supermarkets and indoor swimming pools.

ACCOMPLISHMENTS

A market survey was completed that evaluated the potential for this technology in the U.S. and New York State. Designs were developed and components specified for dehumidification systems for supermarket and indoor swimming pool applications. Computer simulations were performed based on these designs to determine their energy performance and cost-effectiveness.

FINDINGS AND CONCLUSIONS

The marketing survey revealed there are approximately 350 supermarkets renovated in New York State each year that could use this technology. This survey also found there are approximately 4,200 indoor swimming pools in New York State (commercial, public, and residential). It also estimated that the annual New York State market for swimming pool dehumidifiers is more than 250 units.

Computer simulations determined that the energy costs required for cooling and dehumidifying indoor swimming pool areas and supermarkets could be reduced by 50% and 60%, respectively, if conventional systems were replaced with Nautica systems. Based on projected costs, a Nautica supermarket system would cost less to install than a conventional system, because less cooling capacity is needed due to Nautica's innovative heat-exchanger and damper configuration. While the cost of installing a Nautica indoor swimming pool dehumidifier would be higher than that for a conventional system, the resulting energy savings for the Nautica system are projected to provide a payback period of less than one year.

REALIZED OR ANTICIPATED BENEFITS

Significant energy savings will be received by supermarket and indoor swimming pool owners who implement this technology. The indoor air quality of indoor swimming pool areas will be dramatically improved by reducing the moisture build-up in the enclosure. A new heating and cooling product may also be manufactured in New York State.

TECHNOLOGY TRANSFER ACTIVITIES

This technology has been featured in science- and energy-related publications. Nautica Dehumidifiers intends to commercialize this technology by teaming with an HVAC manufacturer.

FUNDING	TOTALS
NYSERDA	$190,224
ESEERCO	70,357
Nautica Dehumidifiers, Inc.	69,446
TOTALS	$330,027

Contractor: Nautica Dehumidifiers, Inc and Chinook Phi-Beta Corporation
Site: Huntington, Suffolk County, and Gloucester, Ontario, Canada
Contract Duration: 4/93 - 12/96
Key Words: product development, assist business, HVAC, heat recovery, indoor air quality
Project Manager: Bob Carver (518) 862-1090 ext. 3242
Program: Buildings
Subprogram: Heating and Cooling Systems
Contract No.: 1940-IABR-BES-93

-> Wet-Recuperated Combustion Gas-Fired Heating System Development

Develop aluminum hydronic boiler with 95% annual fuel utilization efficiency and low emissions of nitrogen oxide and carbon monoxide.

BACKGROUND

Heating system manufacturers are faced with more regulations for energy efficiency and emissions of nitrogen oxides (NO_x) and carbon monoxide (CO).

ACCOMPLISHMENTS

This project developed an innovative hydronic boiler that uses wet-recuperated natural gas combustion to achieve significant energy and environmental benefits compared to currently available boiler systems. The system incorporates a secondary heat exchanger that transfers heat and moisture from discharged flue gases to incoming combustion air.

Phase I included the technical and economic evaluation of alternative design concepts, and the preparation of preliminary design drawings and specifications. Phase II included construction and laboratory testing of a proof-of-concept system. Phase III included initial field-testing in residential and small commercial buildings. Phase IV included advanced product development, field-testing, and initial commercialization activities.

FINDINGS AND CONCLUSIONS

The new boiler has been introduced into the marketplace under the Quantum Leap trade name. The boiler has an annual fuel utilization efficiency of 95%, with NO_x and CO emission levels of under 10 and 20 ppm, respectively.

REALIZED OR ANTICIPATED BENEFITS

Economic benefits will result from Dunkirk Radiator Corporation's manufacturing the boiler. Building owners and consumers will benefit from the availability of an economical system to reduce natural gas consumption.

TECHNOLOGY TRANSFER ACTIVITIES

Dunkirk Radiator Corporation has begun to market the Quantum Leap boiler for residential and small commercial heating applications.

FUNDING	TOTALS
NYSERDA	$661,464
New York Gas Group	230,000
Dunkirk Radiator Corp.	365,012
Dunkirk Radiator Corp. (in-kind)	239,000
Con Edison	100,000
Brooklyn Union	150,000
National Fuel Gas	150,000
TOTALS	$1,895,476

Contractor: Dunkirk Radiator Corporation
Site: Dunkirk, Chautauqua County
Contract Duration: 10/92-12/96
Key Words: product development, environmental, gas, heating, heating equipment, emissions, NO_x
Project Manager: Ray Albrecht (518) 862-1090, ext. 3253
Program: Buildings Research
Subprogram: Heating and Cooling Systems
Contract No.: 3009-EEED-BES-94

-> Encap™ Process for Foam Products

Develop process to manufacture building products with recycled plastics.

BACKGROUND

Using expanded polystyrene (EPS) as insulation in building construction offers significant energy savings. However, some disadvantages, such as low flame-resistance and dimensional stability, limit its use. The Institute for Research, Inc. has developed a method (the Encap™ Process) to produce foam that not only overcomes these disadvantages, but also permits foam panels to be manufactured with recycled EPS and contaminated, commingled plastics. The Encap™ Process is at the stage where laboratory-scale foam panels have been produced and tested. Equipment for large-scale production also has been fabricated.

OBJECTIVE

To develop the Encap™ Process by scaling up current laboratory-scale production to a pilot-plant manufacturing operation.

DESCRIPTION

The contractor will: (1) optimize the Encap™ Process to produce foam products with waste plastic from the food service, medical, and packaging-material industries; (2) evaluate resulting foam for use in various building products, such as wall and roof insulation, insulated concrete forms, and fireproof doors; (3) perform marketing and economic analyses to quantify the available supply of plastic waste, identify customer needs and specifications, and establish the overall economic feasibility of the Encap™ Process; (4) establish and operate a pilot plant for producing foam products at Shelter Enterprises, Inc. of Cohoes; and (5) test foam samples produced by Shelter Enterprises in actual building products.

BENEFITS

This project will provide energy savings by manufacturing foam-insulation products for buildings. Shelter Enterprises will benefit by manufacturing and selling the foam products. Schenectady International also will benefit by producing and selling the polymer resin needed for the molding process.

SCHEDULE AND STATUS

A video and workshop have been completed. The Final Report is being prepared.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$253,500	0	$253,500
Institute for Research, Inc.	67,000	0	67,000
Rockwell International Corp.	166,000	0	166,000
Schenectady International, Inc.	22,238	0	22,238
TOTALS	$508,738	0	$508,738

Contractor: Institute for Research, Inc.
Site: Schenectady, Schenectady County; and Cohoes, Albany County, and Houston, Texas
Contract Duration: 3/95 - 12/96
Key Words: product development, environmental, buildings, insulation, recycling
Project Manager: Bob Carver (518) 862-1090, ext. 3242
Program: Buildings
Subprogram: Building Envelope Systems
Contract No.: 4109-IABR-BR-95

-> Continuous Process Extruder for Insulated Sheathing

Develop equipment to extrude and face sheathing material made with recycled expanded polystyrene.

BACKGROUND

Shelter Enterprises, Inc. produces an insulated sheathing that is used underneath the siding of homes by molding expanded polystyrene (EPS) billets and slicing them with a hot wire cutter into one-inch-thick panels upon which foil facing is applied. The company could significantly reduce its manufacturing costs if these three processes could be performed in a single operation that also would allow more scrap EPS to be used because the hot wire cutter, which is the step most sensitive to contaminations, would be eliminated.

OBJECTIVE

To design and evaluate equipment for single-step extruding and facing of insulated sheathing material made with recycled EPS.

DESCRIPTION

The contractor will: (1) design and fabricate a 1/10-scale operating model of the extruding equipment; (2) use the model to determine the feasibility of extruding sheathing materials with different feed rates and amounts of scrap EPS; (3) test foam products manufactured with the model for strength, thermal conductivity, flame resistance, and water permeability; (4) determine the optimum raw material mixture and equipment setpoints; (5) perform a cost analysis to assess the economic feasibility of a full-scale extruder; and (6) design, fabricate, and evaluate a full-scale extruder if the testing and cost-analysis results based on the model are favorable.

BENEFITS

The new equipment potentially could reduce annual material and production costs for the insulated sheathing product by $1.5 million. The new equipment also will divert discarded EPS from landfills by developing a new beneficial use for the material. This product also will reduce the energy needed to heat and cool homes by increasing the R-value of a home's walls.

SCHEDULE AND STATUS

The equipment needed for testing foam samples has been assembled. Design of the 1/10 scale prototype extruder has begun.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$192,138	0	$192,138
Shelter Enterprises, Inc.	192,139	0	192,139
TOTALS	$384,277	0	$384,277

Contractor: Shelter Enterprises, Inc.
Site: Cohoes, Albany County
Contract Duration: 3/96 - 9/97
Key Words: product development, buildings, insulation, recycling
Project Manager: Bob Carver (518) 862-1090, ext. 3242
Program: Buildings
Subprogram: Building Envelope Systems
Contract No.: 4380-IABR-BR-96

-> Recycled Glass in Concrete Blocks

Develop treatment process that would permit use of recycled glass as aggregate in concrete blocks.

BACKGROUND

Despite recent efforts, mixed-color post-consumer glass still poses a challenge for recycling. One beneficial use for this waste stream has been aggregate in asphalt for road pavement. However, as the amount of recyclable glass is expected to increase in coming years, new uses will need to be developed for this waste stream. One possible use would be as aggregate in concrete. This concept has not been able to be commercialized because of an adverse chemical reaction among alkali in the cement, silica in the glass, and water in the concrete. Known as alkali-silica reaction (ASR), it can cause structural failures in the concrete.

OBJECTIVE

To determine if concrete blocks can be produced that meet all required American Society for Testing and Materials standards for ASR and strength when crushed mixed-color glass is substituted for a portion of the natural aggregate.

DESCRIPTION

The contractor will: (1) study various glass-surface treatments, such as alkali leaching, chemical encapsulation, and mechanical encapsulation, to determine their effectiveness in minimizing the short- and long-term effects of ASR; (2) test concrete samples made with aggregate treated with each of these methods to determine their effects on ASR and the concrete's strength; (3) manufacture at a production facility concrete blocks to determine the effects of using glass aggregate on block-making equipment; and (4) evaluate the economic feasibility of producing blocks with treated-glass aggregate.

BENEFITS

This project will develop a new beneficial use for recycled mixed-color glass. New York communities will benefit through reduced landfill tipping fees. Using recycled glass also will augment New York State's natural aggregate supply, the mining of which is being increasingly regulated. Energy benefits also will accrue by reducing the amount of aggregate mined in New York State and thus the energy needed to transport it from mines to block manufacturers.

SCHEDULE AND STATUS

Strength testing has begun on concrete samples made with various sizes of recycled glass particles. Production of concrete blocks made with recycled glass is about to begin.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$230,790	0	$230,790
Columbia University	189,135	0	189,135
Dyker Anderson Contracting Co.	20,000	0	20,000
TOTALS	$439,925	0	$439,925

Contractor: Columbia University
Site: New York, New York County
Contract Duration: 3/95 - 3/97
Key Words: product development, university, environmental, buildings, solid waste, recycling
Project Manager: Bob Carver (518) 862-1090, ext. 3242
Program: Buildings Research
Subprogram: Building Envelope Systems
Contract No.: 4113-IABR-BR-95

-> Development of New Smart-Window Technology

Develop windows with changeable light-transmission capability.

BACKGROUND

Approximately 15 percent of the energy needed to heat and cool buildings is due to the presence of windows. One strategy for reducing this penalty is to control the solar radiation entering a building by using smart-window technologies. Such windows have a electrochromatic or liquid-crystal layer enclosed in the glass that can change the window's light-transmission characteristics. The disadvantages of this strategy include absorbing the solar radiation, and thereby still heating the window's glass, and cost. A new class of liquid crystal (cholesteric liquid crystal, or CLC) has been developed that reflects, instead of absorbs, solar radiation, at a substantially lower cost. Reveo has previously produced a 1"x1" smart glass pane that can reflect nearly 100 percent of solar radiation.

OBJECTIVE

To develop and determine the feasibility of using CLCs for smart windows that are switchable between reflecting 100-percent light and transmitting 50-percent light.

DESCRIPTION

The contractor will: (1) optimize the composition of CLC for smart-window applications, (2) determine if CLCs can be produced that are switchable between reflecting 100-percent light and transmitting 50-percent light (3) optimize the techniques for producing CLCs, (4) determine if CLCs can be produced that reflect only specific bandwidths of radiation, (5) conduct long-term stability tests on small-scale samples, (6) investigate the effect of solar-radiation incident angle on CLC performance, (7) fabricate a 6"x6" CLC smart-window panel, and (8) conduct economic and energy analyses to determine the benefits of CLC smart windows.

BENEFITS

Preliminary estimates indicate air-conditioning energy usage could be reduced by 20 percent with the new smart window. The new product would also be more cost-effective than other available smart-window technologies. Manufacturing jobs in New York State could also be created if the new technology becomes commercialized.

SCHEDULE AND STATUS

The project has just begun.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	0	$105,693	$105,693
Reveo, Inc.	0	105,697	105,697
TOTALS	0	$211,390	$211,390

Contractor: Reveo, Inc.
Site: Hawthorne, Westchester County
Contract Duration: 3/97 - 3/98
Key Words: product development, windows, buildings, materials
Project Manager: Bob Carver (518) 862-1090, ext. 3242
Program: Buildings
Subprogram: Building Envelope Systems
Contract No.: 4520-IABR-BR-97

-> Foamed Structural Lumber

Develop plastic lumber products that incorporate coal-combustion fly ash.

BACKGROUND

Nearly 80 percent of the fly ash generated in the U.S. by coal-fired power plants is disposed of in slurry ponds, old mines, and landfills at a cost of $40 per ton. If a beneficial use could be found for this material, utilities could avoid this disposal fee. Central Hudson Gas & Electric Corp. has teamed with Ecomat, Inc. to develop a process to use fly ash to foam thermoset polystyrene into a product that could be substituted for lumber. A laboratory facility and prototype pilot plant would be sited in Central Hudson's service territory as a result of these efforts.

OBJECTIVE

To support the establishment of a pilot production facility for foamed-plastic structural lumber made with fly ash from coal-fired power plants.

DESCRIPTION

Ecomat and the National Association of Home Builders (NAHB) Research Center will: (1) identify potential lumber products to be made at the pilot production facility, (2) evaluate the use of various chemical formulations and reinforcing strategies to ensure potential lumber products have required material properties, (3) mold prototypes at the pilot production facility, (4) test prototypes to determine their abilities to meet structural and building code requirements, (5) produce and test final engineering prototypes of a composite structural beam and dimensional lumber replacement, (6) develop and evaluate a production process for the most promising prototype at the pilot production facility, and (7) complete marketing analyses for the most promising lumber products.

BENEFITS

Using plastic lumber could save energy for heating and cooling buildings by increasing the R-value of walls. A new beneficial use for fly ash would be developed, diverting this material from landfills. Jobs also would be created by establishing a new manufacturer in the State.

SCHEDULE AND STATUS

Plastic lumber prototypes have been fabricated at the pilot production facility. Prototypes are undergoing structural and thermal testing.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	0	$176,995	$176,995
Central Hudson Gas & Electric Corp.	$100,000	100,000	285,000
NAHB	0	20,000	20,000
TOTALS	$100,000	$296,995	$481,995

Contractor: National Association of Home Builders Research Center
Site: Poughkeepsie, Dutchess County, and Upper Marlboro, MD
Contract Duration: 9/96 - 9/97
Key Words: product development, buildings, industrial waste, recycling
Project Manager: Bob Carver (518) 862-1090 ext. 3242
Program: Buildings
Subprogram: Building Envelope Systems
Contract No.: 4381-IABR-BR-97

-> Grease-Trapping Filters for Commercial Kitchens

Design and test grease-trapping filter for ventilating cooking areas in commercial kitchens.

BACKGROUND
Trine Rolled Moulding is a manufacturer of grease-trapping filters for exhaust systems used in the cooking areas of commercial kitchens. To capture an acceptable amount of grease from the air, these ventilating systems are typically operated at a higher airflow rate than the standards set by the American Society of Heating, Refrigerating and Air-Conditioning Engineers. This results in the kitchen being over-ventilated, thereby increasing heating and cooling requirements. While Trine's filters have a good grease-capturing efficiency, their efficiency could be improved and still meet ventilation standards using lower airflow rates.

OBJECTIVE
To design and develop new filters with high grease-capturing efficiencies that reduce energy requirements for kitchen exhaust systems.

DESCRIPTION
The contractor will: (1) research existing filter technologies and design requirements, (2) benchmark design variables and product costs for the new filter, (3) identify alternative materials and coatings to improve performance, (4) acquire and configure simulation software, (5) develop simulation models of new filter designs, (6) use the simulation models to optimize filter designs, (7) construct a filter-testing facility, (8) fabricate and test prototype filter designs, (9) field-test promising prototypes in commercial kitchens for three months, (10) conduct economic and energy savings evaluations for the new filter, and (11) disseminate project results.

BENEFITS
The new filter could reduce fan power needed for exhaust systems. The lower airflow rate would reduce air-conditioning requirements for a commercial kitchen. The new filter would reduce the possibility of grease fires in kitchens. The manufacturer's competitiveness in the market would be improved with the introduction of the new filter

SCHEDULE AND STATUS
The project has just begun.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	0	$224,989	$224,989
Trine Rolled Moulding Corporation	0	235,847	235,847
TOTALS	0	$460,836	$460,836

Contractor: Trine Rolled Moulding Corporation
Site: Bronx, Bronx County
Contract Duration: 3/97 - 4/98
Key Words: product development, HVAC, buildings, commercial, indoor air quality
Project Manager: Bob Carver (518) 862-1090, ext. 3242
Program: Buildings
Subprogram: Building Envelope Systems
Contract No.: 4518-IABR-BR-97

-> Stock Characterization of Air-Distribution System in Northern Homes

Assess energy losses attributable to air-distribution systems.

BACKGROUND

Recent studies have shown that energy losses due to air-distribution systems average from 30 to 40 percent for southern homes. However, these losses cannot be assumed to be representative of northern homes due to differences in climate, duct materials, and construction techniques. To date, little data exists to quantify the magnitude of the energy losses attributable to air-distribution systems in northern homes, making it difficult to provide reasonable guidelines for home builders to design and construct energy-efficient duct systems.

OBJECTIVE

To determine energy losses attributable to air-distribution systems in northern homes and evaluate the effectiveness of repair and retrofit techniques for reducing energy losses.

DESCRIPTION

The contractor will (1) identify a representative sample of 20 homes in New York State and 10 in Wisconsin for characterization, including new and existing homes; (2) monitor these home to determine the baseline efficiency of their air-distribution systems; (3) repair and seal the air-distribution systems; (4) determine the efficiencies of the improved air-distribution systems; (5) evaluate the cost effectiveness of the repair and sealing work; and (6) develop design, construction, and repair guidelines for air-distribution systems in northern homes.

BENEFITS

Utilities will benefit by gaining data to promote the design of energy-efficient air-distribution systems in northern homes, thereby reducing their peak demand during heating and cooling seasons. Homeowners will benefit through lower energy costs for heating and cooling their homes, and by having air-distribution systems that provide better thermal comfort.

SCHEDULE AND STATUS

The Final Report is being reviewed.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$119,000	0	$119,000
Central Hudson Gas & Electric Corp.	50,000	0	50,000
Electric Power Research Institute	69,000	0	69,000
Wisconsin Center for DSR	94,000	0	94,000
TOTALS	$332,000	0	$332,000

Contractor: Synertech Systems Corporation
Site: New York State and Wisconsin
Contract Duration: 6/94 - 12/96
Key Words: buildings, HVAC, residential, utilities, thermal distribution
Project Manager: Bob Carver (518) 862-1090, ext. 3242
Program: Buildings Research
Subprogram: Building Envelope Systems
Contract Nos.: 4024-IABR-BR-95

-> Air-Infiltration/Ventilation Evaluation Program

Identify and analyze ventilation approaches for New York State homes.

BACKGROUND

Over the past two decades, rising home-heating costs have increased efforts to construct homes that are better-insulated and limit air infiltration. These efforts to build more energy-efficient homes have succeeded in reducing home heating costs. However, these efforts also have inadvertently resulted in the construction of homes so "tight" that they do not allow for adequate ventilation. Builders are now faced with the task of identifying and selecting products that will provide sufficient ventilation without having a significant impact on the home's energy usage.

OBJECTIVE

To evaluate active and passive ventilation approaches and products based on cost-effectiveness, ability to provide adequate ventilation, and impact on energy efficiency for new and existing homes.

DESCRIPTION

The contractor will (1) collect and analyze cost, performance, and installation data for various ventilation approaches; (2) collect and analyze existing measured data for air-infiltration and ventilation rates to characterize air infiltration in New York State and California homes; (3) perform detailed analyses to determine the most promising ventilation approaches for New York State and California homes; and (4) develop a Ventilation Guide for home builders and heating, ventilating, and air conditioning (HVAC) designers that identifies and discusses appropriate ventilation approaches for New York State homes.

BENEFITS

This project will assure that the ventilation products and approaches installed in homes will provide sufficient ventilation to meet current American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) standards without compromising the home's energy efficiency. This project also may stimulate economic benefits for New York State manufacturers, distributors, and installers of ventilation systems by promoting the use of such products.

SCHEDULE AND STATUS

The Ventilation Guide and Final Report are undergoing final review.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$200,000	0	$200,000
CA Institute of Energy Efficiency	100,000	0	100,000
TOTALS	$300,000	0	$300,000

Contractor: Lawrence Berkeley Laboratory
Site: Berkeley, California
Contract Duration: 8/93 - 12/96
Key Words: buildings, residential, ventilation and infiltration, air quality, HVAC
Project Manager: Bob Carver (518) 862-1090, ext. 3242
Program: Buildings
Subprogram: Building Envelope Systems
Contract No.: 1951-EEED-BES-93

-> Developing Advanced Refrigerator Insulation

Develop advanced insulation system for household refrigerators.

BACKGROUND

Foam insulation materials traditionally used in refrigerators were manufactured with chloroflurocarbon (CFC) blowing agents. The use of non-CFC-blowing agents in conventional manufacturing techniques has led to lower R-values of foam-insulation materials. This project's objective was to develop an advanced insulation system for household refrigerators that would achieve an R-value per inch greater than 20.

ACCOMPLISHMENTS

A technical marketing study of advanced insulation systems was completed. A thermal conductivity tester for measuring materials at vacuum pressures was designed and constructed. Various insulation systems made of alternating reflective foils and micro-fiberglass paper were tested.

FINDINGS AND CONCLUSIONS

The technical marketing study concluded that micro-fiberglass insulation systems could compete with other advanced vacuum systems, with their greatest market potential in high-performance applications (R-values greater than 30). The thermal conductivity tester measured R-values per inch ranging from 35 to 80 when in a vacuum for tested insulation systems, depending on the fiber materials used. These values compare to R-values per inch of 20 for other vacuum-panel systems, such as powder-evacuated panels and silica aerogels. While these results appear to represent a substantial improvement, it must be noted that the tested materials did not have encapsulation systems to contain the insulation at vacuum conditions. Development of such a system represents a significant technical challenge. Such an encapsulation system also would likely reduce the overall insulation's R-value per inch.

REALIZED OR ANTICIPATED BENEFITS

Test results allowed Lydall to characterize the thermal performance of its various paper products. Correlations among fiber diameter, weight per unit area, and R-value also were developed.

TECHNOLOGY TRANSFER ACTIVITIES

A technical paper discussing the development of the thermal conductivity tester was presented at the International Cryogenics Engineering Conference.

FUNDING	TOTALS
NYSERDA	$178,998
Lydall, Inc.	178,998
TOTALS	$357,996

Contractor: Lydall, Inc. (Manning Nonwoven Division)
Site: Green Island, Albany County
Contract Duration: 1/91 - 6/96
Key Words: product development, refrigeration, insulation, chlorofluorocarbons, CFC
Project Manager: Bob Carver (518) 862-1090, ext. 3242
Program: Buildings
Subprogram: Building Envelope Systems
Contract No.: 1585-EEED-BES-90

-> Evaluation of Mobile-Home Duct Systems

Evaluate design options for improving energy performance of mobile-home duct systems.

BACKGROUND

Mobile homes built and sold in New York State are manufactured in accordance with U.S. Department of Housing and Urban Development (HUD) standards that specify requirements for structural integrity and building envelopes. While HUD's current standards specify requirements for design and construction of duct systems, researchers have estimated that mobile-home duct systems can experience thermal-energy-distribution losses of 20 to 30 percent.

ACCOMPLISHMENTS

The project completed an evaluation of current design and construction methods for mobile-home duct systems. Twenty-six homes were monitored in New York, North Carolina, Florida, and Alabama to determine the energy losses attributable to duct systems. Detailed computer analyses also were performed to determine the cost-effectiveness of design improvements to duct systems.

FINDINGS AND CONCLUSIONS

Testing and analysis found that the duct systems installed in New York State and North Carolina homes have efficiencies of approximately 60 percent during heating mode. Alabama, Florida, and North Carolina efficiencies were found to be approximately 80 percent during cooling mode. Conductive losses were estimated to be larger than leakage and infiltration losses during heating. However, leakage and infiltration losses each were estimated to be larger than conductive losses during cooling. If duct efficiencies could be raised from 60 to 80 percent, a homeowner living in Syracuse, New York, would save an estimated $170 in heating costs annually. The incremental cost for improved ducts in a new home would be approximately $260 to the homebuyer. The simple payback would be 1.6 years. For a home located in Raleigh, North Carolina, increasing the duct efficiency from 60 to 80 percent would save an estimated $180 in heating costs, providing a simple payback of 1.5 years.

REALIZED OR ANTICIPATED BENEFITS

Project results could be used by mobile-home manufacturers to improve the energy efficiency of their products. Such improvements would significantly reduce the energy costs for heating and cooling homes.

TECHNOLOGY TRANSFER ACTIVITIES

A technical paper discussing the results of this project was presented at the 1996 American Council for an Energy-Efficient Economy summer session. HUD will distribute copies of the final report to the members of the Manufactured Housing Institute.

FUNDING	TOTALS
NYSERDA	$99,725
NC Alternative Energy Corporation	241,653
U.S. Dept. of HUD	147,633
Carolina Power & Light Company	50,000
Bonneville Power Authority	35,000
TOTALS	$574,011

Contractor: North Carolina Alternative Energy Corporation
Site: New York State, North Carolina, Florida, and Alabama
Contract Duration: 1/94 - 6/96
Key Words: assist business, HVAC, air quality, mobile homes, thermal distribution
Project Manager: Bob Carver (518) 862-1090, ext. 3242
Program: Buildings
Subprogram: Building Envelope Systems
Contract No.: 3035-EEED-BES-94

Demonstrate highly energy-efficient single- and multifamily homes throughout New York State.

BACKGROUND
NYSERDA, New York State utilities, product manufacturers, mortgage financiers, and builders had worked with NY-Star, Inc. to implement a voluntary home energy-rating system in New York State. Permanent performance specifications with new requirements were developed.

ACCOMPLISHMENTS
One two-family and 30 single-family demonstration homes were completed. More than 40 builders gained experience with new construction techniques and building products. These demonstrations successfully incorporated central ventilation systems without compromising the homes' overall performance.

FINDINGS AND CONCLUSIONS
Because of the successful incorporation of the central ventilation systems, NY-Star revised its certification standards to require this equipment in all new homes. The use of incentives ($4,000 for single-family homes and $5,000 for multifamily homes) linked with required recipient promotional activities was judged to have a positive effect in marketing the NY-Star program.

REALIZED OR ANTICIPATED BENEFITS
Consumers were able to purchase homes 25% more energy-efficient than conventional homes. The overall number of NY-Star homes built significantly increased while the demonstrations were being performed.

TECHNOLOGY TRANSFER ACTIVITIES
Extensive local advertising and open houses were used to educate consumers and other builders of the benefits of the new construction techniques and building products.

FUNDING	TOTALS
NYSERDA	
Petroleum Overcharge Funds	$125,000
TOTALS	$125,000

Contractor: 31 New York State builders
Site: Statewide
Contract Duration: 6/93 - 12/96
Key Words: assist business, residential efficiency, demonstration
Project Manager: Bob Carver (518) 862-1090, ext. 3242
Program: Buildings Research
Subprogram: Building Envelope Systems
Contract No.: 3037-3077-EEED-POP-94

Develop and produce window treatments and controls for fully integrated window blind/lighting systems.

BACKGROUND

In 1988, DECOTEX, then Comfortex, received start-up funding from NYSERDA to manufacture window blinds and deployment systems for residential use. Phase I of this project designed, developed, and tested a window energy-management system, including optimum design and selection of a motorized blind-deployment system, controls, instrumentation, power-conditioning components, and an integrated optimized lighting system. A novel proprietary foam-injected window cornice to accommodate these systems also was produced.

ACCOMPLISHMENTS

The contractor: (1) developed designs for several foam-core cornice styles to house the lighting and control systems, (2) completed the tooling requirements, and (3) undertook the demonstration and marketing efforts needed to commercialize the Luminel Cornices.

FINDINGS AND CONCLUSIONS

The contractor produced a decorative product that is attractive to the customer from a design perspective and that offers convenient high-efficiency indirect lighting. Its largest market appears to be the hospitality industry.

REALIZED OR ANTICIPATED BENEFITS

The integrated window-treatment system optimizes interior ambient climate and lighting with minimum energy use and loss due to window thermal loads.

TECHNOLOGY TRANSFER ACTIVITIES

A final report was completed and the Luminel Cornice was displayed at several window-treatment and lighting trade shows.

FUNDING	TOTALS
NYSERDA	$334,000
DECOTEX	507,820
TOTALS	$841,820

Contractor: DECOTEX
Site: Cohoes, Albany County
Contract Duration: 2/96 - 2/97
Key Words: product development, commercial, residential windows, lighting
Project Manager: Marsha Walton (518) 862-1090, ext. 3271
Program: Buildings
Subprogram: Lighting
Contract No.: 4062-IABR-BR-95

-> Recycled Plastic in Structural Insulated Building Panels

Evaluate structural insulated building panels made with recycled plastics.

BACKGROUND

Approximately 25 million square feet of structural insulated panels (SIPs) were manufactured for use in home construction in 1993. Expanded polystyrene (EPS) is used as the insulating material in the cores of 80 percent of these panels. They are manufactured with 100-percent virgin EPS and meet structural and fire building codes. This project's objective was to determine how much recycled EPS could be used in SIPs without adversely affecting their structural characteristics.

ACCOMPLISHMENTS

SIPs were fabricated with varying percentages of recycled EPS, ranging from 10 to 25 percent. The recycled EPS was collected from an SIP manufacturing operation. One panel was fabricated with materials collected from a third-party source. These panels were tested by independent laboratories to determine their structural and thermal properties. Tests also were performed on a mock construction site to evaluate the effects of actual handling and assembly processes on the panels. From these tests, the effect of varying percentages of recycled material on the performance of SIPs was determined.

FINDINGS AND CONCLUSIONS

The level of recycled material was found to have little effect on the panels flexural and tensile strength. Several panels made with recycled materials were found to have greater strength than panels made with 100-percent virgin materials. Testing revealed that, as the level of recycled material increased, panel transverse strength decreased. However, panels containing recycled material were found to have sufficient transverse strength to meet code requirements for residential walls and floors. Thermal testing revealed that, as the amount of recycled material increased, the R-value of the panel's core decreased slightly (2.3-percent decrease for 25-percent recycled materials as compared to 100-percent virgin material). Qualitative construction testing found no differences between panels made with 100-percent virgin material and recycled material in terms of handling, installing, connecting, and finishing. It was noted during panel manufacture that panel cores made with recycled materials were more difficult to cut with a hot wire. This difficulty resulted in some cores having minor surface irregularities. Another cutting method probably would be needed if panels were to be made with greater than 25-percent recycled material.

REALIZED OR ANTICIPATED BENEFITS

This project may promote building homes with SIPs, which are 15 to 20 percent more energy-efficient than conventional building materials. Thermal Foam, Inc., of Buffalo, an SIP manufacturer, also may benefit through reduced material costs for its product. Also, a new beneficial use for waste EPS was developed.

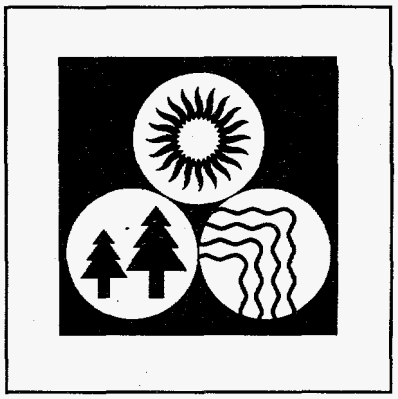
TECHNOLOGY TRANSFER ACTIVITIES

Project results have been disseminated by the Structural Insulated Panel Association through newsletters and conferences.

FUNDING	TOTALS
NYSERDA	$170,501
BASF Corporation Corp.	95,100
Structural Insulated Panel Assn.	239,075
TOTALS	$504,676

Contractor: Steven Winter Associates
Site: Buffalo, Erie County
Contract Duration: 3/95-12/95
Key Words: product development, environmental, buildings, insulation, recycling
Project Manager: Bob Carver (518) 862-1090, ext. 3242
Program: Buildings
Subprogram: Building Envelope Systems
Contract No.: 4107-IABR-BR-95

ENERGY RESOURCES



Benefits and Rationale

New York is heavily dependent on foreign petroleum and imported natural gas. With only 7.4% of the State's total primary energy supplies provided by in-State resources, R&D is necessary to keep more dollars spent on energy within our borders. The Energy Resources program is designed to expand the use of New York's own energy resources for electric generation and direct energy use, and as substitutes for petroleum-based products. In addition to diversifying the State's energy supply base, developing renewable and other indigenous energy resources can create new jobs in New York and provide numerous environmental benefits, including improved air quality.

The demand for renewable energy systems is increasing rapidly around the world. Due to NYSERDA's long-term commitment to renewable energy, there are an increasing number of renewable energy-based companies starting in New York that will manufacture products for sale both nationally and internationally.

The Energy Resources program focuses on renewable and other indigenous resources, including biomass, photovoltaics, wind, hydro, and natural gas, at diverse locations throughout the State. Other renewable resource projects, such as passive solar, daylighting, solar water heating, municipal wastes, and landfill gas, are supported in other NYSERDA program areas.

The Energy Resources program is driven by the needs of the end-user. The program strives to bring multiple perspectives and technical disciplines together to become a catalyst for innovation. Through a close working relationship with State and national stakeholders (including utilities and the federal government), a research plan is developed for each component of the Energy Resources program to fill in the gaps of private and utility sector research; support the efforts of small, start-up companies as they strive to achieve their goals; and continue a strong research base at our universities. As the utility industry evolves, NYSERDA will try to address any future research gaps that might arise in renewable and indigenous resources, within our limited budget.

Global demand for *solar photovoltaic* (PV) modules grew by 13% in 1996, with the majority of the demand in developing countries. Most of the market is for smaller-scale electric loads that are not connected to the utility grid, such as remote homes, lighting, monitoring, and communications, as well as consumer products. The scale of cost-effective PV applications and their market will continue to increase as the price of PV power is reduced. The goal of NYSERDA's PV program is to use New York's skilled labor and facilities to place it in a leadership position to develop and test innovative PV technology, products, and systems for New York markets and export. Future success in the PV area can be measured by the annual increase in the manufacture and sale of PV products made in New York; the development of a sustainable base of PV manufacturers; and a significant increase in the amount of unsubsidized, high-value, and building-integrated PV installed in New York within five years.

New York offers opportunities for *wind* energy development in areas with moderate wind resources. Advances in turbine technologies have increased and will continue to increase wind energy's competitiveness due to lower installed costs, increased reliability, and improved performance at moderate wind speeds. Over the long term, NYSERDA's goal is to establish wind as a viable energy source for distributed and specialty power generation applications and to work with New York businesses to manufacture components for the small-scale wind turbine industry. Success in the wind area will be determined by the level of interest power or energy service companies have in pursuing markets for wind power in New York and through the establishment of commercial enterprises in the business of manufacturing wind energy system components.

New York has considerable *biomass* supplies; more than 60% of the State's land is forested and more than 1.8 million tons of waste wood are generated annually across the State. Combustion of wood for residential heat,

industrial applications, and utility production of electricity comprises 14% of New York's renewable resource use and is the second largest renewable resource contributor after hydropower. Converting industrial organic waste into high-value fuels and energy-intensive chemicals also has great potential. Innovative technologies are emerging that can turn waste, such as papermill sludge, into revenue-producing chemicals.

Future efforts in biomass will focus on three areas: (1) converting low-cost feedstocks, such as agricultural, manufacturing, and clean municipal wastes, into fuel and chemical products; (2) developing industries, such as enzyme manufacturing, that support the production of biofuels; and (3) expanding the use of willow plantations as both a source of energy and a crop for New York farmers. Within five years, the biomass program will demonstrate sustainable operation of a levulinic acid facility in Glens Falls; demonstrate the value of co-firing wood in utility-scale pulverized coal power plants; create the opportunity to make a competitive product from New York biomass resources; and establish 2,000 acres of willow plantations on private farmland.

Indigenous natural gas provides New York with 1.5% of its natural gas demand. Approximately $5 billion is exported from the State each year to import gas to meet the rest of the demand. NYSERDA is striving to improve this imbalance through a highly collaborative relationship with the oil and gas industry designed to bring advanced exploration technologies into the State. Natural gas development is an information-intensive, technologically driven business. New York's industry primarily comprises small independents that lack the research staff or funding to exploit innovative technology or identify new exploration targets. Beyond the evaluation of new technology, NYSERDA has initiated a technical seminar series with the Independent Oil and Gas Association of New York to broaden the reach of our research program. Success will be measured by an increase in the number of new exploration companies working in New York, the adoption of new exploration techniques by industry, and a measurable increase in the amount of natural gas produced annually from targeted formations.

New York and the Northeast have abundant potential *hydropower* generating capacity. Many hydropower plants were installed decades ago and face relicensing, which involves more stringent environmental requirements that can increase cost and decrease capacity. Also, the restructuring of the electric utility industry will have an impact on the competitiveness of New York State's hydropower facilities. This uncertainty makes it difficult to invest in new or existing hydropower capacity. NYSERDA is looking for ways to help keep hydropower competitive given this period of regulatory change.

Goals

- Maximize the use of renewable and indigenous energy resources in applications where the value to the end-user exceeds the cost of alternative solutions.
- Focus on New York's industrial and research strengths to increase the competitive advantage of State firms in supplying products to the growing international market for renewable energy.
- Improve New York's economic climate by establishing strong coalitions to commercialize innovative energy resource technologies.

Demonstrate electric-utility-connected photovoltaics.

BACKGROUND
Solar energy, through photovoltaics (PV), provides electric power on a renewable basis with minimal environmental impacts. This demonstration project provides New York State's electric utility industry with the opportunity to evaluate the long-term performance of PV systems.

OBJECTIVE
To demonstrate an 85-kW utility-grid-intertied PV system.

DESCRIPTION
An 85-kW PV system was installed on the SUNY/Farmingdale campus on Long Island. The system includes the following sub-systems: (1) a 23-kW roof-mounted module, (2) a 23-kW single-axis tracking system mounted on the ground, (3) a 23-kW concrete pier-mounted system, and (4) a 16-kW ground-mounted system installed as a demand-side management application next to the campus day care center. A data-acquisition system also was installed. The system is being operated, maintained, and monitored for two years, with results reported.

BENEFITS
Determining how local operating conditions influence performance will help in optimizing subsequent PV installations. The operating experience acquired by downstate building managers, electric utilities, code inspectors, performance contractors, engineers, construction contractors, and the PV industry will help implement photovoltaic projects at other sites. The project will help pave the way for extensive use of distributed photovoltaic systems in grid-connected applications on Long Island.

SCHEDULE AND STATUS
The systems are not operational because of problems with SUNY-Farmingdale's electric distribution lines. When this is corrected, trouble-shooting of the PV systems will commence. System acceptance has not yet occurred.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$268,000	0	$639,603
Petroleum Overcharge Funds	500,000	0	500,000
PVUSA	178,625	0	178,625
TOTALS	$946,625	0	$1,318,228

Contractor: Integrated Power, Inc.
Site: East Farmingdale, Suffolk County
Contract Duration: 8/88 - 11/97
Key Words: renewable, university, solar, photovoltaic, utilities
Project Manager: Jennifer Harvey (518) 862-1090, ext. 3264
Program: Energy Resources
Subprogram: Solar/Wind, Petroleum Overcharge
Contract No.: 1784-ERER-ER-92; 1369-ERER-ER-89

-> Solar Radiation and Farmingdale PV Installation Monitoring

Monitor four solar photovoltaic systems at SUNY/Farmingdale.

BACKGROUND

As photovoltaic (PV) solar power becomes more economical, operational data from installed PV systems will be needed to calculate the cost-effectiveness of specific PV installations.

OBJECTIVE

To gather operational PV data by monitoring four PV installations at the SUNY/Farmingdale campus, and correlate the performance of the Farmingdale PV systems with Long Island Lighting Company's (LILCO's) system characteristics and customer usage patterns.

DESCRIPTION

The contractor will monitor and evaluate the performance of the four Farmingdale PV systems through December 1997. The contractor will automatically retrieve and archive data from the Farmingdale PV installations and summarize daily and monthly performance for each PV system. Farmingdale PV performance data will be used to evaluate the effects of PV generation on LILCO's power-generation and delivery system, on different classes of LILCO customers, and on Long Island's environment.

BENEFITS

The performance data from the Farmingdale PV systems provide planners with operational data from installed PV systems. Insolation and PV performance data will help determine the value of photovoltaic power to the utility system.

SCHEDULE AND STATUS

Solar radiation monitoring is completed and monitoring of the SUNY-Farmingdale PV system is on hold because the system is off-line.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$152,970	0	$152,970
Long Island Lighting Company	15,471	0	15,471
TOTALS	$168,441	0	$168,441

Contractor: Ascension Technology, Inc.
Site: East Farmingdale, Suffolk County
Contract Duration: 1/96 - 12/97
Key Words: renewable, electricity, photovoltaics, sunlight, solar energy, utilities
Project Manager: Jennifer Harvey (518) 862-1090, ext. 3264
Program: Energy Resources
Subprogram: Solar/Wind
Contract No.: 3006N-ERTER-ER-94

-> SUNY/Farmingdale and SUNY/Albany Photovoltaic Systems Maintenance and Monitoring

Monitor and maintain two utility grid-connected photovoltaic systems.

BACKGROUND

NYSERDA installed four photovoltaic (PV) systems totalling 85 kW at the SUNY/Farmingdale campus on Long Island in mid-1992. Problems have plagued start-up these systems and it has become apparent that NYSERDA needs independent technical representation to perform day-to-day maintenance, coordinate warranty repairs, monitor the systems, and train SUNY/Farmingdale personnel so they are prepared to take over system ownership in two years. This project will provide that service.

NYSERDA is installing a 16.6-kW PV system at SUNY/Albany's Center for Environmental Sciences and Technology Management, which is to be completed in 1997. This project also will provide the services described above for this PV system.

OBJECTIVE

To monitor and maintain the PV systems at SUNY/Farmingdale and SUNY/Albany.

DESCRIPTION

This project will: (1) maintain the Farmingdale and Albany PV systems, (2) gather data from the systems, and (3) provide hands-on training for SUNY/Farmingdale and SUNY/Albany personnel.

BENEFITS

This project will ensure that the SUNY/Albany and SUNY/Farmingdale PV systems run reliably. It also will train campus maintenance personnel on operation of the systems to prepare them for system ownership.

SCHEDULE AND STATUS

The contractor is coordinating with the PV system installer for the SUNY CESTM building and is starting design of the data analysis system. No work is currently being done on the SUNY-Farmingdale PV system since it is not operational because of problems with the SUNY-Farmingdale generating grid.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	0	$110,000	$220,000
TOTALS	0	$110,000	$220,000

Contractor: AWS Scientific
Site: Farmingdale, Nassau County, and Albany, Albany County
Contract Duration: 12/96 - 12/98
Key Words: renewable, university, solar, photovoltaic, utilities
Project Manager: Jennifer Harvey (518) 862-1090, ext. 3264
Program: Energy Resources
Subprogram: Solar/Wind
Contract No.: 4500-ERTER-ER-97

-> Combining Satellite- and Ground Measurement Resources

Develop methods to access and validate satellite-based solar radiance data.

BACKGROUND

Solar insolation data are needed for systems designers and sophisticated PV consumers to determine the most efficient PV system for specific applications. For example, such data will help to optimize PV system location, orientation, and tilt angle, and will help evaluate the need for a tracking system. Ground solar radiation-monitoring stations accurately monitor solar radiation; however, the satellite is the most accurate option for determining solar radiation.

OBJECTIVE

To develop and test ways to provide high-density solar radiation-resource capability for specific locations using satellite data. Solar radiation data gathered since 1990 from southeastern New York by NYSERDA and the New York Power Authority will validate the approaches.

DESCRIPTION

The contractor will verify and archive solar radiation data from NYSERDA's nine-site solar monitoring network. Data will be checked for site-to-site calibration consistency and adjusted if necessary. Satellite images for the same period will be acquired. Algorithms that compare satellite with ground network data will be implemented, and methods to correct inconsistencies will be developed. Preliminary research will identify practical ways to process satellite and network data in routine production. The contractor will collaborate with the National Renewable Energy Laboratory to plan and hold a workshop from a solar data user's perspective.

BENEFITS

This project will increase and make available solar resource data in New York State. The data will probably be available on the Internet. Data are necessary to optimize the design of future commercial PV systems. Data will help utilities to determine the interaction between PV systems and site- and time-specific load requirements, and monitor the output of dispersed PV systems on the utility grid.

SCHEDULE AND STATUS

The draft final report has been received.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$65,857	0	$131,714
National Renewable Energy Lab.	163,073	0	326,160
The University at Albany	23,244	0	46,474
TOTALS	$252,174	0	$504,348

Contractor: The Research Foundation of SUNY, The University at Albany
Site: Albany, Albany County
Contract Duration: 3/95 - 6/97
Key Words: renewable, university, electricity, photovoltaics, sunlight, solar energy
Project Manager: Jennifer Harvey (518) 862-1090, ext. 3264
Program: Energy Resources
Subprogram: Solar/Wind
Contract No.: 4146-ERTER-ER-95

-> New York State Police Radio Communication Photovoltaic Demonstration

Demonstrate and evaluate photovoltaics for powering two remote New York State Police radio communication stations.

BACKGROUND

The New York State Police (NYSP) operate and maintain a network of 98 radio base stations. The Governor's Task Force on Information Resource Management is charged with overseeing a comprehensive upgrade of the State's radio communication system and designated the NYSP as the lead agency for implementing this upgrade. The upgrade, which will take place over the next 5-10 years, involves reexamining all existing radio communication stations and constructing new ones.

This project will integrate photovoltaics (PV) into the existing wind/propane generator systems at two NYSP communication sites to provide the operational and reliability data necessary for PV to be considered in all phases of design and acquisition of the upgraded State radio communication system. The ability to use PV to power a radio communication system will allow the upgraded system to be designed for optimal radio coverage without being constrained to sites near existing power lines, allowing for a reduction in the number of towers (at $500,000 each).

OBJECTIVES

To: (1) establish operational characteristics and reliability of using photovoltaics integrated in a wind/engine-generator system as a high-reliability power source in the upgraded NYS radio communications system, and (2) determine the potential savings in using PV in the upgraded communications system.

DESCRIPTION

Two PV systems will be installed at two Adirondack mountaintop radio communication towers to augment the present wind/generator/battery systems. System performance will be monitored for 18 months.

The NYSP will be integrally involved in the program, transporting the systems to the sites via helicopter, providing installation and maintenance assistance, collecting data from the systems, and performing analyses on the effects of using PV in its upgraded radio communication system. The NYSP will lead two studies: one to determine the number of radio communication stations that could be saved in one zone (three to four counties) by locating the sites without regard to power availability, and the other to determine the cost difference between using PV power and extending line to a remote site. Results of these studies and the field demonstrations will be presented to key players responsible for designing and implementing the Statewide radio communication system upgrade.

BENEFITS

This project will foster the use of PV in NYS in a high-value application. It will also place Direct Global Power, a start-up New York company, in a leadership position for installing PV power for radio communication systems worldwide.

SCHEDULE AND STATUS

The project has just begun.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	0	$125,000	$125,000
New York State Police	0	136,000	136,000
Direct Global Power	0	24,230	24,230
TOTALS	0	$285,230	$285,230

Contractor: Direct Global Power
Site: Cathead Mtn., Hamilton County; Black Mtn., Washington County; and Schenectady, Schenectady County
Contract Duration: 3/97 - 2/99
Key Words: renewable, hybrid, solar, photovoltaic
Project Manager: Jennifer Harvey (518) 862-1090, ext. 3264
Program: Energy Resources
Subprogram: Solar/Wind
Contract No.: 4502-ERTER-ER-97

-> Remote Residential Photovoltaic-Hybrid Monitoring

Monitor and evaluate performance of photovoltaic (PV) hybrid systems at remote residences.

BACKGROUND

More than 500 rural New York State residences are not connected to the utility grid. Homeowners more than 500 feet from a utility power line must pay high-priced line-extension costs to interconnect with the utility. Utilities locally and nationally have expressed interest in offering standardized, self-contained power systems that contain PV as well as a generator (PV-hybrid system) as an alternative to expensive line extensions. Several technical questions are relevant before utilities can develop remote PV-hybrid service programs.

OBJECTIVE

To gather operational data from three PV-hybrid systems that provide electricity to three remote residences.

DESCRIPTION

This program, a collaborative effort among NYSERDA, the New York Power Authority, New York State Electric & Gas Corp., and Niagara Mohawk Power Corp. will develop one or more standardized PV-hybrid systems to meet the electricity needs of remote residential customers. Three PV-hybrid systems will be installed at different households by the participating utilities. Each PV-hybrid system will consist of a PV array, battery, engine-generator, control system, inverter, and equipment shelter. NYSERDA is cosponsoring and independently managing this project to monitor and evaluate the PV-hybrid systems. This project will: (1) develop a plan and install systems to monitor three remote PV-hybrid systems; (2) gather operational data from each system for two years; (3) survey the homeowners' experiences with the systems; (4) analyze the data and evaluate the performance of each system; (5) recommend improvements; and (6) provide materials to inform and educate utility companies, PV system manufacturers and installers, and others.

BENEFITS

The project will provide experience and data for utilities to help them meet the needs of remote customer loads through a renewable energy option.

SCHEDULE AND STATUS

The draft final report has been received. Monitoring for all three PV-hybrid systems is complete.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$102,504	0	$102,504
New York Power Authority	20,700	0	20,700
New York State Electric & Gas Corp.	25,000	0	25,000
Niagara Mohawk Power Corp.	70,000	0	70,000
TOTALS	$218,204	0	$218,204

Contractor: Board of Regents, New Mexico State University, Southwest Technology Development Institute, Las Cruces, New Mexico
Sites: Essex County, St. Lawrence County, and Clinton County
Contract Duration: 10/93-06/97
Key Words: renewable, solar, photovoltaics, hybrid, utilities
Project Manager: Jennifer Harvey (518) 862-1090, ext. 3264
Program: Energy Resources
Subprogram: Solar/Wind
Contract No.: 3109-ERER-ER-94

-> Photovoltaic Cellular-Phone Power Supply and Charger

Develop and manufacture urethane-encapsulated photovoltaic panels for cellular-phone power supply and charging.

BACKGROUND

NYSERDA has been working with SunWize to develop urethane-encapsulated solar cells. These solar cells are now sold commercially and ongoing R&D is improving manufacturing techniques and developing new product lines. SunWize has identified several complementary product and marketing strategies to commercialize the technology, including the development of personal photovoltaic (PV) chargers for cellular telephones.

The worldwide market for wireless telecommunications and portable electronics is growing geometrically. Cellular phones and radio-telephones are the technology of choice in both urban centers and rural areas of developing countries. This product will be marketed worldwide, especially in developing countries where new communication infrastructures are wireless.

This product will also be targeted to domestic customers who are in the field, such as insurance adjusters, field engineers, geologists, conservationists, surveyors, the military, emergency personnel, petroleum and mineral field personnel, and others.

OBJECTIVE

To develop a SunWize-brand PV cellular-telephone power supply and charger.

DESCRIPTION

Performance parameters and a conceptual design will be developed. SunWize will build and test a prototype and use the results to evaluate the manufacturing techniques, performance, and visual impact of the product. Manufacturing methods will be developed and production molds and other tools for volume production will be procured.

BENEFITS

The product will allow for cellular-phone operation where power is not accessible. It will be designed to operate a cellular phone directly (when used in direct sunlight), or recharge the batteries. This product is expected to generate up to 15 new jobs in the first two years.

SCHEDULE AND STATUS

The project is under way.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	0	$196,193	$196,193
SunWize	0	220,419	220,419
TOTALS	0	$416,612	$416,612

Contractor: SunWize Specialty Products, Inc.
Site: Kingston, Ulster County
Contract Duration: 3/97 - 7/98
Key Words: renewable, product development, solar, photovoltaics
Project Manager: Jennifer Harvey (518) 862-1090, ext. 3264
Program: Energy Resources
Subprogram: Solar/Wind
Contract No.: 4552-ERTER-ER-97

-> Solar Home System for the Chihuahua Rural Electrification Project

Develop and test photovoltaic systems to serve remote homes in Chihuahua, Mexico.

BACKGROUND

More than 7,000 villages within the State of Chihuahua, Mexico, have no access to basic electricity services for lights, radios, and small equipment. A revolving loan program will be established by the State of Chihuahua and the U.S. government to finance the purchase of photovoltaic (PV)-based energy systems for the rural population in Chihuahua. Applications will include electrification for rural homes, village power systems, water-pumping systems, and systems that support infrastructure and development.

SunWize presently offers a line of packaged PV power systems known as the SolaGen-Pac,™, consisting of a PV module, a sealed lead-acid battery, and a system controller housed in a lockable enclosure. These systems will be modified to produce a line of solar home-system products to meet the needs of this large Mexican market.

OBJECTIVE

To develop and test a PV/battery system to serve home-power needs in remote areas of developing countries.

DESCRIPTION

SunWize will design, specify, manufacture, test, and deliver 200 solar home systems based on a modification of SunWize's SolaGen-Pac™ product line. The systems will be pre-assembled and factory-tested, and feature state-of-the-art components, including a microprocessor-based controller with low-battery disconnect, sealed deep-cycle battery, single-crystal PV modules, and complete accessories in a lockable enclosure.

BENEFITS

This product will provide solar-generated home power for large markets in developing countries and smaller domestic markets. Developing this product for large-quantity sales in foreign markets will allow for bulk component purchases and more efficient manufacturing that will reduce costs for domestic systems. This product has potential applications for remote homes or cabins in New York State.

This project will create job growth and export opportunities for SunWize. The product's projected revenues are $200,000 in the first year, and up to $2.5 million in the fifth year.

SCHEDULE AND STATUS

The project has just begun.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	0	$114,495	$114,495
State of Chihuahua, Mexico	0	90,975	90,975
Sandia National Labs	0	99,000	99,000
SunWize	0	9,776	9,776
Siemens Solar Industries	0	3,990	3,990
TOTALS	0	$318,236	$318,236

Contractor: SunWize Energy Systems
Site: Kingston, Ulster County, and Chihuahua, Mexico
Contract Duration: 2/97 - 2/99
Key Words: renewable, solar, photovoltaics, product development, international
Project Manager: Jennifer Harvey (518) 862-1090, ext. 3264
Program: Energy Resources
Subprogram: Solar/Wind
Contract No.: 4533-ERTER-ER-97

-> Photovoltaic-Hybrid System Demonstration

Evaluate photovoltaic-hybrid systems, develop an efficient controller, and integrate hybrid system with ice-maker.

BACKGROUND

Systems containing photovoltaics, batteries, and an engine-generator (PV-hybrid) or photovoltaics and batteries (PV) are cost-effective options for providing electricity to many remote loads. This project builds on a previous NYSERDA project to monitor PV-hybrid systems installed by the New York Power Authority, Niagara Mohawk Power Corp., and New York State Electric & Gas Corp. Two of these systems were manufactured by SunWize Energy Systems of Kingston.

OBJECTIVES

To: (1) determine the performance and reliability of skid-mounted PV-hybrid systems in different but replicable applications and geographic locations; (2) develop and test a "smart" photovoltaic/generator hybrid control system designed to improve energy efficiency by 20 percent or more; and (3) package a PV-hybrid system with an ice-maker to expand the markets for PV-hybrid systems.

DESCRIPTION

Under Phase I, SunWize will prepare site-selection criteria and help identify eight viable government and non-profit sites. The systems will be specified and constructed on an assembly line. SunWize will provide two years of maintenance and arrange for two years of monitoring for eight installations. The ninth system will be tested at an independent laboratory.

In Phase II, SunWize will develop and write PV-hybrid control-system software for more efficient operation. The control system will be installed, monitored, and evaluated in the existing New York State Electric & Gas hybrid system in Plattsburgh. The new control system will be integrated into the SunWize hybrid-system product line.

In Phase III, SunWize will integrate its existing WPVGEN1800 PV-hybrid system with an existing commercial ice machine of approximately 600-1000 lb/day capacity. This system will be fabricated, assembled, and tested at the SunWize manufacturing facility, and then tested at a fishing cooperative in Mexico.

BENEFITS

Phase I will identify new high-value applications for PV, increase technical understanding of PV-hybrid systems, familiarize government and non-profit organizations with PV, and reduce PV systems cost. Phase II will increase the market size for SunWize's New York-based production line through increased economic feasibility of the end-product and a competitive market advantage. Phase II will increase product sales through expanding markets.

SCHEDULE AND STATUS

Six PV-hybrid systems are installed. Negotiation for the site agreement of the Mexican PV-hybrid system is under way.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$366,142	$140,130	$506,272
SunWize Energy Systems, Inc.	54,481	109,935	164,416
Sandia National Laboratory	62,382	4,200	66,582
State of Chihuahua, Mexico	0	41,000	41,000
TOTALS	$483,005	$295,265	$778,270

Contractor: SunWize Energy Systems, Inc.
Site: Kingston, Ulster County
Contract Duration: 9/94 - 2/98
Key Words: renewable, solar, photovoltaics, hybrid, product development
Project Manager: Jennifer Harvey (518) 862-1090, ext. 3264
Program: Energy Resources
Subprogram: Solar/Wind
Contract No.: 4041-ERTER-ER-95

-> Titanium Dioxide Photovoltaic Cell Product and Market Development

Identify products that can incorporate new type of solar cell.

BACKGROUND

A new type of solar cell based on titanium dioxide (TiO_2) was developed at the Ecole Polytechnique Fédérale de Lausanne, Switzerland. This solar cell is based on technology more closely related to photosynthesis than solid-state electronics. This technology is promising for solar cells because the materials required are low-cost, very little material is needed, and the cells are easy to make in the laboratory. In addition, TiO_2 solar cells can be made in a variety of colors and levels of transparencies to meet customer requirements.

OBJECTIVE

To bring together the appropriate project partners to commercialize the TiO_2 technology.

DESCRIPTION

Potential markets, products, and partners will be identified and developed, and then products need to be made and commercialized. Because of the current state of TiO_2 technology, the focus will be first on developing small, indoor applications with relatively short lives. These applications can be commercialized in the very near term. As long-term outdoor stability is demonstrated and improved, larger applications for the outdoors can be developed. Direct Gain will identify and work with New York product manufacturers to integrate TiO_2 solar cells into their products. Direct Gain also will identify markets for the products and steps that need to be taken to integrate the solar cells into the products.

Standish (Wisconsin), a liquid-crystal display manufacturer with the capability of manufacturing TiO_2 solar cells, will fund research into manufacturing the cells.

The National Renewable Energy Laboratory (NREL) is working to optimize the TiO_2 solar cell technology, including improving longevity, increasing stability and efficiency, and developing a detailed understanding of how it works.

BENEFITS

This project will facilitate technology transfer and integration of TiO_2 solar cells into a variety of products. Currently, little is known about the skills required to integrate these new solar cells into products, including any potential mounting and integration issues. Direct Gain expects to increase its staff within the next six months, partially as a result of this effort.

SCHEDULE AND STATUS

Work at NREL started in the summer of 1995; however, a Cooperative Research and Development Agreement (CRADA) with NREL has not yet been signed. Direct Gain has identified several New York companies that are interested in incorporating solar cells into products they manufacture.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$50,000	0	$50,000
National Renewable Energy Laboratory	100,000	$100,000	300,000
Standish	100,000	0	100,000
TOTALS	$250,000	$100,000	$450,000

Contractor: Direct Gain, LLC
Site: Cottekill, Ulster County
Contract Duration: 2/96 - 12/96
Key Words: renewable, product development, solar, photovoltaics
Project Manager: Jennifer Harvey (518) 862-1090, ext. 3264
Program: Energy Resources
Subprogram: Solar/Wind
Contract No.: 4348-ERTER-ER-96

-> Improved Photovoltaic Systems Using Diamond-Like Nanocomposite Films

Develop coating to protect solar cells.

BACKGROUND

The use of photovoltaic technology for large-scale generation of electricity and other more cost- and lifetime-sensitive applications is limited by several factors, including long-term environmental stability, efficiency, and cost. Advanced Refractory Technologies, Inc. (ART) has been developing a diamond-like nanocomposite (DLN) technology and has established a state-of-the-art facility for large-area deposition. DLN technology could be used to replace current encapsulation approaches, resulting in greater PV product-design flexibility, reduced cost, and improved efficiency.

OBJECTIVES

To: (1) demonstrate the feasibility of coating various types of cells with DLN coatings without physical degradation, (2) study environmental-protection effects of the coatings, (3) design and fabricate multilayer anti-reflective coatings to improve coupling and measure transmission, and (4) study the effect of coatings on spectral and photovoltaic response.

DESCRIPTION

ART will work with SUNY/Buffalo, Golden Photon, Direct Gain, and Conserval to acquire solar cells and substrate materials for coating. Substrates will be coated using a plasma-assisted ion beam. The effects of varying dopant, dopant concentration, precursor type, deposition pressure, plasma current, substrate potential, and multilayering will be investigated. Samples will be characterized and optimized for environmental resistance. With the assistance of optical coating-design software, ART will optimize the refractive index of multilayer DLN coatings to maximize cell efficiency. Photovoltaic response of the coated cells will be measured.

BENEFITS

This project's goal is to commercialize the technology. Any commercialization arrangements will bring revenues and high-technology jobs to New York State. ART has already added four positions related to DLN technology during the last year, and plans to add six to eight additional positions within the next 12 months.

SCHEDULE AND STATUS

Coatings have been deposited on various solar cells and have been tested. Improvements to the coatings are being developed.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$99,788	0	$99,788
Advanced Refractory Technologies	23,558	0	23,558
Golden Photon	20,000	0	20,000
SUNY/Buffalo	6,758	0	6,758
Direct Gain	7,500	0	7,500
Conserval	7,500	0	7,500
TOTALS	$165,104	0	$165,104

Contractor: Advanced Refractory Technologies, Inc.
Site: Buffalo, Erie County
Contract Duration: 3/96 - 3/97
Key Words: product development, solar, renewable, photovoltaics, coatings
Project Manager: Jennifer Harvey (518) 862-1090, ext. 3264
Program: Energy Resources
Subprogram: Solar/Wind
Contract No.: 4306-ERTER-ER-96

-> Photovoltaics with Porous Silicon

Prepare, demonstrate, and optimize photovoltaic devices based on porous silicon.

BACKGROUND

Low-cost solar cells are not efficient enough to generate electric power competitively. Porous silicon, produced when silicon is immersed in an acidic solution through which a constant direct current is passed (anodization), promises to be an inexpensive, efficient material from which to manufacture photovoltaic devices. Anodization produces micron-high silicon columns as thin as 5 or 10 nanometers. These columns are thought to give porous silicon unusual properties, such as visible photoluminescence; however, many properties of porous silicon have not been established.

OBJECTIVE

To determine if porous silicon can be used to produce less expensive, efficient photovoltaic solar cells by: producing porous silicon consistent with the desired properties, (2) establishing porous silicon's optical and electrical properties, (3) fabricating and testing high-quality electrical contacts, (4) fabricating and evaluating porous-silicon-based photovoltaic solar cells, and (5) minimizing the cost of the entire manufacturing process.

DESCRIPTION

The contractor will grow the porous-silicon samples in an electrochemical chamber using lasers and optics to monitor and control growth. Relevant characteristics, including photon absorption, luminescence, carrier lifetime and collection, bandgap, and absorption coefficient, will be examined using photoluminescent spectroscopy, Raman scattering, time-resolved pump and probe spectroscopy, and dark and photo-conductivity. The results will be used to design, manufacture, and test experimental photovoltaic cells. Phase II of this project will concentrate on improving top electrical contacts by investigating three types: indium tin oxide, conducting polymer, and semitransparent metal. Phase II will also investigate different solar cell designs and lower-cost fabrication methods.

BENEFITS

This research could lead to developing an inexpensive, efficient solar cell and lower the cost of producing electricity from photovoltaics.

SCHEDULE AND STATUS

NYSERDA is awaiting a final project report.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$265,000	0	$265,000
Rochester Gas and Electric Corp.	190,000	0	190,000
AT&T (in-kind)	28,800	0	28,800
Xerox (cash and in-kind)	20,000	0	20,000
CVC (in-kind)	10,000	0	10,000
TOTALS	$513,800	0	$513,800

Contractor: University of Rochester
Site: Rochester, Monroe County
Contract Duration: 1/93 - 6/97
Key Words: renewable, university, solar, federal, photovoltaics, semiconductors, utilities
Project Manager: Jennifer Harvey (518) 862-1090, ext. 3264
Program: Energy Resources
Subprogram: Solar/Wind
Contract No.: 1901-ERER-ER-93

Develop techniques to manufacture photovoltaic panels encapsulated in urethane.

BACKGROUND

Most photovoltaic (PV) modules are somewhat fragile, which limits integrating them into products that require shaped, lighter-weight, or tougher PV modules. The capability to manufacture flexible or shaped PV modules will open the market. Using urethane to encapsulate PV circuits produces modules that can be flexible and made to the shape and size specified by the customer. SunWize Specialty Products (SSP), a subsidiary of Besicorp, was created to develop and manufacture urethane-encapsulated PV modules from purchased PV cells.

OBJECTIVE

To lower the cost and increase the design flexibility of specialty photovoltaics.

DESCRIPTION

Manufacturing techniques will be developed that allow PV modules to be produced in sizes and shapes required by customers, making it possible to incorporate PV into more products. Module-encapsulation techniques will be improved and qualified, and tooling for the complete, precise interconnection of the solar-cell circuit in a fixture will be designed.

In Phase I, SSP will improve and test a new PV module-manufacturing technique that uses a clear urethane compound poured into a form containing the PV circuit and then cured. Several urethane materials will be tested to determine degradation mechanisms. SSP also will design tooling for the complete, precise interconnection of the solar-cell circuit in a fixture, to both improve product quality and increase automation of production.

In Phase II, SSP will design and build machinery to automate the interconnection of solar cells. Specifically, equipment to solder or bond individual cells into a circuit will be designed, and required automated methods will be developed to load and unload solar cells from this equipment. SSP will also automate the urethane-dispensing system. An automated system will be developed to index interconnected modules under a multiple-head manifold system, dispense the urethane over the modules, and move them to a heated room for curing.

BENEFITS

This project, a key factor in setting up a PV-module-manufacturing facility in the Hudson Valley, will promote business growth and increase the number of viable PV products. The modules will be sold nationally and internationally for incorporation into consumer products, in addition to being integrated into PV products that SSP is planning to manufacture.

SCHEDULE AND STATUS

Phase I is complete. SSP is manufacturing and selling urethane-encapsulated solar cells. Alternative soldering methods and methods to automate processes are being developed in Phase II.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$332,470	0	$332,470
Besicorp Group Inc.	504,704	0	504,704
TOTALS	$837,174	0	$837,174

Contractor: Besicorp Group Inc.
Site: Kingston, Ulster County
Contract Duration: 3/94 - 12/97
Key Words: renewable, product development, solar, photovoltaics
Project Manager: Jennifer Harvey (518) 862-1090, ext. 3264
Program: Energy Resources
Subprogram: Solar/Wind
Contract No.: 3155M-ERTER-ER-94

-> Powerguard™ -- Commercialization of Market-Ready Photovoltaic Roofing

Develop manufacturing processes and facilities to make PowerGuard™ roof tiles.

BACKGROUND

Power Light Corporation developed and demonstrated the PowerGuard™ technology, a building-integrated photovoltaic (PV) system consisting of tiles that act as both a roof and a solar power plant. The company's New York manufacturing partner, T. Clear Corporation, manufactures Lightguard Ballasted Roof Insulation,™ which has a structure similar to PowerGuard™, making it a perfect partner to manufacture the PowerGuard™ roof tiles. Prototype testing is completed and the product has been demonstrated at six sites. This project will develop semi-automated manufacturing capability for the product. Markets for this product are promising, as grid-connected PV energy is approaching economic feasibility in selected locations, providing the focus is on customer-sited building-integrated PV. Southeastern New York has some of the best economics for grid-connected PV because of its retail electric rates, the coincidence between sunlight and peak electricity demands, and the fairly good solar resource.

OBJECTIVE

To develop a facility to manufacture PowerGuard™ roof tiles in Mount Marion, NY.

DESCRIPTION

Manufacturing processes and stations will be developed for manufacturing PowerGuard™ at T. Clear's Mt. Marion facility. The project will address: semi-automated backerboard fabrication, weather-resistant coating application, cure-coating station, cure-rack station, and vacuum lift to place the PV laminates on the backerboard for curing. Several PowerGuard™ systems are scheduled to be demonstrated in New York through a New York Power Authority program.

BENEFITS

By saving the cost of the roofing material and eliminating the extra PV mounting costs, PowerGuard™ reduces the cost of grid-connected PV systems, expanding domestic markets. Passive energy savings occur from stand-off roof shading and R-10 polystyrene insulation. PowerGuard™ can be installed quickly and easily with no roof penetrations within existing roofing industry weight, wind speed, and seismic standards. This project will result in the development of a New York manufacturing facility, providing three jobs immediately, and 95 jobs over the next four years, as well as tax benefits. The projected revenues for the product are $6.9 million in the first year, increasing to $44.8 million in the fifth year.

SCHEDULE AND STATUS

The project is under way.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	0	$199,987	$199,987
Power Light Corporation	0	224,568	224,568
TOTALS	0	$424,555	$425,555

Contractor: Power Light Corporation
Site: Mount Marion, Ulster County
Contract Duration: 3/97 - 5/98
Key Words: renewable, product development, solar, photovoltaics
Project Manager: Jennifer Harvey (518) 862-1090, ext. 3264
Program: Energy Resources
Subprogram: Solar/Wind
Contract No.: 4534-ERTER-ER-97

-> Small-Scale Photovoltaic Power Electronics Development

Develop series of electronic controllers for photovoltaic systems of up to 175 watts.

BACKGROUND

Most current small-scale and portable photovoltaic (PV) applications require careful matching of the PV modules to the application load to achieve reasonable PV performance. Improper matching results in the PV modules operating at suboptimal voltages, reducing efficiency. Standard electrical interfaces to match PV modules and small-scale application equipment do not exist; only costly custom designs are available.

SunWize has developed and completed testing of prototype controllers for applications up to 50 watts. SunWize controllers are innovative in that they also allow small PV modules to be used in relatively large power applications, contributing energy and extending battery life even when the module is not capable of powering the whole system.

OBJECTIVES

To: (1) investigate related power products and technologies; (2) develop methods to evaluate existing and proposed controllers; (3) develop product specifications; (4) develop new circuit designs; (5) build and test prototype circuit designs; (6) design, fabricate, and test prototypes for packaging and printed circuit boards; and (7) finalize the overall product design for the PV controller.

DESCRIPTION

SunWize prototypes and up to three other controllers will be tested and evaluated to establish cost and performance baselines. Based on this information, Automated Engineering Corporation will develop up to four new circuit designs for use in three applications such as laptop computers, cellular phones, SunWize specialty modules, and portable power systems. Cavalier then will source components and construct circuit prototypes that will be tested by Applied Testing Laboratories, and compared to baseline data. SunWize and Cavalier will develop the packaging and connectors. The final design of the PV controller will be tested for compliance with environmental and Federal Communications Commission regulations.

BENEFITS

If successful, a new renewable-energy product will be manufactured in New York. The product will have an immediate market, as it can be incorporated into some of SunWize's existing commercial products. In addition, potential markets exist outside the PV industry. The controllers also will be marketed to other PV systems integrators. The controller will make new portable PV applications feasible and reduce small-scale PV system costs.

SCHEDULE AND STATUS

The design and prototype have been completed for one controller. Two other controllers are in progress.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$23,154	0	$23,154
SunWize	25,135	0	25,135
Cavalier	600	0	600
TOTALS	$48,889	0	$48,889

Contractor: SunWize Energy Systems, Inc.
Site: Kingston, Ulster County
Contract Duration: 3/96-10/97
Key Words: renewables, product development, solar, photovoltaics
Project Manager: Judy Jarnefeld (518) 862-1090, ext. 3293
Program: Energy Resources
Subprogram: Solar/Wind
Contract No.: 4360-ERTER-ER-96

-> Photovoltaic-Compatible Power-Conditioning System Development

Develop innovative inverter and power-quality enhancement system.

BACKGROUND

Niagara Mohawk Power Corporation is interested in developing a photovoltaic-compatible, robust power-conditioning system, called the Power Enhancement and Delivery System (PEDS), which will be used to support distribution systems and improve power quality for individual customers. Currently available inverters lack the robustness required for this application and do not have battery-charge-control capability. An East Greenbush feeder has been identified as a potential test site for the PEDS. The project was submitted under the Utility PV Group (UPVG) TEAM-UP (a Global Climate Change initiative) solicitation and was awarded $300,000 to support the PV panel costs.

OBJECTIVE

To develop and demonstrate PEDS, an innovative power-control, storage, and conversion unit.

DESCRIPTION

The PEDS will be designed to: (1) invert the power from the PV array and battery storage, (2) optimize power transfer from the photovoltaic array to the battery and utility system, (3) control charging and discharging of storage, and (4) eliminate voltage disturbances and outages downstream of its location. The PEDS design will be geared toward modularity based on ease of maintenance, high reliability, and utility system compatibility. A prototype PEDS will be constructed, and then installed at a test location and demonstrated with either a fuel cell or a PV system. The system will be monitored for one year.

BENEFITS

Components for this product will be manufactured in New York State. The PV market needs a reliable large-scale inverter. Power-quality and reliability features will enhance the market and value of this product. Because there will be widespread need for PEDS in power-quality applications, significant economies of scale are readily achievable.

SCHEDULE AND STATUS

The overall specifications for the PEDS system have been determined. Negotiations are under way with potential partners for the PEDS.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$400,000	0	$400,000
Niagara Mohawk Power Corp.	663,000	$505,000	1,168,000
Astropower	0	120,000	120,000
TOTALS	$1,063,000	$625,000	$1,688,000

Contractor: Niagara Mohawk Power Corporation
Site: Syracuse, Onondaga County
Contract Duration: 1/96 - 12/97
Key Words: product development, photovoltaics, electricity, utilities, power quality, solar, renewable
Project Manager: Jennifer Harvey (518) 862-1090, ext. 3264
Program: Energy Resources
Subprogram: Solar/Wind
Contract No.: 4156-ERTER-ER-96

-> Develop, Build, and Test a Solar Photovoltaic SOLARWALL® Building System

Incorporate photovoltaics in commercial SOLARWALL® wall-cladding for fresh-air solar heating.

BACKGROUND

When photovoltaic (PV) cells produce energy from sunlight, some of the sun's energy is lost in the form of heat. Very little has been done to recover the thermal energy. Conserval Systems, Inc. has a commercial SOLARWALL® air-heater that preheats ventilation air using low-temperature solar thermal energy. The SOLARWALL® air-heating system represents a major breakthrough, reducing the cost of solar energy by eliminating glazing and using common wall construction.

OBJECTIVE

To integrate PV modules into the SOLARWALL® system.

DESCRIPTION

One or two PV SOLARWALL® designs will be developed, optimized, tested, and evaluated. The panel design will integrate photovoltaics in the thermal panel to provide thermal and electrical energy. The work will determine the optimum distribution of PV and thermal energy, and investigate several techniques for reconfiguring the cladding to attach the PV cells and modules. Commercial and emerging photovoltaic cell or module designs will be evaluated to determine the most promising technologies to incorporate in the SOLARWALL®. The contractor will use this information to design a computer-modeled PV SOLARWALL®. Thermal and photovoltaic output will be optimized. Cost estimates for a commercial product will be developed. A small prototype will be built and tested to verify the design and computer model. The system's long-term durability will be tested outdoors.

BENEFITS

The proposed system would simplify PV installation and reduce PV-mounting costs. Removing the heat produced by PV cells will improve their efficiency and improve the thermal gain of the air, providing energy advantages compared to conventional PV-mounting methods. The technology is best-suited to northern climates, so New York State would benefit. Conserval's U.S. headquarters is in Buffalo, the aluminum comes from Alcan's Oswego plant, and cladding perforation is done by Erdle in Rochester.

SCHEDULE AND STATUS

Potential solar cells have been reviewed and are being applied to the SOLARWALL®. A test panel has been manufactured and analyzed.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$112,455	0	$112,455
Conserval (in-kind)	20,955	0	20,955
Bechtel (in-kind)	20,000	0	20,000
CANMET (cash & in-kind)	36,500	0	36,500
Sandia National Lab. (cash & in-kind)	35,000	0	35,000
TOTALS	$224,910	0	$224,910

Contractor: Conserval Systems, Inc.
Site: Buffalo, Erie County; Toronto, Canada; San Francisco, CA
Contract Duration: 4/95 - 6/97
Key Words: renewable, product development, solar, photovoltaics
Project Manager: Jennifer Harvey (518) 862-1090, ext. 3264
Program: Energy Resources
Subprogram: Solar/Wind
Contract No.: 4150-ERTER-ER-95

-> Lamination of Thin-Film Photovoltaics for Building-Integrated Applications

Develop facility to manufacture laminated thin-film photovoltaic panels for building-integrated applications.

BACKGROUND

There has been an explosion of interest in building-related applications of photovoltaics, following the realization of the potentially vast markets for multi-functional building materials. These products perform conventional functions such as weather protection and improvement of aesthetics, but with the additional benefit of electricity generation for demand-side management and load-shifting functions. In this way, the economic barrier to grid-connected photovoltaic (PV) use can be reduced enormously. The availability of PV modules in a size large enough to simplify installation and present an attractive appearance would help accelerate the introduction of building-integrated PV.

Kiss + Cathcart is an international architectural firm that has a special interest and experience in developing building-integrated PV. Energy Photovoltaics (EPV) is a PV cell manufacturer in Princeton, NJ. EPV's basic PV module size of 2'x4' is too small for effective building integration. This project is aimed at developing an encapsulation process that could laminate several EPV modules to a larger glass substrate up to 4'x8'. A new New York manufacturing facility would be established to manufacture these modules to serve medium- to high-end commercial construction markets in NY, nationwide, and internationally. Any building using glass, metal, or stone-curtain wall construction is a potential user of this product, as well as buildings with skylights and atriums.

OBJECTIVE

To develop manufacturing methods and equipment to manufacture building-integratable PV panels.

DESCRIPTION

This project will develop manufacturing equipment and techniques to make large-area thin-film-based PV modules for the building-integrated PV market. It would use EPV's modules and develop the encapsulation process to construct 4'x8' prototype modules for testing. The process would laminate four 2'x4' PV plates between two 4'x8' pieces of tempered glass.

BENEFITS

Building-integrated PV offers significant system-cost savings by replacing the building skin, and eliminating costs for land and a support structure. In highly developed areas, building-integrated PV is the only way to deploy renewable energy when land is not available or is very expensive.

This project would result in a PV-laminating plant and associated jobs in New York State. Projected revenues (adjusted to half those projected in the proposal) are $1.5 million in the first year up to $3.9 million in the third year.

SCHEDULE AND STATUS

Contract negotiation is about to begin.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	0	$199,920	$199,920
Kiss + Cathcart	0	199,921	199,921
TOTALS	0	$399,841	$399,841

Contractor: Kiss + Cathcart
Site: New York City, New York County, and Princeton, NJ
Contract Duration: 4/97 - 5/98
Key Words: renewable, product development, assist business, solar, photovoltaics
Project Manager: Jennifer Harvey (518) 862-1090, ext. 3264
Program: Energy Resources
Subprogram: Solar/Wind
Contract No.: 4537-ERTER-ER-97

-> Innovative Mounting and Interconnection System for Single-Module PV Systems

Develop and manufacture mounting and interconnection systems for Evergreen Solar's single-module PV systems.

BACKGROUND

A substantial and growing segment of the international rural PV market is served with single-module systems consisting of one 20-60-watt module, simple control electronics, a battery, and a mounting system. As costs continue to decline and the market infrastructure matures, the large international markets will expand rapidly. Current PV modules are designed for multimodule systems and are over-designed for single-module use. Single-module systems do not need the full frame strength nor the structural and electrical flexibility provided by existing module frames and junction boxes, providing opportunities for cost-reduction.

Evergreen Solar, a PV module manufacturer based in Massachusetts, and Jefferson Shingleton, a New York State consulting engineer, recently developed new, stronger PV module back-skin material that opens up new possibilities for producing lower-cost single-module systems without compromising performance. This project will develop the new panels into a commercial product, focusing on mounting systems for pole- and wall-mounting and necessary electrical connections.

OBJECTIVE

To develop and manufacture mounting methods for Evergreen Solar's single-module PV systems.

DESCRIPTION

This project will develop a single-module PV product, complete with mounting system and electrical connections. Module-lamination methods have been developed, so this project will develop mounting systems for pole- and wall-mounting and necessary electrical connections. Conceptual designs will be developed and reviewed with key industry players and customers. Prototypes will be designed, fabricated, and evaluated; final prototypes will be designed, fabricated, and tested, resulting in a fully commercial product.

BENEFITS

This product will serve large and rapidly growing markets. It will be a high-quality product that costs less than competing modules with conventional frames and junction boxes. The innovative mounting systems developed in this project will be manufactured in New York, resulting in new jobs.

SCHEDULE AND STATUS

The project has just begun.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	0	$94,562	$94,562
Evergreen Solar, Inc.	0	79,432	79,432
Direct Gain	0	15,129	15,129
TOTALS	0	$189,123	$189,123

Contractor: Evergreen Solar, Inc.
Site: Waltham, MA; Schenectady, Schenectady County; and Auburn, Cayuga County
Contract Duration: 3/97 - 7/98
Key Words: renewable, product development, solar, photovoltaics
Project Manager: Jennifer Harvey (518) 862-1090, ext. 3264
Program: Energy Resources
Subprogram: Solar/Wind
Contract No.: 4535-ERTER-ER-97

-> Improved Poly- and Single-Crystalline Silicon Solar Cells with Deposition of Emitter Layers by Glow-Discharge Processing

Develop computer model to design silicon solar cells with deposited emitters and make and test cells based on computer designs.

BACKGROUND

Deposited emitters have the potential for improving the efficiency and reducing the production costs of solar cells. NYSERDA's recent photovoltaic (PV) materials projects have been largely experimental in nature. This project focuses on computer modeling of solar cells and uses experimental devices to validate the models.

OBJECTIVE

To produce an optimal and validated design for improved solar cells based on a novel design principle using ultra-thin amorphous or microcrystalline silicon-emitter layers deposited on a conventional crystalline-silicon substrate.

DESCRIPTION

The solar-cell design will be optimized with a model-simulation-fabrication testing cycle using improved concepts to describe electron transport and new simulation methods to enhance the optimized design.

Fundamental numerical descriptions of electronic transport in amorphous and micro-crystalline silicon will be developed using Monte Carlo statistical descriptions. Silicon films will be fabricated and their characteristics compared to model predictions. The model then will be expanded to describe simple solar-cell structures. Solar cells will be designed, tested, and optimized with the help of the model. A partner will be sought to commercialize the computer model.

BENEFITS

The contractor claims this technology will reduce the cost of polycrystalline and crystalline solar cells by 20 percent by using low-cost manufacturing processes and improving performance. Research results will lead to development of a novel power transistor and a new New York State business to manufacture this transistor.

SCHEDULE AND STATUS

Progress is being been made in applying the 3-dimensional hopping transport to amorphous silicon. Substantial improvement was seen when the crystallized amorphous silicon emitter case was used instead of amorphous silicon. Technology developments in this project will be used to commercialize a power transistor in the near term.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$74,060	$74,060	$148,120
SUNY/Stony Brook	72,718	72,718	145,436
Biota Corporation	22,218	22,218	44,436
TOTALS	$168,996	$168,996	$337,992

Contractor: The Research Foundation of SUNY on behalf of SUNY/Stony Brook
Site: Stony Brook, Suffolk County, and Locust Valley, Nassau County
Contract Duration: 7/95 - 6/97
Key Words: product development, renewable, university, solar, photovoltaics, semiconductors
Project Manager: Jennifer Harvey (518) 862-1090, ext. 3264
Program: Energy Resources
Subprogram: Solar/Wind
Contract No.: 4213-ERTER-ER-96

-> Toroidal Accelerator Rotor Platform Wind-Energized Independent Light System

Develop and test remote street-lighting system that operates on wind energy.

BACKGROUND

Many regions of New York State have sufficient wind to meet the demands of outdoor lighting units, with the cycle of darkness-periods-per-day also tending to vary in phase with annual wind availability. The Toroidal Accelerator Rotor Platform (TARP) is an obstruction-flow concentrator and amplifier that creates high-kinetic wind-energy regions at the turbine blades.

OBJECTIVE

To demonstrate the viability of the TARP Wind-Energized Independent Light (TWILIGHT) system by constructing a prototype and testing it at a site in New York State. The results of the test will be discussed at a workshop when the study is finished.

DESCRIPTION

The project includes design, fabrication, and assembly of the TWILIGHT system, including mechanical/structural, electrical, and data-acquisition systems; site testing and data-collection; and technology transfer.

BENEFITS

Potential users that could benefit from this technology include municipalities, State and local departments of transportation and parks and recreation, forest services, and electric and telephone utilities.

SCHEDULE AND STATUS

All components have been reinstalled following mechanical problems and vandalism. The system suffered major damage during a winter storm in 1996. The contractor is attempting to make as many repairs as possible given the limited budget remaining. A final report is expected during 1997.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$231,650	0	$231,650
P.W. Scott Associates	185,650	0	185,650
TOTALS	$417,300	0	$417,300

Contractor: P.W. Scott Associates
Site: Belleayre Mountain State Ski Area, Highmount, Ulster County
Contract Duration: 8/92 - 6/97
Key Words: renewable, wind, lighting, product development
Project Manager: Jeff Peterson (518) 862-1090, ext. 3288
Program: Energy Resources
Subprogram: Solar/Wind
Contract No.: 1912-ERER-ER-93

-> 6-MW New York Wind Plant Demonstration Program

Install and test six megawatts of wind turbines in New York State.

BACKGROUND

Over the past 10 years, the cost of electricity from wind has decreased significantly and the reliability of wind machines has increased, with availabilities of more than 95 percent. Wind-power plants are producing energy that costs between 4.5 and 5 cents per kWh in high wind regimes. These improvements in wind technology were necessary to make wind an attractive option in New York's moderate wind regimes. Demonstration of wind turbines in New York is the next step necessary to commercialize utility-scale wind turbines in the State. This project is part of the National Renewable Energy Laboratory/Electric Power Research Institute Turbine Verification Program, where participating utilities install six MW of advanced-design domestic wind turbines and share their experiences.

OBJECTIVES

To: (1) provide operational experience with utility-scale wind-power plants in New York State in terms of turbine reliability, maintenance requirements, and other performance issues; (2) evaluate new advanced wind-turbine technologies appropriate for New York's wind resource; (3) address siting, environmental, and public-acceptance issues that large wind plants are likely to encounter in New York; (4) assess the economics and capacity-value of wind plants in New York's wind regime; and (5) investigate potential impacts on power quality and grid-system stability.

DESCRIPTION

Six megawatts of wind turbines (12-20 utility-scale turbines) will be installed at a site in New York State. Analysis of wind speeds and interconnection costs has been ongoing in two areas of the State, the Tug Hill Plateau and the Cattaraugus Highlands; candidate communities in those areas will be identified. Outreach to the local communities will occur throughout the project siting process. Once the final candidate sites have been selected, wind leases will be negotiated with landowners and environmental permits will be sought. Purchase and installation of wind turbines will be bid competitively. Factors for selecting the wind turbines include: (1) innovativeness, (2) projected energy cost in New York wind conditions, (3) anticipated maintenance requirements and reliability in New York's weather, (4) environmental impacts, (5) ease of maintenance, (6) vendor support and corporate philosophy, and (7) turbine effects on utility-grid power quality. Once selected, the wind turbines will be installed and monitored.

BENEFITS

The experience gained in siting, operating, and integrating wind generation into the utility system will help wind become a viable generation option when capacity is needed in New York.

SCHEDULE AND STATUS

Site environmental and wind resource studies are under way. Installation of the turbines is on hold and NMPC is negotiating for a reduced size of the wind installation.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$400,000	0	$1,500,000
National Renewable Energy Lab.	700,000	0	1,500,000
Niagara Mohawk Power Corp.	3,695,000	0	12,000,000
TOTALS	$4,795,000	0	$15,000,000

Note: Appropriations of co-funders based on their fiscal years.

Contractor: Niagara Mohawk Power Corporation
Site: Albany, Albany County, and Syracuse, Onondaga County; wind site to be determined
Contract Duration: 3/96 - 12/02
Key Words: renewable, wind, utility, electricity
Project Manager: Jennifer Harvey (518) 862-1090, ext. 3264
Program: Energy Resources
Subprogram: Solar/Wind
Contract No.: 4012-ERTER-ER-95

-> Commercialization of Variable-Reluctance Wind Generators

Demonstrate and commercialize variable-reluctance generator for wind turbines.

BACKGROUND

Variable-reluctance-generator (VRG)-based wind turbines are expected to be more reliable and produce lower-cost energy than induction-based variable-speed wind generators. Control electronics for the VRG were developed and tested, and the concept of incorporating the VRG into advanced wind-conversion systems was proven at the bench level in a previous project with Rensselaer Polytechnic Institute and Atlantic Orient Corporation (AOC).

OBJECTIVE

To build on the previous NYSERDA project and support fabrication and laboratory- and field-testing of a 20kW direct-drive VRG using an existing site and tower. A future phase will support commercialization of the technology, including development of a business plan, production engineering, prototype fabrication and field-testing, final design, and arranging for system manufacture.

DESCRIPTION

Two prototype VRGs with power-electronic utility/generator interfaces will be built and tested. The first machine will be tested in a laboratory and will serve as input to optimize the design of the second machine. Laboratory testing will verify the mechanical integrity of the VRG and confirm all control functions of the electronics. A rotor for the machine will be developed in parallel with VRG and electronics manufacture. AOC has conceptual ideas for the rotor design based on its experience in developing wind turbines. The second VRG system will be tested in the field using an existing site and tower.

BENEFITS

This project is the catalyst to establish Power Conditioning & Conversion (PCC), a New York start-up company that will develop and construct VRGs and associated power electronics. The VRG will fill a market void by developing a small-scale (20kW) variable-speed wind turbine for use in New York, national, and foreign markets. This lower-cost, small-scale wind system will make wind power more feasible for New York end-users.

SCHEDULE AND STATUS

The power electronics and the first VRG are fabricated. Laboratory testing of the system is under way.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$147,710	0	$147,710
Power Conditioning & Conversion	94,370	0	94,370
Atlantic Orient Corporation	53,340	0	53,340
TOTALS	$295,420	0	$295,420

Contractor: Power Conditioning & Conversion
Site: Glens Falls, Warren County
Contract Duration: 6/95 - 12/96
Key Words: renewable, electricity, wind, variable-reluctance, product development
Project Manager: Jennifer Harvey (518) 862-1090, ext. 3264
Program: Energy Resources
Subprogram: Solar/Wind
Contract No.: 4236-ERTER-ER-96

-> Thin-Film Silicon by Constitutional Supercooling

Investigate feasibility of producing low-cost, efficient solar cells using thin-film polycrystalline silicon (Si).

BACKGROUND

Low-cost solar cells are not efficient enough to generate electric power competitively. Thin-film amorphous silicon (Si) solar cells are relatively inexpensive to produce; however, their efficiency is low and many have degradation problems. While Si-wafer solar cells are more efficient and do not have degradation problems, they are more expensive to produce. This project, a cooperative effort with the National Renewable Energy Laboratory, was aimed at producing thin-film polycrystalline Si by constitutional supercooling (CS). This material was expected to provide performance similar to crystalline wafer-Si solar cells at the cost of amorphous-Si solar cells.

ACCOMPLISHMENTS

Cell fabrication of amorphous silicon on crystalline Si progressed toward the 17-percent efficiency predicted by computer modeling. CS thin-film silicon demonstrated high mobility, good lifetime, and large grain size.

FINDINGS AND CONCLUSIONS

Amorphous/crystalline solar cells were manufactured with 10-percent efficiencies. CS Si solar cells were much less efficient because uniformity problems caused pinholes that short-circuited the solar cells. This problem, however, could be overcome by examining different melt layers and thicknesses, using a better sputter gun, and rotating the sample. Other characteristics indicated that CS Si is very promising for use in solar cells.

REALIZED OR ANTICIPATED BENEFITS

The CS Si solar cell should have the efficiency of a crystalline Si solar cell and use a fraction of the Si material. It should also be less expensive to manufacture, lowering the cost of electricity produced from solar cells. Commercialization of the technology also could result in economic development for New York State.

TECHNOLOGY TRANSFER ACTIVITIES

Technical papers have been written and presented at professional conferences. Partnerships with New York State businesses and other universities have been pursued.

FUNDING	TOTALS
NYSERDA	$55,088
National Renewable Energy Lab.	215,406
SUNY Research Foundation	58,042
TOTALS	$328,536

Contractor: Research Foundation of the State University of New York
Site: Buffalo, Erie County
Contract Duration: 1/94 - 6/96
Key Words: renewable, electricity, solar, photovoltaics, semiconductors, university
Project Manager: Jennifer Harvey (518) 862-1090, ext. 3264
Program: Energy Resources
Subprogram: Solar/Wind
Contract No.: 3161-ERTER-ER-94

-> Energy and Material Conservation in the Forest Products Industry

Develop applied research program that investigates energy issues affecting New York State's forest products industry.

BACKGROUND

The forest products industry is a major one in New York State. By addressing the energy-efficiency and production needs of the industry, economic benefits can accrue to the State.

OBJECTIVES

To: (1) establish a manageable multidisciplinary research program that meets the high research standards of the academic community, provides a foundation for education, and addresses the defined needs of the funding organizations; (2) administer an integrated program that offers long-term stability to those performing the research (3) strengthen research in science and engineering to enhance future industrial technological opportunities; (4) improve the linkages between universities and industrial firms; and (5) stimulate the development and commercialization of university technologies through a partnership with the State, the university, and business/industry.

DESCRIPTION

The program is designed to support three to four major projects the first year; a series of small exploratory research projects for concept definition, technology proof-of-concept, and technology support; and information-transfer events. Two scoping workshops were held: one to explore the market potential of biofuels and one to identify the needs/opportunities for new energy technologies for the pulp and paper industry.

BENEFITS

Bringing the research capabilities of the State University of New York College of Environmental Science and Forestry to bear on the energy and environmental needs of New York's significant forest products industry can provide the State with substantial economic development benefits.

SCHEDULE AND STATUS

The final project for the program was approved. The objective of the work is to evaluate the effects of applying chicken manure to willow plantations at Wegmans egg farm.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$620,000	0	$620,000
Niagara Mohawk Power Corp.	600,000	0	600,000
SUNY-ESF (in kind)	115,198	0	115,198
Northeast Regional Biomass Program	49,231	0	49,231
TOTALS	$1,384,429	0	$1,384,429

Contractor: State University of New York College of Environmental Science and Forestry
Site: Syracuse, Onondaga County
Contract Duration: 7/92 - 12/97
Key Words: university, assist business, biomass
Project Manager: Jeff Peterson (518) 862-1090, ext. 3288; Judy Jarnefeld, ext. 3293
Program: Energy Resources
Subprogram: Biomass
Contract No.: 1719O-ERER-ER-92

-> Bioenergy from Willow

Evaluate intensive tree cultivation to provide feedstock for producing energy.

BACKGROUND

Intensive tree management can increase yields by a factor of five compared to conventional forestry, as well as address environmental concerns such as global warming and biodiversity.

OBJECTIVE

To assess basic cultural techniques, including genetics and breeding, fertility, spacing-cutting cycles, efficient water use, competition management, insect and disease problems, and feedstock quality, to allow high, sustained, and economical biomass/energy production.

DESCRIPTION

The base research program at the State University of New York College of Environmental Science and Forestry (ESF) involves continuing research on basic cultivation techniques. The Ontario Ministry of Energy Program supports the University of Toronto's scale-up project. This demonstration program is supported by the U.S. Department of Energy (U.S. DOE). Project goals include identifying field-management techniques that maximize long-term yield and survival per unit area; providing cooperation with and a scientific research base for the willow biomass demonstration energy farm at the University of Toronto; and establishing large-scale biomass demonstration plantations in New York State to provide data for assessing cultivation and management techniques.

BENEFITS

A fast-growing forest system will use substantially more carbon dioxide in a given period than a mature, unmanaged forest system. A managed tree plantation also may provide an environment to efficiently dispose of waste products such as wood ash.

SCHEDULE AND STATUS

Willow yields on a three-year rotation average 10 dry tons per acre annually, more than 10 times that of the natural forest. The research team has expanded its list of cooperators in the project to include Niagara Mohawk Power Corp., New York State Electric & Gas Corp., Oak Ridge National Laboratory, and the Electric Power Research Institute. A draft final report has been reviewed. In addition, a Willow Handbook is being published as part of the project.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$227,826	0	$227,826
ESEERCO	227,825	0	227,825
SUNY-ESF	350,988	0	350,988
Niagara Mohawk Power Corp.	20,000	0	20,000
TOTALS	$826,639	0	$826,639

Contractor: SUNY College of Environmental Science and Forestry
Site: Tully and Syracuse, Onondaga County
Contract Duration: 11/91 - 6/97
Key Words: renewable, university, biomass, utilities
Project Manager: Jeff Peterson (518) 862-1090, ext. 3288
Program: Energy Resources
Subprogram: Biomass
Contract No.: 1737-ERER-ER-92

-> Levulinic Acid Demonstration Pilot Plant

Produce high-value chemicals from biomass.

BACKGROUND

Biofine, in cooperation with NYSERDA, has developed a technology to convert lignocellulosic biomass to the chemical intermediate levulinic acid, with furfural, formic acid, and lignin as coproducts. Using proven chemical routes, levulinic acid can be converted to a wide range of marketable, high-value chemicals such as tetrahydrofuran and succinic acid. Formic acid and furfural have established commodity markets. Lignin can be used as a boiler fuel or possibly converted to a marketable product such as a soil additive. Waste fibers from pulping and paper-making operations appear to be ideal feedstocks for the Biofine process, as they are finely divided, available as a dilute slurry, and predominately cellulosic.

OBJECTIVE

To design, build, and operate a prototype plant to demonstrate the commercial feasibility of Biofine's technology. Construction will be completed in the first year. Biometics, Inc. will manage the project; Biofine, Inc. will supply the technology; and Great Lakes Chemicals will provide analytical services and a market for the products.

DESCRIPTION

This three-year project will: (1) design; (2) procure; (3) construct; and (4) operate a small (one-dry-ton/day paper sludge) prototype plant to convert wastepaper sludge or other low-grade cellulosic biomass wastes to levulinic acid, furfural, and combustible tars; (5) optimize the plant with operating data, (6) project economic data for a commercial-scale plant; and (7) perform market assessments. In a related project, NYSERDA is working with Biofine and the National Renewable Energy Laboratory to develop new uses for chemicals derived from levulinic acid. This Cooperative Research and Development Agreement will help support the overall effort to establish a levulinic acid manufacturing facility in New York State.

BENEFITS

Economically converting papermill-waste fibers to high-value chemicals could offer significant benefits to New York State, including a waste-management alternative to landfilling, potential displacement of materials that otherwise would be derived from petroleum, and a new biomass industry. The Biofine technology may give New York State paper mills a competitive advantage.

SCHEDULE AND STATUS

Construction at a site in South Glens Falls is essentially complete. Startup is scheduled for spring of 1997.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$353,000	$206,000	$559,000
U.S. Department of Energy	2,060,300	492,800	2,553,100
Biofine	600,000	100,000	700,000
Great Lakes Chemicals	45,000	1,010,000	1,055,000
TOTALS	$3,058,300	$1,808,800	$4,867,100

Contractor: Biometics, Inc., Waltham, MA
Site: South Glens Falls, Saratoga County
Contract Duration: 11/95 - 11/98
Key Words: renewables, product development, biomass
Project Manager: Judy Jarnefeld (518) 862-1090 ext. 3293
Program: Energy Resources
Subprogram: Biomass
Contract No.: 4204-ERTER-ER-96

-> Development of High-Value Derivatives for Levulinic Acid

Support levulinic acid markets.

BACKGROUND

Biofine, Inc. of Waltham, Massachusetts, patented a process to convert biomass into levulinic acid (LA). Biofine, with support from NYSERDA, the U.S. Department of Energy, Great Lakes Chemical Corporation, and Biometics, Inc., is building a one-ton-per-day demonstration plant to manufacture LA in upstate New York.

Levulinic acid is a highly versatile chemical intermediate, sold at $4-6 per pound. As the scale of LA manufacturing increases, production costs will drop from $0.32 to $0.04 per pound. In the short term, LA could be sold as is or converted through proven routes to higher-value derivatives such as diphenolic acid, succinic acid, pyrrolidines, pyrrolidones, ketals, and agricultural chemicals such as delta amino LA. Over the longer-term, Biofine would produce larger-volume chemicals such as 1, 4 butanediol, gamma butyrolactone, and tetrahydrofuran. Ultimately, LA at $0.04 to $0.05 per pound could be used to produce the gasoline oxygenate additive methyl tetrahydrofuran. LA's high price has inhibited large-scale use. The overall effort to establish an LA manufacturing facility in NYS, therefore, supports work on the conversion of LA into derivative chemicals. To fulfill obligations under our Cooperative Research and Development Agreement (CRADA) with the National Renewable Energy Laboratory (NREL), NYSERDA will join forces with Biofine to explore LA derivatives.

OBJECTIVES

To: (1) develop and optimize methods for producing derivative chemicals from LA and develop new market applications for the derivatives, resulting in an expanded market.

DESCRIPTION

NREL will provide in-house services in a separate agreement. NYSERDA's and Biofine's portion of the work will occur in two overlapping parts. Part I will study markets. In Part II, a university or company will be selected with a Request for Proposals (RFP) to optimize synthesis routes. In Part I, the contractor will: (1) identify potential end-use applications for value-added derivatives of LA; (2) perform a preliminary check on the viability of manufacturing processes and costs for the products; (3) visit major product users and prospects; and, (4) help to refine the RFP goals and select research partners. The Part II contractor will: (1) identify new market applications for derivatives selected in Part I and (2) optimize processes or new technologies to produce these derivatives from LA.

BENEFITS

Economically converting biomass to high-value chemicals could offer significant benefits to New York State, including a waste-management alternative to landfilling, potential displacement of materials that otherwise would be derived from petroleum, and new jobs in our emerging biomass industry.

SCHEDULE AND STATUS

NREL has made progress on making derivatives of levulinic acid. Part I of the NYSERDA/Biofine work is nearly complete.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	0	$40,000	$150,000
NREL*	0	150,000	150,000
Biofine	0	40,000	150,000
TOTALS	0	$230,000	$450,000

* The $150,000 provided by NREL is part of the CRADA among the three parties.

Contractor: Biofine, Inc., Waltham, MA
Site: Statewide
Contract Duration: 11/96 - 8/98
Key Words: product development, biomass, renewables
Project Manager: Judy Jarnefeld (518) 862-1090, ext. 3293
Program: Energy Resources
Subprogram: Biomass
Contract No.: 4487-ERTER-ER-97

-> Upgrading Recycled Fiber-Stocks Through Hydrodynamic Fractionation

Enhance paper recycling through improved separation techniques.

BACKGROUND

Fiber fractionation, or separation of recycled fibers into grades of different lengths, can upgrade the quality of secondary products, and increase the amount of secondary fibers used in the pulp and paper industry. For example, cardboard boxes are made by bonding two distinct products: linerboard and corrugated medium. The long fibers in the linerboard resist punctures and the short fibers in the medium resist crushing. When boxes are recycled, these fibers need to be kept separate to retain their desirable properties.

OBJECTIVE(S)

To improve techniques for separating secondary fibers. The overall goal is to increase separation efficiencies and reduce the energy consumed by continuous fiber-fractionation methods. When short and long fibers are mixed, the properties of the final product are compromised.

DESCRIPTION

Fiber is fractionated by screening the paper pulp. The unconventional methods to be researched include sedimentation enhanced with inclined plate-settlers or with convection induced by buoyant particles, and the use of hydrocyclones. The researchers will (1) fractionate virgin and recycled pulps through enhanced settling, screens, and hydrocycloning; (2) determine how pulp consistency, quality, and flow-rate affect the quality of the fractionated pulps; (3) determine the properties of the final products, including the bleaching requirements of the fractionated pulps; and (4) determine the energy benefit of enhanced methods compared to conventional screening and bleaching.

BENEFITS

Improved fractionation of fibers may lead to greater flexibility in producing recycled-paper products; reduced pulp-bleaching for a particular fiber fraction with identical product quality and brightness; and less energy needed for the fractionation process, improving the competitiveness of New York State mills. Researchers project energy savings of 120 kWh/ton of recycled pulp processed if the new technologies replace screening.

SCHEDULE AND STATUS

The other parties have negotiated an agreement and work has begun.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$67,539	0	$212,761
Niagara Mohawk Power Corp.	67,539	0	212,760
SUNY-ESF	62,037	0	194,324
Ahlstrom-Kamyr	24,500	0	73,500
International Paper	25,000	0	75,000
Degussa Corporation	5,500	0	11,500
TOTALS	$252,115	0	$779,845

Contractor: Niagara Mohawk Power Corporation
Site: SUNY-ESF, Syracuse, Onondaga County
Contract Duration: 10/96 - 10/99
Key Words: renewables, product development, assist business, biomass
Project Manager: Judy Jarnefeld (518) 882-1090, ext. 3293
Program: Energy Resources
Subprogram: Biomass
Contract No.: 4070-ERTER-ER-95

Identify high-value uses for biomass.

BACKGROUND

A recent National Renewable Energy Laboratory report identifies a number of high-volume chemicals that could be produced from biomass and compete in the current market. Expanding these to include specialty chemicals and other low-volume, high-value products would make energy, environmental, and economic sense for New York State. NYSERDA's biomass program focuses on converting low-cost feedstocks into energy-intensive chemicals. Producing levulinic acid from paper sludge is one opportunity NYSERDA has identified as having the potential to support an emerging biomass industry. Our goal is to find other chemical products that could be produced from New York State biomass.

OBJECTIVES

To further the biomass-to-chemicals industry in New York State. Specific objectives are to: (1) identify potential high-value uses for selected biomass wastes and (2) identify companies capable of investing in research and commercialization activities, such as construction of manufacturing facilities. The result will be a listing of New York State biomass companies and a description of promising biomass-based chemicals.

DESCRIPTION

The contractor will: (1) search databases such as Chemical Abstracts for information on state-of-the art technologies for producing chemicals from biomass, (recognizing that choices of products/technologies are linked to biomass feedstocks); (2) search patents for potential product opportunities; identify new business opportunities to produce specific value-added chemicals, especially from cellulosic biomass such as wood, paper sludge, or low-value scrap paper; (3) perform a preliminary assessment of target costs for these chemicals; (4) identify New York State companies that use biomass in chemical manufacturing; (5) identify New York State companies in supporting industries such as biotechnology or enzyme manufacturing; (6) identify New York State companies producing chemicals that could be manufactured from biomass or using bio-processes to manufacture chemicals, or out-of-State manufacturers of biomass-derived chemicals that could manufacture those chemicals in New York State; (7) delineate the products made by those companies; (8) determine New York State companies' interest in investing in new technologies; and (9) analyze New York State companies' capabilities. An important product of the work will be a list of New York State companies that includes key contact names, financial performance records, status of R&D departments, and a measure of in-house innovation compared to others in the industry.

BENEFITS

Economically converting waste biomass to high-value chemicals could offer significant benefits to New York State, including a waste-management alternative to landfilling, potential displacement of materials that otherwise would be derived from petroleum, and new jobs in our emerging biomass industry.

SCHEDULE AND STATUS

Work so far has centered on database and patent searches.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	0	$15,000	$15,000
CONEG	0	30,000	30,000
TOTALS	0	$45,000	$45,000

Contractor: A. A. Pope and Co.
Site: Stanfordville, Dutchess County
Contract Duration: 6/96 - 12/97
Key Words: product development, biomass, renewables
Project Manager: Judy Jarnefeld (518) 862-1090, ext. 3293
Program: Energy Resources
Subprogram: Biomass
Contract No.: 4400-ERTER-ER-97

-> Beneficial Use of Sludge through Production of E-fuel

Construct and operate commercial-scale plant for E-fuel pellets as alternative to stoker coal.

BACKGROUND

The 1990 U.S. Clean Air Act Amendments aim to reduce sulfur dioxide (SO_2) emissions by electric utilities. One way to do so is to use low-sulfur fuel such as paper-mill sludge, a renewable resource. E-fuel pellets, made from a mixture of coal fines and paper sludge, may be less costly than correctly sized stoker-grade coal.

OBJECTIVES

To construct and operate a commercial-scale E-fuel plant that can provide an economical alternative to coal for New York State's stoker boilers.

DESCRIPTION

The contractor will: (1) demonstrate the pilot-scale production and use of E-fuel with paper-mill sludge as a component; (2) evaluate the cost of E-fuel production in New York State; (3) evaluate boiler emissions during E-fuel use, as well as potential emission reductions; (4) develop a market for E-fuel; and (5) construct a commercial-scale E-fuel plant.

BENEFITS

Potential benefits to New York State include lower fuel costs for stoker boilers, lower paper-mill sludge-disposal costs, and the retention of up to 10 direct and 10 support jobs in New York State for each facility using 25,000 tons per year of paper sludge to make 30 tons per day (100,000 tpy) of pellet fuel. Liability for long-term sludge disposal would be reduced, and 3,000 tons per year of imported fossil fuels displaced. It is anticipated that emissions of SO_2 and nitrogen oxides (NO_x) would be reduced by 26% and 12%, respectively. In addition, 66,000 cubic yards of landfill space would be saved each year.

SCHEDULE AND STATUS

Phase I pilot-testing is now being performed at an existing CQ, Inc. facility.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$300,000	$200,000	$500,000
New York State Electric & Gas Corp.	114,261	1,263,380	1,377,641
Paper mill TBD	625	6,135	6,760
CQ, Inc.	58,163	1,170,498	1,228,661
TOTALS	$473,049	$2,640,013	$3,113,062

Contractor: New York State Electric & Gas Corp. (subcontractor: CQ, Inc.)
Site: Greenidge Station, Yates County
Contract Duration: 10/96 - 2/99
Key Words: renewable, assist business, biomass
Project Manager: Judy Jarnefeld (518) 862-1090, ext. 3293
Program: Energy Resources
Subprogram: Biomass
Contract No.: 4282-ERTER-ER-96

Use cellulose hydrolysis as waste-treatment alternative for packaging materials.

BACKGROUND
Solid waste planners are not always aware of new technologies or options for disposal. Some waste streams have special problems (e.g., gable-top paper milk cartons cannot be recycled easily because the paper is typically coated with plastic, making fiber-recovery difficult). Cellulose hydrolysis may be used to treat these waste streams.

OBJECTIVE
To inform solid-waste planners about cellulose hydrolysis, a potential alternative to treat cellulosic packaging materials.

DESCRIPTION
The contractor will: (1) collect information on cellulose hydrolysis of packaging materials and (2) present the information to the solid waste community so they can determine the viability of cellulose hydrolysis as a disposal option for their particular situations.

BENEFITS
New York State would benefit from improved disposal options for cellulosic packaging wastes such as paper milk cartons.

SCHEDULE AND STATUS
The project is under way.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA Petroleum Overcharge Funds	$150,000	0	$150,000
TOTALS	$150,000	0	$150,000

Contractor: Rochester Institute of Technology
Site: Rochester, Monroe County
Contract Duration: 11/94 - 6/97
Key Words: renewable, biomass
Project Manager: Judy Jarnefeld (518) 862-1090, ext. 3293
Program: Energy Resources
Subprogram: Biomass
Contract No.: 4241-ERTER-POP-96

-> Producing CMA from Waste Cellulosic Biomass

Produce high-value chemicals from renewable energy resources.

BACKGROUND

Using chloride salts for roadway deicing causes serious corrosion and environmental problems in "frost belt" areas, damaging automobiles, concrete, asphalt, bridges, and underground cables. Calcium magnesium acetate (CMA), a biodegradable deicing salt, may replace sodium chloride for selected applications with less or no negative side effects; however, CMA, which is currently expensive to produce, requires substantial quantities of acetic acid derived from natural gas.

OBJECTIVE

To commercialize CMA production. The Ohio researchers hope to develop a $265/ton CMA system; the Arkansas researchers are aiming for $137/ton.

DESCRIPTION

Two projects, one at Ohio State University and one at Bioengineering Resources, Inc. in Arkansas, completed Phase I, and attempted to meet Phase-II funding criteria, which included involving New York industries. The Ohio project derives acetic acid from cheese whey, while the Arkansas project uses sewage sludge. Both processes are adaptable to other biomass-waste streams. While both use anaerobic fermentation to produce the acetic acid, the Ohio project uses a co-culture and a novel immobilized-cell continuous bioreactor, while the Arkansas project uses a pure culture of a novel organism (ERI2). The Arkansas researchers use sludge gasified with traditional technology. The syngas (CO, CO_2, and H_2) then is fermented into acetic acid using a proprietary process. Phase I of each project included laboratory optimization in small reactors (0.5-L and 2-L for Ohio and Arkansas, respectively). In Phase II, researchers will design and construct a process-development unit to produce pound quantities of CMA.

BENEFITS

A CMA-production facility in New York State would promote economic development, provide an alternative use for cheese whey or other waste biomass, and supply CMA deicing salt for the "frost belt." Using CMA would avoid the adverse side effects of sodium chloride application.

SCHEDULE AND STATUS

Phase I work has been completed on both projects. NYSERDA and the Federal Highway Administration (FHA) are sponsoring Phase II of the Ohio project, while the FHA alone will support the Arkansas project in Phase II. NYSERDA and the Federal Highway Administration will contract separately with Ohio. The Ohio project has gained significant support from the New York dairy industry. Phase II work in Ohio has been extended six months; the equipment is assembled and ready to operate.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$135,000	0	$135,000
Ohio State University	73,643[1]	0	73,643
Glitsch Technology Co.	35,000	0	35,000
Kraft General Foods	65,000	0	65,000
Other industry (Phase II)	25,000	0	25,000
Federal Highway Administration	146,627	0	146,627
TOTALS	$480,270	0	$480,270

[1] Does not include in-kind contributions from industrial sponsors in Phase I.

Contractor: Ohio State University (Phase II)
Site: Columbus, Ohio
Contract Duration: Phase I: 5/93 - 4/94; Phase II: 4/95 - 11/97
Key Words: renewable, biomass, environmental, fermentation, high-value chemicals, CMA, industrial process
Project Manager: Judy Jarnefeld (518) 862-1090, ext. 3293
Program: Energy Resources
Subprogram: Biomass
Contract No.: 4161-ERTER-ER-95

-> Biomass Fuel Processing and Drying

Prepare biomass for co-firing with coal through drying and particle-size reduction.

BACKGROUND

The 1990 Clean Air Act Amendments aim to reduce SO_2 emissions by electric utilities. One way to do this is to use low-sulfur fuel such as wood biomass, a renewable resource with a sulfur content of less than 0.1 percent. This project will attempt to increase the availability of wood feedstocks appropriate for a pulverized-coal boiler by preparing previously unacceptable wood through drying and particle-size reduction. This project will complement an ongoing project to modify a pulverized-coal plant to accept pulverized-wood fuels.

OBJECTIVE

To expand on previous research conducted by the Electric Power Research Institute (EPRI) and explore new applications of existing processing technologies. The goal is to inform other pulverized-coal units about technical limitations and required modifications to convert to wood/coal-blended fuels. Currently, suitable pulverized-wood fuel is limited to sawmills and manufacturing facilities that produce wood waste with a fine particle size. This project could lead to wider availability of wood feedstocks. Ultimately, the goal is to design an optimized system for wood-fuel preparation and handling in pulverized-coal boilers.

DESCRIPTION

The contractor will: (1) identify processes and vendors for size-reduction equipment used by the pulp and paper, fiber- and particle-board industries, evaluating it for its suitability to the power industry; (2) study new applications of drying technologies, with particular emphasis on using existing energy sources in the power plant, including steam, flue gases, or hot air, (3) select vendors for a demonstration system to be installed at New York State Electric & Gas Corp.'s Greenidge Station; (4) run the demonstration facility for six months to gather data on maintenance, reliability, cost-effectiveness, energy efficiency, and the logistics of using this equipment in a new application.

BENEFITS

New York State would benefit from improved disposal options for wastes from the forest-products industry. In previous work, adding wood fuel to pulverized-coal boilers reduced sulfur and NO_x emissions. Currently, suitable pulverized-wood fuel is limited to sawmills and manufacturing facilities that produce wood-waste with a fine particle size. This project could lead to reductions in wood-waste disposal.

SCHEDULE AND STATUS

Processing equipment was selected and installed. Drying equipment was not economical. Test burns on wood, including fast-growing willow, were conducted to gather data on the effectiveness of the size-reduction equipment. A dust collection system was installed. The final report is being prepared.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$100,000	0	$100,000
Electric Power Research Institute	183,015	0	183,015
ESEERCO	100,000	0	100,000
New York State Electric & Gas Corp.	100,000	0	100,000
TOTALS	$483,015	0	$483,015

Contractor: Electric Power Research Institute (subcontractor: NYS Electric & Gas Corp.)
Site: Greenidge Station, Yates County
Contract Duration: 9/95 - 11/97
Key Words: renewable, assist business, biomass
Project Manager: Judy Jarnefeld
Program: Energy Resources (518) 862-1090, ext. 3293
Subprogram: Biomass
Contract No.: 4155-ERTER-ER-96

Prepare for commercial introduction of biomass plantations.

BACKGROUND

NYSERDA has been a major supporter of short rotation forestry using both willow and hybrid poplar. The concept of dedicated willow plantations is now ready for commercial introduction. A consortium of New York State Electric & Gas (NYSEG), Niagara Mohawk Power Corporation (NMPC), NYSERDA, and others has been funded by the U.S. Department of Energy (U.S. DOE). U.S. DOE will contract with Niagara Mohawk Power Corp. (NMPC). NYSERDA will sign a contract with SUNY-ESF.

OBJECTIVE

To enhance New York State's ability to produce biomass on a large scale, ensure a long-term supply, and mitigate environmental concerns with harvesting forests. Specifically, to: (1) evaluate potential problems with scale-up when planting many acres of willow; (2) determine the costs and benefits associated with co-firing willow or waste wood blends in a pulverized coal boiler; and, (3) establish a private cooperative to manage the plantations and provide wood to power plants.

DESCRIPTION

Phase One is a six-month preparation for Phase Two involving final engineering design and organization of the venture. In Phase One, SUNY-ESF will: (1) explore fuel supplies for NYSEG's power stations; (2) continue crop research; (3) develop an outreach program for Phase Two growers, (4) provide field trial support; and, (5) provide support for overall risk management. Phase Two is the site preparation and planting of approximately 100 acres of willows by 1997 on private farm land, with up to 3,000 planted acres targeted by the year 2000. NYSEG will complete their investigation of wood/coal co-firing, and install a full-scale wood handling and preparation system at Greenidge Station. A private cooperative venture will be established to manage the wood-supply infrastructure. To support further planting, NYSEG will offer the farmers a fixed price per acre of willow regardless of productivity levels. SUNY-ESF will (1) supply the technical support necessary to prepare, plant, and manage the willow sites.

BENEFITS

Supporting the market for biomass such as willow will allow New York's farmers to add willow fiber to their list of viable cash crops. Environmental benefits are associated with reducing the coal consumption at New York's power plants. In addition, although willow plantations are not as diverse as natural forest, the National Audubon Society feels willow can add diversity for birds and wildlife compared to traditional crops. In particular, willow plantations can serve as connections between forested areas.

SCHEDULE AND STATUS

The project is under way. Growers are being identified.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	0	$80,000	$400,000
Niagara Mohawk Power Corp.	0	224,000	2,402,000
SUNY-ESF	0	55,330	561,700
New York State Electric & Gas Corp.	0	0	1,310,000
U.S. Department of Energy	0	0	4,959,000
U.S.Department of Agriculture	0	0	1,200,000
Other Consortium members	0	0	2,907,300
TOTALS	0	$359,330	$13,740,000

Contractor: SUNY-ESF (Niagara Mohawk contracts with U.S.DOE)
Site: Syracuse, Onondaga County
Contract Duration: 10/96 - 7/97
Key Words: renewable, assist business, biomass
Project Manager: Judy Jarnefeld
Program: Energy Resources (518) 862-1090, ext. 3293
Subprogram: Biomass
Contract No.: 4163-ERTER-ER-97

-> Upgrading Poplar Biomass to Industrial Polysaccharides

Investigate producing useful polysaccharides from wood-to-ethanol by-product.

BACKGROUND

Wood fiber historically has been a feedstock for many useful products. NYSERDA has investigated converting wood to fuels for a number of years. The production of cost-competitive fuels requires an approach that uses all components of the fiber.

OBJECTIVE

To produce commercial quality heteropolysaccharides from hemicellulose. These heteropolysaccharides, in turn, will be purified and tested for composition, structure, and physiochemical and rheological properties.

DESCRIPTION

This project will explore developing processes to modify hemicellulose by biological means into polysaccharides for potential industrial use as substitutes for energy-intensive and petroleum-derived substances.

BENEFITS

These biotransformations are believed to be environmentally compatible, non-energy-intensive and compatible with ongoing bioengineering projects concerned with effectively using biomass for energy. If successful, this approach will provide better profit margins for processes that derive renewable fuels from biomass, and will create a potential source of new jobs.

SCHEDULE AND STATUS

The research team has successfully amplified a fragment of DNA from an insert originally derived from the A. viscosus genomic library. This is a significant achievement in the molecular biological investigations of the acetyl transferase gene from Arthrobacter viscosus. A draft final report has been prepared and reviewed.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$312,332	0	$312,332
Niagara Mohawk Power Corp.	20,000	0	20,000
Tennessee Valley Authority	10,000	0	10,000
SUNY-ESF	341,757	0	341,757
TOTALS	$684,089	0	$684,089

Contractor: State University of New York College of Environmental Science and Forestry
Site: Syracuse, Onondaga County
Contract Duration: 2/89 - 6/97
Key Words: university, biomass
Project Manager: Jeff Peterson (518) 862-1090 ext. 3288
Program: Energy Resources
Subprogram: Biomass
Contract No.: 1026-ERER-ER-89

-> Effects of Air Quality on Ecosystems for the Commercial Forest Resource of the Adirondack Mountains

Determine impact of acidic precipitation on forest ecosystem of New York's Adirondack region.

BACKGROUND

The impact of acidic precipitation on the forest ecosystem has been a major issue for the past 10 years. This project is experimentally manipulating four sites across the Adirondacks for a period of three years. Various levels of nitrates, sulfates, and base cations will be added to the forest system and the resulting impact measured.

OBJECTIVE

To ascertain the response of the forest to an increase in acidic deposition and, through monitoring the system as it recovers, determine the recovery rate of the ecosystem with a decrease of acidic deposition.

DESCRIPTION

At each of four sites in the Adirondacks, 27 test plots were located and, following a predetermined design, sulfur, nitrogen, base cations, and litter were added in different amounts. Acidic inputs were assessed by examining foliar nutrient status on control and fertilized plots. These results will be examined further using information from models that predict how changing inputs will affect forest health and acidification of lakes. In the final year of the study, when chemical additions have been terminated, the systems' recovery times from the acidic additions will be evaluated.

BENEFITS

Wood is one of the primary sources of renewable energy in New York State, the long-term availability of which can be ensured through a greater understanding of the forces that have an impact on it. Also, because the products of combustion are considered to be precursors to acid precipitation, it is important to understand the forest ecosystem and the impact acid precipitation has on it, watersheds, and lakes. This experiment will verify models developed to predict forest ecosystem impacts.

SCHEDULE AND STATUS

All chemical treatments have been performed. The research team is now in the data-reduction and analysis stage. Planning is under way for a conference in November 1997 focusing on forest ecosystem research in the Adirondacks.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$596,840	0	$596,840
ESEERCO	620,000	0	620,000
Nat'l. Comm. on Air & Stream Improvement	50,000	0	50,000
SUNY-ESF	582,713	0	582,713
TOTALS	$1,849,553	0	$1,849,553

Contractor: State University of New York College of Environmental Science and Forestry (ESF)
Site: ESF, Onondaga County; Huntington Forest, western Essex and eastern Hamilton counties; Pack Demonstration Forest, Warren County; Woods Lake and Pancake-Hall Creek, Herkimer County
Contract Duration: 1/90 - 12/97
Key Words: university, environment, utilities, biomass
Project Manager: Jeff Peterson (518) 862-1090, ext. 3288
Program: Energy Resources
Subprogram: Biomass
Contract No.: 1513Q-ERER-ER-91

-> Energy-Intensive Chemicals From Wood

Convert woody biomass to chemicals.

BACKGROUND
Using wood biomass to produce energy-intensive chemicals could lessen New York State's dependence on imported petroleum, as well as stimulate economic development in the State.

ACCOMPLISHMENTS
Researchers determined that constructing a plant to convert wood to energy-intensive chemicals in New York State was both technically and economically feasible.

FINDINGS AND CONCLUSIONS
The contractors: (1) tested samples of New York State hardwoods in a pilot plant at Dartmouth College and (2) performed engineering cost estimates and a preliminary economic analysis. Results were favorable, and a site was later selected in New York State for a full-scale feasibility study.

REALIZED OR ANTICIPATED BENEFITS
An economic process for converting paper-mill waste fibers to high-value chemicals could offer significant benefits to New York State, including a waste-management alternative to landfilling, potential displacement of materials that otherwise would be derived from petroleum, new economic return from selling high-value chemicals, and a competitive advantage for New York State paper mills.

TECHNOLOGY TRANSFER ACTIVITIES
A one-ton/day pilot plant was recently completed in South Glens Falls, New York as part of a follow-on project, 4204-ERTER-ER-96.

FUNDING	TOTALS
NYSERDA	$250,057
National Renewable Energy Lab.	13,300
Badger	10,650
Biofine, Inc.	149,950
TOTALS	$423,957

Contractor: Biofine, Inc.
Site: Dartmouth, NH
Contract Duration: 11/88 - 12/96
Key Words: renewable, product development, biomass
Project Manager: Judy Jarnefeld (518) 862-1090, ext. 3293
Program: Energy Resources
Subprogram: Biomass
Contract No.: 1105-ERER-ER-89A

-> Optimizing Cellulase Mixtures for Maximum Rate and Extent of Hydrolysis

Use cellulose hydrolysis to produce fuels and chemicals.

BACKGROUND

In New York State, wood is abundant, renewable, and composed of approximately 50% cellulose. Breaking down cellulose with enzymes produces wood sugars cleanly and efficiently. Unfortunately, the cost of enzymes needs to be reduced.

ACCOMPLISHMENTS

Researchers combined pure and crude cellulase enzymes from several different microorganisms to yield an improved rate and extent of cellulose hydrolysis. The researchers established several pure sources of cellulase enzymes by inserting the gene for individual cellulase enzymes into organisms that do not normally make cellulases. This process avoids difficult and expensive purification of complex enzyme mixtures. The researchers then determined which ratios of different enzymes improved the rate and extent of hydrolysis. They also progressed toward developing a kinetic model that describes the observed synergisms.

FINDINGS AND CONCLUSIONS

The researchers made considerable progress in understanding the behavior of individual cellulases and mixtures of cellulases. Although there is considerable variability in the activity of commercial cellulases, which are mostly crude mixtures of *Trichoderma reesei* cellulases, the researchers have yet to obtain a *T. Fusca* cellulase mixture that is much better than the best commercial preparation. Industrial application of *T. fusca* cellulases is still a feasible goal, however, for four reasons. First, *T. fusca* cellulases are stable at more elevated temperatures than *T. reesei* cellulases. Second, they operate under a broader pH range. These advantages provide greater flexibility in reactor design and operation, and foster cellulase use in new applications. Third, new capabilities in cloning and site-directed mutagenesis may lead to higher specific activities. Lastly, there is considerable industrial interest.

The other project findings were: (1) *T. Fusca* cellulases E_2 and E_5 are active endoglucanases that produce many random cuts in the cellulose chain; (2) the amount of endogluconase in a cellulase mixture is the most important influence on the rate and extent of catalysis; (3) *T. fusca* E_3 is an exogluconase that attacks the cellulose from the end of the polymer. E_3 acts synergistically with E_2, E_5, and the *T. reesei* cellulase CBHI; (4) E_4 is an active cellulase that is synergistic with all the tested cellulases; (5) increasing the total cellulase concentration to greater than 0.21 μmol of cellulase per gram of Avicel cellulose resulted in no significant benefits; and (5) DNA sequences and X-ray structures show homology between *T. fusca* cellulases and other cellulases. This could explain the lack of synergism in the extent of hydrolysis when mixing similar families of cellulases from different microbial systems.

REALIZED OR ANTICIPATED BENEFITS

More effective enzymes would enhance the potential to profitably convert wood cellulose to sugars. These sugars, in turn, could be fermented into fuels and other energy-intensive chemicals that could decrease New York State's oil dependence.

TECHNOLOGY TRANSFER ACTIVITIES

Cornell University and the National Renewable Energy Laboratory have expanded the research. The contractor has been actively seeking interest from enzyme companies and others. If successful, a follow-on project would be appropriate.

FUNDING	TOTALS
NYSERDA	$139,124
Cornell University	104,082
TOTALS	$243,206

Contractor: Cornell University
Site: Ithaca, Tompkins County
Contract Duration: 9/88 - 12/96
Key Words: renewables, university, biomass
Project Manager: Judy Jarnefeld (518) 862-1090, ext. 3293
Program: Energy Resources
Subprogram: Biomass
Contract No.: 1150-ERER-ER-89

-> Feasibility Study for Conversion of Paper-Mill Waste Fibers to High-Value Chemicals

Produce high-value chemicals from biomass.

BACKGROUND

Biofine, in cooperation with NYSERDA, has developed a process technology to convert lignocellulosic biomass to the chemical intermediate levulinic acid, with furfural, formic acid, and lignin as coproducts. Using proven chemical routes, levulinic acid can be converted to a wide range of marketable, high-value chemicals such as tetrahydrofuran and succinic acid. Formic acid and furfural have established commodity markets. Lignin can be used as a boiler fuel or possibly converted to a marketable product such as a soil additive. Waste fibers from pulping and paper-making operations appear to be ideal feedstocks for the Biofine Process, as they are finely divided, available as a dilute slurry, and predominately cellulosic.

ACCOMPLISHMENTS

The contractor investigated the feasibility of integrating the Biofine Process to convert paper-mill waste fibers to high-value chemicals.

FINDINGS AND CONCLUSIONS

The contractor: (1) developed a process design for a one ton/day plant and a 50 ton/day plant to produce levulinic acid; (2) investigated the production of a new pesticide, delta-amino-levulinic acid; (3) conducted an economic assessment for the two plant sizes; (4) conducted product-yield and process-operability experiments with representative paper sludges; (5) purified levulinic acid; and (6) characterized and evaluated the effluent stream.

REALIZED OR ANTICIPATED BENEFITS

An economic process for converting paper-mill waste fibers to high-value chemicals could offer significant benefits to New York State, including a waste-management alternative to landfilling, potential displacement of materials that otherwise would be derived from petroleum, new economic return from selling high-value chemicals, and a competitive advantage for New York State paper mills.

TECHNOLOGY TRANSFER ACTIVITIES

A pilot plant is being constructed in South Glens Falls, New York as part of a follow-on project, 4204-ERTER-ER-96. Levulinic acid has been produced and tested for purity.

FUNDING	Totals
NYSERDA	$230,000
Champion International	89,000
Biofine	10,000
Biometics	10,000
Dartmouth College	4,000
TOTALS	$343,000

Contractor: Biofine Incorporated, Wellesley, MA
Site: Biofine Incorporated, Wellesley, MA, and Dartmouth College, Hanover, NH
Contract Duration: 10/92 - 3/97
Key Words: renewables, product development, biomass, chemicals
Project Manager: Judy Jarnefeld (518) 862-1090, ext. 3293
Program: Energy Resources
Subprogram: Biomass
Contract No.: 1903-ERER-ER-93

-> Modular Inclined-Screen (MIS) Demonstration - Green Island Hydroelectric Generating Station

Demonstrate technology to mitigate primary environmental impact of hydroelectric facilities.

BACKGROUND

The modular inclined screen (MIS) is a fish-diversion technology that provides flexibility for existing hydroelectric facilities. This is particularly important in New York, where half the State's hydroelectric sites will need to be relicensed by 2000. These facilities will be required to offer some form of fish-diversion technology to qualify for relicense.

OBJECTIVE

To demonstrate a technology that may economically mitigate a documented environmental impact associated with hydroelectric facilities.

DESCRIPTION

The MIS provides flexibility at any type of water intake and with different flow rates. The project includes design, fabrication, installation, and hydraulic and biological testing of the demonstration-scale MIS and strobe-light barrier. Green Island was selected due to the blueback herring's semiannual migration. The results of this demonstration will be used to assess the technology and its commercial potential. The test module is a half-size unit consisting of an entrance with trash racks, dewatering stop-log slots, an inclined wedgewire screen set at a shallow angle to the flow, and a bypass to direct diverted fish to a transport pipe. The test module is completely enclosed and designed to operate at water velocities ranging from 2-10ft/sec, depending on the species and life stages to be protected.

Testing includes hydraulic measurement, diversion capabilities of the strobe assembly, and biological performance of the screen. The MIS will be evaluated in terms of percent of fish diverted live (immediate survival), injury rates, and delayed mortality. Testing will occur over two seasons.

BENEFITS

Commercializing this technology may improve the environmental performance of New York State's hydroelectric industry while maintaining existing power-production levels.

SCHEDULE AND STATUS

The project is now in its second year of diversion-testing. The module was removed in the fall of 1996. The report has been prepared. A final presentation will be made in May 1997.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$100,000	$100,000	$300,000
Niagara Mohawk Power Corp.	1,419,000	250,000	1,669,000
Electric Power Research Institute	763,000	0	763,000
ESEERCO	200,000	50,000	250,000
New England Electric System	50,000	0	50,000
California Dept. of Water Resources	50,000	0	50,000
TOTALS	$2,582,000	$400,000	$3,082,000

Contractor: Niagara Mohawk Power Corporation
Site: Green Island, Albany County
Contract Duration: 6/96-6/97
Key Words: renewable, utilities, product development, hydropower, regulations
Project Manager: John Martin (518) 862-1090, ext. 3265
Program: Energy Resources
Subprogram: Indigenous Resources
Contract No.: 4035L-ERTER-ER-95

-> Gas-Operated Automatic Lift (GOAL) Petro Pump Demonstration

Demonstrate new technology to remove brine and other by-products from existing New York State natural-gas wells.

BACKGROUND

Many oil and gas wells were developed in southwestern New York during the early 1980s, when tax laws and oil and gas prices were more favorable for the operators. Those wells are now in the waning years of their economic life due to natural depletion, the decline in oil and gas prices, and normal increases in labor and other operating costs. The majority of gas wells drilled during that time were completed in the Whirlpool/Medina formations. They were generally equipped with 1-1/2" tubing that was set near the top of the perforated interval. The tubing served as a siphon string to help keep water off the formation. During the early life of these wells, this technique worked effectively. However, as the formation pressures deplete with time, the technique becomes less effective.

OBJECTIVE

To thoroughly evaluate the GOAL Petro Pump to determine its ability to improve productivity and extend the economic life of New York oil and gas wells.

DESCRIPTION

The GOAL Petro Pump's ability to increase the productivity, and extend the economic life, of two wells in Chautauqua County will be tested. As designed, the pump operates within the production casing of the well, removing well-bore fluids from the completed formation and lifting them to the surface. The efficient removal of well-bore fluids reduces back pressure on the producing formation, allowing it to readily release additional fluids into the well bore. The tool uses the well's own pressure to provide the lifting force, requiring no external forms of energy and thereby reducing operating costs. Records will be kept of pressure and production-rate data. The information will be documented in monthly progress reports and a final case study report for each well. The reports will be made available to other well operators through copies supplied by NYSERDA or at annual Independent Oil and Gas Association events.

BENEFITS

The tool should provide a cost-effective way to increase production from existing Medina, Queenston, and Bass Islands wells in New York State. Increased well productivity will help New York producers compete, increase property tax revenues, and provide indigenous natural gas to meet New York State demand.

SCHEDULE AND STATUS

The units are complete and are undergoing field-testing.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$49,995	0	$49,995
BEDCO, Inc.	102,336	0	102,336
TOTALS	$152,331	0	$152,331

Contractor: Brandywine Energy & Development Company, Inc. (BEDCO, Inc.)
Site: Chautauqua County (multiple sites)
Contract Duration: 4/96 - 6/97
Key Words: assist business, gas, production
Project Manager: John Martin (518) 862-1090, ext. 3265
Program: Energy Resources
Subprogram: Indigenous Resources
Contract No.: 4319-ERTER-ER-96

-> Natural Gas Liquefaction by Linear-Motor Pulse-Tube Refrigerator

Develop commercially viable cryogenic unit for well-site application.

BACKGROUND

The contractor has developed a reciprocating motion/AC electricity transducer called STAR™. The contractor's partner, Cryenco, is developing the orifice pulse-tube refrigerator (OPTR) for high-reliability, small-scale, cryogenic liquefaction. The resulting combination creates an electricity-run liquefier with only one moving part, making the package extremely reliable. The product has passed the proof-in-concept stage.

The natural gas industry relies on an economic model that must cover the cost of a gas-gathering system into a distribution pipeline. Lower-volume or remote wells may not justify the cost of a gathering system. This technology may offer an alternative to gathering systems.

OBJECTIVE

To develop a commercially viable cryogenic unit for well-site and other applications.

DESCRIPTION

The overall development plan for the STAR™-OPTR is divided into three phases: initial demonstration with system definition; first-generation full-scale prototype development; and a second-generation pre-production, multiunit test sequence leading to product sales. This project enables timely progress from laboratory demonstration of STAR™-OPTR's feasibility to a full-scale operating gas-liquefaction system. Phase 1 includes system definition, prototype construction, and field-demonstration.

BENEFITS

The company plans to produce the STAR™ motor in New York State. New York's indigenous natural gas industry will benefit from applying the technology to producing fields that require alternative transportation methods, which ultimately may increase the use of indigenous gas.

SCHEDULE AND STATUS

The project is under way.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	0	$96,898	$96,898
Clever Fellows Innovation Consortium	0	22,716	22,716
Cryenco	0	95,080	95,080
Gas Producer	0	2,000	2,000
TOTALS	0	$216,694	$216,694

Contractor: Clever Fellows Innovation Consortium, Inc.
Site: Troy, Rensselaer County, and Denver, Colorado
Contract Duration: 3/97-1/98
Key Words: product development, natural gas
Project Manager: John Martin (518) 862-1090, ext. 3265
Program: Energy Resources
Subprogram: Indigenous Resources
Contract No.: 4493-ERTER-ER-97

Identify potential gas-storage formations in New York State.

BACKGROUND

Underground natural gas storage is an important component of the natural-gas supply distribution system. Storage allows utilities and transmission pipeline companies to meet peak gas demand and maintain system balance requirements. Siting gas-storage facilities requires geological interpretation, technology application, environmental protection, and market access. The right conditions exist in New York State to expand natural-gas storage to meet the State's future supply needs. Before the in-situ resource base can be turned into new gas storage, substantial resource identification and geological assessment work are necessary. This project will assess the regional geology of New York State to identify potential gas-storage sites.

OBJECTIVES

To identify and characterize potential gas-storage sites based on the regional geology of New York State, assess their viability based on structure and stratigraphy, and identify geologic techniques for gas storage currently available but not in use in New York State.

RESEARCH EFFORT

Identifying low- and high-deliverability gas-storage sites will be accomplished through a multiphase research program. The first phase will identify formations for storage facilities through data collection, discussions with industry and government representatives, and a review of geologic techniques for storage. An industry panel will be established to focus the research effort. The second phase will define structure and stratigraphy of potential formations such as depleted gas fields, non-gas-bearing rock, salt formations, and brine-disposal beds through field investigations, review of downhole data, and petrographic studies. The third phase will assess the potential for subsurface brine disposal in the Sauk Sequence of South Central New York State. New York's utilities, pipeline companies, and storage operators will use the results to site future natural-gas-storage facilities.

BENEFITS

This project may accelerate the development of natural-gas-storage fields. which would improve the stability of the State's natural-gas market and help create a competitive storage industry.

SCHEDULE AND STATUS

All of the field information, well logs, and distribution-system data have been collected. The final report is complete for the first two phases. Collection is continuing for the brine-disposal analysis of the Sauk Sequence.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$187,930	0	$187,930
New York Gas Group	207,880	0	207,880
Tejas Power Corporation	20,000	0	20,000
TOTALS	$415,810	0	$415,810

Contractor: New York Gas Group; subcontractor: Northeastern Science Foundation, Inc.
Site: Troy, Rensselaer County
Contract Duration: 6/94-12/97
Key Words: assist business, gas, utilities, energy storage
Project Manager: John Martin (518) 862-1090, ext. 3265
Program: Energy Resources
Subprogram: Indigenous Resources
Contract No.: 4027L-ERTER-ER-95

-> Three-Dimensional Seismic Demonstration - The Northwoods Project

Demonstrate use of three-dimensional seismic technology to characterize new indigenous natural gas reservoir.

BACKGROUND

The advent of large, fast computers (particularly supercomputers and parallel processors) enables three-dimensional (3D) imaging of the subsurface. The computers permit collection of the vast data needed to form a complex 3D image. This technology will allow a more accurate characterization of the deep Cambro-Ordovician reservoirs in New York State. The Cambro-Ordovician section has been the target for exploratory drilling in Ohio for more than a decade, during which time it has gone from an insignificant reservoir to 49 percent of all permits issued in 1994. With this increase in exploratory drilling has come a significant increase in oil and gas production directly associated with Cambro-Ordovician reservoirs. Because the geology and stratigraphy of the Cambro-Ordovician section in New York are similar to that in Ohio, the potential clearly exists for hydrocarbons from this section in New York.

OBJECTIVES

To: (1) demonstrate an emerging technology for applicability in New York State, and (2) identify the size, shape, and structure of a Cambro-Ordovician gas reservoir, which could be New York State's most promising prospect for new indigenous natural gas.

DESCRIPTION

Ardent Resources, Inc. has demonstrated productive potential by discovering natural gas from the Cambrian Theresa Sandstone in Wyoming County, New York. The well was located using conventional (2D) vibroseis and cross-country dynamite seismic, but the reservoir's characteristics, including arcal extent, overall morphology, infrastructure, and methods for optimizing drilling and production from the field, are poorly understood. A three-square-mile, 3D seismic survey will be completed to image and characterize the reservoir. The data will be analyzed at Los Alamos National Laboratory using new reservoir-simulation tools Ardent then will apply the project results to this specific reservoir, among others.

BENEFITS

3D seismic is a powerful tool that could greatly increase the ability of producers to find and exploit indigenous natural gas. The Cambro-Ordovician reservoir may represent the best opportunity to increase natural-gas production in New York State.

SCHEDULE AND STATUS

Results were presented in July 1996 at the Independent Oil and Gas Association summer meeting. Final case study submission is expected in May 1997.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$60,000	0	$60,000
Los Alamos National Laboratory (CRADA)	70,000	0	70,000
Ardent Resources (cash and in-kind)	70,000	0	70,000
TOTALS	$200,000	0	$200,000

Contractor: Ardent Resources, Inc.
Site: Arcade, Wyoming County, and Los Alamos, NM
Contract Duration: 8/95 - 5/97
Project Manager: John Martin (518) 862-1090, ext. 3265
Key Words: assist business, gas, exploration
Program: Energy Resources
Subprogram: Natural Gas
Contract No.: 4207-ERTER-ER-96

-> St. Lawrence Lowlands Geologic Investigation

Investigate hydrocarbon potential of St. Lawrence Lowlands.

BACKGROUND
The St. Lawrence Lowlands, along with the upper Champlain Valley, form the southern edge of the St. Lawrence paleorift basin. Although there is natural gas production in Quebec, little exploration has been done in the New York zone.

OBJECTIVE
To assess the potential for economic accumulations of hydrocarbons in the St. Lawrence Lowlands region.

DESCRIPTION
This study will investigate the regional geology, hydrocarbon potential, past oil and gas industry activity, and technical and economic implications of future drilling and production activity. The project will: (1) collect and analyze relevant well data, including, but not limited to, drill reports, well logs, and well tickets; (2) collect and analyze remote-sensing data to identify hydrocarbon accumulations; (3) collect and analyze anecdotal information to assist in characterizing potential producing formations in the study area; and (4) prepare summary reports and presentations of the results of the investigation, with emphasis on geologic, engineering, and economic implications.

BENEFITS
If the study indicates the potential for hydrocarbons, the project may lead to further indigenous natural gas exploration and production activity.

SCHEDULE AND STATUS
The project is under way.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	0	$9,980	$9,980
TOTALS	0	$9,980	$9,980

Contractor: Dan Billman
Site: St. Lawrence, Franklin, and Clinton counties
Contract Duration: 1/96-9/97
Key Words: natural gas, exploration
Project Manager: John Martin (518) 862-1090, ext. 3265
Program: Energy Resources
Subprogram: Indigenous
Contract No.: 4550-ERTER-ER-97

-> Catskill Mountains Geologic Investigation

Investigate hydrocarbon potential of Catskill Mountains.

BACKGROUND
The Catskill Mountain region is a prominent area containing rocks primarily of Devonian or Ordovician origin. The mountains represent the northeastern-most portion of the Catskill Delta formed during the Devonian Period. Many of these formations have produced economic levels of hydrocarbons in other regions, but there has been little produced in the Catskills themselves.

OBJECTIVE
To assess the potential for economic accumulations of hydrocarbons in the Catskill Mountain region.

DESCRIPTION
This study will include the investigation of the regional geology, hydrocarbon potential, past oil and gas industry activity, and technical and economic implications of future drilling and production activity. The contractor will: (1) collect and analyze relevant well data including, but not limited to, drill reports, well logs and well tickets; (2) collect and analyze remote-sensing data to identify hydrocarbon accumulations; (3) collect and analyze anecdotal information assisting in the characterization of potential producing formations in the study area; and (4) prepare summary reports and presentations of the results of the investigation, with emphasis on geologic, engineering, and economic implications.

BENEFITS
If the study indicates the potential for hydrocarbons, the project may lead to further indigenous natural gas exploration and production activity.

SCHEDULE AND STATUS
The project is under way.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	0	$9,989	$9,989
TOTALS	0	$9,989	$9,989

Contractor: Wilbur Smith Associates
Site: Latham, Albany County; and Schoharie, Greene, Ulster, Delaware, and Sullivan counties
Contract Duration: 12/96-7/97
Key Words: natural Gas, exploration
Project Manager: John Martin (518) 862-1090, ext. 3265
Program: Energy Resources
Subprogram: Indigenous
Contract No.: 4551-ERTER-ER-97

Perform remote-sensing and geologic evaluation of large portion of New York State.

BACKGROUND
Locating and characterizing fractured reservoirs using remote-sensing techniques can be useful when trying to evaluate the potential for economic production from those reservoirs. This analysis will be used to help identify and assess prospective areas in New York that have a high potential for containing commercial reserves of oil and gas in fractured shales, siltstones, and sandstones for New York's Ordovician through Devonian stratigraphy.

OBJECTIVE
To provide practical and useful tools and information for basin-level exploration for fractured-reservoirs.

DESCRIPTION
From the EOSAT/EROS archive of satellite data, the contractor will select the 10 best thematic mapper scenes that cover the target area. The contractor will interactively review the data and choose the best digital enhancement process for geologic interpretability. The enhanced data will be geocoded, digitally mosaicked, and divided into four image maps that cover the Appalachian Basin and St. Lawrence Lowlands. Other geologic information will be incorporated into the analysis. The results will be interpreted for faults, folds, fractures, vegetation, and tonal anomalies that may mark hydrocarbon microseepage, and any other features that may be useful in pursuing fractured-rock reservoirs. The results will be provided electronically.

BENEFITS
The study will be incorporated in a larger investigation of fractured-reservoir exploration in New York State.

SCHEDULE AND STATUS
The project is under way.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	0	$69,956	$69,956
TOTALS	0	69,956	$69,956

Note: See companion project 4479-ERTER-ER-97

Contractor: Earth Satellite Corporation
Site: Upstate New York
Contract Duration: 12/96-5/97
Key Words: natural gas, exploration
Project Manager: John Martin (518) 862-1090, ext. 3265
Program: Energy Resources
Subprogram: Indigenous
Contract No.: 4538-ERTER-ER-97

-> Application of Innovative Technologies to Shallow Fractured Reservoir Development

Complete a hydrocarbon prospect evaluation for fractured reservoirs over a large portion of New York State.

BACKGROUND

The location and characterization of fractured reservoirs using remote sensing techniques and basin-level geologic analysis can be useful when trying to evaluate the potential for economic production from these reservoirs. This analysis will be used to identify and assess prospective areas in New York that have a high potential for containing commercial reserves of oil and gas in fractured shales, siltstones, and sandstones for New York's Ordovician through Devonian stratigraphy.

OBJECTIVE

The objective of this study is to apply innovative technology to a systematic exploration effort targeting fractured shale and interbedded sandstone reservoirs including remote sensing, a new application of sidewall coring, and using geographic information systems as an exploration tool.

DESCRIPTION

This project will compile, examine and, if necessary, augment geologic and production data for use in evaluating the potential for fractured reservoir development in the Ordovician and Devonian clastic deltaic sequences. The project will integrate the data and the results of the remote sensing fracture analysis to update or generate a new spacial database that shall be used to evaluate areal extent of commercially viable fractured reservoirs. The remote sensing data will be interpreted for faults, folds, fractures, vegetation, and tonal anomalies that may mark hydrocarbon microseepage, and any other features that may be useful in pursuing fractured-rock reservoirs. A geologic analysis will be performed to identify likely productive intervals throughout the Basin, determine geologic controls on reservoir development, and delineate fractured reservoir provinces based on potential type of fractured reservoir and expected gas/oil-in-place. Finally, the project will rank provinces by their overall potential productivity; and perform more detailed assessment of two or more provinces selected by an industry consortium.

BENEFITS

The study will help define prospective drilling targets for hydrocarbon production.

SCHEDULE AND STATUS

The project is under way.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	0	0	0
U.S. Department of Energy	0	$50,000	$50,000
Gas Research Institute	0	20,000	20,000
Natural Gas E&P Companies	0	100,000	100,000
TOTALS	0	$170,000	$170,000

(Remote Sensing funded as project 4538-ERTER-ER-97).

Contractor: The Cadmus Group, Inc.
Site: Upstate New York
Contract Duration: 10/96-6/97
Key Words: Natural Gas, exploration
Project Manager: John Martin (518) 862-1090, ext. 3265
Program: Energy Resources
Subprogram: Indigenous
Contract No.: 4479-ERTER-ER-97

-> Application of Paleogeomorphic Mapping Techniques to Exploration Problems in New York State

Demonstrate paleogeomorphic mapping of three distinct natural-gas exploration targets.

BACKGROUND

Paleogeomorphic mapping is used to identify stratigraphic hydrocarbon reservoirs that can be missed by geophysical methods. Paleogeomorphic maps are created by identifying thicknesses of stratigraphic rock sequences indicative of depositional conditions. Thinning of the chosen map interval is directly related to the presence of hydrocarbon reservoirs and is related to those elements necessary for the formation of a hydrocarbon reservoir, including porosity, permeability, fluid content, and trapping mechanism. In the paleogeomorphic high proper, porosity and permeability, as well as hydrocarbons, are usually found. The key is that the paleogeomorphic high creates conditions that promote the formation of porosity, whether in clastic or carbonate rocks.

OBJECTIVE

To demonstrate the applicability of paleo-geomorphic mapping to the natural gas reservoirs of New York State.

DESCRIPTION

The project will identify three demonstration sites where paleogeomorphic mapping will be tested. The sites will be chosen to address identification of: (1) new exploration areas, (2) additional infill or secondary recovery areas, and (3) suitable horizons for natural-gas storage. Data will be collected from each site and interpreted using the paleogeomorphic mapping methodology. Results will be presented at an industry meeting sponsored by NYSERDA and the Independent Oil and Gas Association of New York.

BENEFITS

If successful, this technique offers an extremely cost-effective alternative to seismic methods to help identify stratigraphic traps.

SCHEDULE AND STATUS

Data analysis is complete. The project results will be presented in July 1997.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	0	$6,900	$6,900
Pyron Consulting	0	14,940	14,940
TOTALS	0	$21,940	$21,940

Contractor: Pyron Consulting
Site: Tioga County, and Pottstown, PA
Contract Duration: 10/96-7/97
Key Words: assist business, gas, petroleum, production
Project Manager: John Martin (518) 862-1090, ext. 3265
Program: Energy Resources
Subprogram: Indigenous Resources
Contract No.: R2069

-> High-Potential Recovery by Gas-Repressurization Demonstration

Demonstrate use of flue-gas as repressurization method for oil fields.

BACKGROUND

Oil production began in western New York State in 1865, just five years after the Drake Well was drilled in Titusville. These New York fields are still in production today, with more than 3,000 stripper wells still active in Allegany and Cattaraugus counties. State oil production totaled nearly 300,000 barrels in 1994. Unlike natural gas, oil production usually relies on some mechanical lift technology to bring the oil to the surface. This can be a simple pumping mechanism (primary production) or more sophisticated (secondary or tertiary) external pressurization. Primary production, using only mechanical pumps, really only extracts a small percentage of the actual oil in the reservoir. Secondary recovery methods such as waterflooding are common in the U.S. and are used extensively in New York. Secondary methods considerably improve the percentage of oil recovered, but still leave more than half the oil behind. Tertiary recovery, such as gas pressurization, is far less common. Tertiary recovery tackles the remaining oil and improves production rates over secondary means. The U.S. Department of Energy is trying to economically increase stripper-well production by repressurizing the fields using hot flue gas generated by burning natural gas.

OBJECTIVE

To demonstrate a gas-repressurization technique for increased oil production in New York State's historic oil fields.

DESCRIPTION

The Chipmunk Field in Cattaraugus County was developed for primary production in the 1960s by Pennzoil. Subsequently, the field was set up for waterflooding (secondary recovery) and now has 23 producing wells and 18 water-injection wells. The contractor is designing and installing a gas-repressurization system (tertiary recovery) to inject hot flue gas into the injection wells. Bottom-hole pressure should be increased from 400 pounds per square inch (psi) to 600 psi with the system and remain cost-effective even if oil prices drop to $14 per barrel. This is partly due to eliminating the need for water, which reduces disposal costs and increased oil viscosity due to heat. Ultimate recovery for this field is estimated at 500,000 to 1,000,000 barrels, with 80,000 barrels produced at this point. NYSERDA is supporting the technical assistance/ verification portion of the project.

BENEFITS

The project is demonstrating an advanced oil-recovery technology that can lower the cost and simultaneously increase the production of oil from New York State's oil fields.

SCHEDULE AND STATUS

The project is under way.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	0	$10,000	$10,000
U.S. Department of Energy	0	133,000	133,000
Hydrocarbon Generation, Inc.	0	123,000	123,000
TOTALS	0	$266,000	$266,000

Contractor: Hydrocarbon Generation, Inc.
Site: Allegany, Cattaraugus County
Contract Duration: 7/96-8/97
Key Words: assist business, petroleum, production
Project Manager: John Martin (518) 862-1090, ext. 3265
Program: Energy Resources
Subprogram: Indigenous Resources
Contract No.: R2058

-> Improved Recovery in the Naturally Fractured Queenston Formation Using Geologic/Engineering Analysis and Deviated-Well Technology

Demonstrate several advanced natural-gas production technologies in existing gas reservoir.

BACKGROUND

The Auburn field taps into the "tight" sandstone beds of the Queenston Formation in Central New York. The Upper Ordovician Queenston Shale formation includes red shale, red siltstone, and red sandstone. The formation was created as part of a large delta as the last recorded event of the Ordovician era in New York. Rocks of the Silurian Medina Group sit unconformably on top of the Queenston. The New York State Geological Survey estimates the reserves of the Queenston at 580 billion cubic feet. Much Queenston production is now considered marginal at best, partly due to the inconsistency of production from existing wells. Evidence suggests that the natural fracturing of the formation is the reason for this variability. Encountering natural fractures is the key to whether a well is economic or not.

OBJECTIVE

To apply advanced engineering/geologic analysis and directional drilling techniques to enhance well productivity in the Queenston Formation by intersecting natural fractures. Using these technologies will allow the contractor to characterize and improve production from the Formation.

DESCRIPTION

The project team will develop a geologic/engineering model to describe the matrix and natural fracture components of the Queenston Formation; identify step-out and infill new well locations in the Auburn Field through geologic interpretation; carry out reservoir engineering and statistical analysis; and drill and test a deviated well in the best location to encounter significant, undepleted natural fractures. Following well completion, the team will determine the recommended completion and stimulation procedures for fixture-deviated wells, determine incremental reserves and economic benefit of drilling deviated vs. vertical wells, and identify and determine the technology's application in other New York State formations.

BENEFITS

The project will apply several innovations to a New York State gas field, including advanced geologic/engineering analysis of tight sands (pioneered by the Gas Research Institute (GRI) and applied in Wyoming, Texas, and Colorado), deviated-well technology (new to New York), and application of GRI's FRACTPRO^{tm} model. Results will be transferred to other New York State operators.

SCHEDULE AND STATUS

The deviated well has been completed. The results will be presented in May 1997 and the final report is expected in June 1997.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$40,000	0	$40,000
Meridian Exploration Corp.	160,000	0	160,000
TOTALS	$200,000	0	$200,000

Contractor: Meridian Exploration Corp.
Site: Seneca and Cayuga counties
Contract Duration: 9/95 - 6/97
Key Words: assist business, gas, exploration
Project Manager: John Martin (518) 862-1090, ext. 3265
Program: Energy Resources
Subprogram: Indigenous Resources
Contract No.: 4307-ERTER-ER-96

-> Improved Recovery through Infill Drilling in the Queenston Formation in Cayuga County

Demonstrate potential for infill drilling in existing natural gas field.

BACKGROUND

Natural gas reserve estimates continue to increase, even though few new large-scale fields have been located. Infill drilling in existing natural gas fields can increase existing field recovery by 30 percent or more. To date, no systematic infill-drilling program has occurred in New York State.

A systematic approach to finding a site for infill-drilling is required to optimize well location. Also, infill wells often are closer together than allowed by State regulations and require a variance. Engineering analysis offers the clear evidence required for a spacing variance.

The West Auburn field in Cayuga County produces gas from 292 wells from the Queenston sand/shale at a depth of 2,000 ft. In 1994, field production totaled 1.4 billion cubic feet. The contractor operates 260 of these wells on continuous acreage.

OBJECTIVE

To demonstrate an innovative technology, "moving domain" analysis for estimating the optimal infill-well locations and reserves in the contractor's West Auburn Field.

DESCRIPTION

This project will quantify the typical reserve and drainage areas of the existing wells, in addition to estimating recoveries for infill wells using moving-domain analysis. The moving-domain analysis uses a combination of engineering analysis and statistical characterization. Also, the analysis will help evaluate the recommended completion and stimulation procedures for the infill wells. Finally, the project will identify the technology's applicability to other New York State formations and disseminate the results quickly to operators. The project will demonstrate a methodology to identify the best location within other existing fields to drill infill wells and maximize well/field economics. If successful, new well-drilling could experience a resurgence throughout the State's gas industry as the study results become publicized and evaluated in other formations.

BENEFITS

Systematic infill-drilling offers the potential for increased natural gas production in New York's existing natural gas fields, many of which are similar tight sands with matrix porosity. If successful, this methodology could be used at many of these fields. A full infill-drilling program in the West Auburn field could increase production by 400 MMcf per year (roughly 30%).

SCHEDULE AND STATUS

The initial geologic and moving domain analysis is complete. Well siting work continues.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	0	$48,000	$48,000
Meridian Exploration Corp.	0	277,500	277,500
TOTALS	0	$325,500	$325,500

Contractor: Meridian Exploration Corp.
Site: Cayuga County
Contract Duration: 10/96-9/97
Key Words: assist business, gas, production
Project Manager: John Martin (518) 862-1090, ext. 3265
Program: Energy Resources
Subprogram: Indigenous Resources
Contract No.: 4481-ERTER-ER-97

-> Drilling and Well-Core Analysis of the Upper Theresa of Western New York

Collect and analyze well cores, and advanced logging suite for deep well in western New York State.

BACKGROUND

The Cambro-Ordovician section has been the target for exploratory drilling in Ohio for more than a decade. With this increase in drilling, oil and gas production directly associated with Cambro-Ordovician reservoirs has increased significantly. Geology and stratigraphy of the Cambro-Ordovician section in New York is similar to Ohio, with similar potential for hydrocarbons. NYSERDA is funding advanced exploration techniques such as aeromagnetic and three-dimensional (3D) seismic surveys targeting the Upper Cambrian Theresa of western New York. To gain a better scientific understanding of reservoir characteristics, production analysis such as well logs and cores are necessary, particularly for the first major drilling effort.

OBJECTIVE

To generate detailed geologic information on the producing segments of the Cambrian Theresa sandstone of western New York.

DESCRIPTION

The project is a follow-on to the 3D seismic study (4207-ERTER-ER-96). The 3D results have completely altered the currently held view of the Theresa in this area; this project will further enhance the technical understanding of this important reservoir. The contractor will collect and analyze logs and cores from the target well. A research firm or institution will interpret and report the results. Core analysis will be used to describe the geological characteristics of the Theresa formation as compared to similar producing formations in Ohio. Results will be transferred to industry. Producers then will use this information to increase indigenous production from this formation.

BENEFITS

The well core is expected to yield critical information, including specific permeability and porosity figures, hydrocarbon and water saturation, and full rock evaluation. Broad distribution of this information will help other producers and researchers interested in this formation. If the well is successful, the information may lead to significant increases to New York State's reserve base and production levels.

SCHEDULE AND STATUS

The logging and coring work is complete and the geologic analysis and report are expected by July 1997.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	0	$87,600	$87,600
U.S. Energy Development Corp.	0	241,405	241,405
TOTALS	0	$329,005	329,005

Contractor: U.S. Energy Development Corporation
Site: Arcade, Wyoming County
Contract Duration: 10/96-7/97
Key Words: assist business, gas, production
Project Manager: John Martin (518) 862-1090, ext. 3265
Program: Energy Resources
Subprogram: Indigenous Resources
Contract No.: 4378-ERTER-ER-96

-> Magnetic Resonance Logging Device Demonstration in Medina Gas Wells, Western New York

Demonstrate new logging tool and compare it with traditional tools.

BACKGROUND

Since the turn of the century, thousands of Medina wells have been drilled in Western New York to recover pipeline-quality natural gas. The Medina in New York State is a Lower Silurian Age Group of sandstone, siltstone, and shale formations often referred to as a "blanket sand" because it is present over a broad area from central Ohio (where it is referred to as the Clinton Group) to central New York and across Lake Erie into part of Ontario. In Western New York, the Medina ranges from about 100-155 feed, consisting of interbedded red or white sandstones, siltstones, and red-grey or green shales originally deposited in a low-energy deltaic environment. The deltaic nature of the Medina accounts for the variability in the sand/shale ratio evident from well to well. This variability in turn affects reservoir quality and ultimately the total volume of natural gas recoverable from any one well. Most Medina wells are stimulated by hydraulic fracturing, which has the effect of greatly multiplying the natural gas production during the initial production years. Total recovery of gas is not increased, but the overall time frame for recovery is substantially reduced with a positive effect on cash flow. Most Medina wells would not be economic without stimulation. Operators, however, must make the decision on whether to hydraulically fracture a well based on incomplete information, knowing only porosities. This may lead to either prematurely abandoning a well or incorrectly decide to invest more into a poorly performing well.

OBJECTIVE

To compare and contrast the information derived from both sources to better derive completion and stimulation parameters, and thereby improve natural gas recovery.

DESCRIPTION

Ardent Resources, Inc. proposes to run a magnetic resonance (MR) logging device in each of five Medina gas wells to be drilled in Western New York. This device will be run in conjunction with the "standard" log suite used in most new Medina wells. The project will: combine standard logging data with that derived from an MR tool for a complete evaluation of reservoir characteristics, (2) assess the value of this information in the decision-making process of completion and stimulation, (3) compare and contrast the decisions that would have been made with standard logs versus those made with the added advantage of MR data, and, assuming MR changes the decision-making process, (4) assess the results intervals of gas-production performance) across the five Medina well candidates.

BENEFITS

The MR tool offers New York State operators a potentially economically productive solution to the problem of assessing permeability and water saturation in a primary gas-producing formation.

SCHEDULE AND STATUS

The project is under way.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	0	$28,500	$28,500
Ardent Resources, Inc.	0	621,500	621,500
TOTALS	0	$650,000	$650,000

Contractor: Ardent Resources, Inc.
Site: Buffalo, Erie County, and Chautauqua County
Contract Duration: 2/97 - 2/98
Key Words: natural gas, exploration
Project Manager: John Martin, (518) 862-1090, ext. 3265
Program: Energy Resources
Subprogram: Indigenous Resources
Contract No.: 4547-ERTER-ER-97

-> IOGANY Marginal Well Evaluation

Evaluate marginal and shut-in natural gas wells for innovative ways to bring them back into production.

BACKGROUND

In 1994, New York State produced more than 20 billion cubic feet of gas and 200,000 barrels of oil from 23 counties. The New York State Department of Environmental Conservation (DEC) estimates that 60,000 wells have been drilled in New York State and that the State has over 13,000 producing wells. Current low prices for oil and gas have resulted in a high percentage of operating wells being only marginally profitable. Operators often do not have the time or resources to systematically evaluate every marginal well they control. This project offers the first systematic way for producers to look at these wells again in an effort to return them to a productive state.

OBJECTIVE

To field-test and evaluate 150 to 200 marginal and shut-in wells to determine the potential for additional natural-gas production through future rehabilitation and application of new technologies.

DESCRIPTION

The project will establish an industry-sponsored initiative to bring shut-in wells back to economic production through the creation of systematic methodologies for subsequent field-demonstration. A number of different firms will provide 100-200 candidate wells. Participating producers, along with industry experts from DEC, the Petroleum Technology Transfer Council (PTTC), and the U.S. Department of Energy will help develop the testing and methodology necessary to evaluate these wells. The proposed evaluation model will be subjected to review using PTTC's World Wide Web site to allow oil and gas experts throughout the U.S. to provide input and comments. The wells will be systematically evaluated for productivity enhancement. NYSERDA and the Independent Oil and Gas Association of New York (IOGANY) will hold a workshop outlining the developed model and detailing its results to the New York oil and gas community. Results also will be posted on PTTC's home page.

BENEFITS

Because it is much less expensive to recomplete an existing well than to drill a new one, the project may help increase economic natural-gas production in the State, improving both the operator's revenue and tax collections by municipalities. The project will help avoid plugging potentially productive wells, thus avoiding lost resources (once a well is plugged, it is lost). Finally, this project should help DEC continue its effort to plug nonproductive wells with the help of the industry, creating a positive working environment between government and industry.

SCHEDULE AND STATUS

Well testing will continue until June 1997.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$48,547	0	$48,547
IOGANY and participating producers	68,045	0	68,045
TOTALS	$116,592	0	$116,592

Contractor: Independent Oil and Gas Association of New York
Site: Chautauqua, Erie, Wyoming, Cayuga, Seneca, Cattaraugus, Allegany, and Livingston counties
Contract Duration: 4/96-8/97
Key Words: assist business, gas, production
Project Manager: John Martin (518) 862-1090, ext. 3265
Program: Energy Resources
Subprogram: Indigenous Resources
Contract No.: 4335-ERTER-ER-96

-> Implementation of a Model-Based Neural System for Wireline Well-Log Analysis

Develop and commercialize advanced well-log interpretation system.

BACKGROUND

Well logs are curves of amplitude versus depth obtained by running well log "tools" (sensors) down a borehole. The well logs provide information about the rock and fluid properties, and are the single most important instrument used to determine how much hydrocarbon might exist in rocks. Because each borehole might have several different tools, interpretation of such multitool logs in rocks of a complex and changing lithology poses a challenge best solved by computers, along with equations that attempt to model rock properties. To date, most models have not been successful. Neural nets are a mathematical way of analyzing large datasets where there is no apparent model to explain the interrelationships among variables, or when the relationships among variables are highly non-linear. GAMLS (Geologic Analysis via Maximum Likelihood System) is a model-based neural system for analyzing wireline well logs and core data.

OBJECTIVE

To fully develop a commercial version of GAMLS as a well-log interpretive tool. The product will lend itself to a service industry, as well as a marketable software product, for the oil and gas industry, where many reservoirs cannot be modeled adequately for accurate reserves evaluation (a key economic consideration).

DESCRIPTION

A prototype version of GAMLS has been developed by the contractor in the last two years. GAMLS uses algorithms developed by Nichols Research Corporation for defense applications; this is the first application of these algorithms to geologic problems. The project will package the current Macintosh version for beta-testing or license to those clients interested in a Macintosh version. Also, the Macintosh version will be converted to Windows 95 and NT platforms. Finally, the contractor will perform comparison studies that compare GAMLS results with those of other analyses, including those where analyses have been done using other neural-net programs or traditional linear and non-linear procedures.

BENEFITS

The market for this software could lead to the development of a New York-based high-technology firm servicing the oil and gas industry. Also, due to New York's complex geology, indigenous producers require better modeling tools. Existing data could be run through this type of system, allowing these reservoirs to be characterized better.

SCHEDULE AND STATUS

The project is ongoing.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	0	$98,928	$98,928
Eric Geoscience	0	28,880	28,880
Phillips Petroleum	0	20,000	20,000
Other sources	0	159,040	159,040
TOTALS	0	$306,848	$306,848

Contractor: Eric Geoscience, Inc.
Site: Glenmont, Albany County
Contract Duration: 9/96-8/97
Key Words: product development, gas, exploration, production
Project Manager: John Martin (518) 862-1090, ext. 3265
Program: Energy Resources
Subprogram: Indigenous Resources
Contract No.: 4482-ERTER-ER-97

-> Aeromagnetic Geologic Demonstration Survey for Natural-Gas Drilling

Use advanced geologic techniques to improve opportunities for natural-gas production in Western New York.

BACKGROUND

The Cambro-Ordovician section has been the target of exploration drilling in Ohio for over a decade. The success rate for wells targeting this section has increased from 30 percent to more than 60 percent during that time due to better geological understanding and improved geophysics, aided by techniques such as aeromagnetic and three-dimensional (3D) seismic. Similarly, oil and gas production has increased substantially in the province of Ontario, Canada, as a direct result of new and prolific Cambro-Ordovician discoveries. Because the geology and stratigraphy of the Cambro-Ordovician section in New York are similar to Ohio and Ontario, similar potential clearly exists for oil and gas production in this section of New York State.

OBJECTIVES

To: (1) demonstrate an emerging technology for applicability to natural-gas exploration in New York State; (2) compare this technology with other exploration techniques (2D, 3D, and subsurface geological interpretation) for the ability to successfully image known producing reservoirs and undrilled anomalies; and (3) use the final interpretation to identify new anomalies for detailed seismic investigation or future drilling.

DESCRIPTION

Ardent Resources, Inc. will acquire an aeromagnetic data set for an eight-township area covering eastern Erie and western Wyoming counties. The survey will be a tight-grid airborne magnetic survey with flight lines spaced 1/4 mile east/west by 1/2 mile north/south. Approximately 1,225 line-miles of data will be acquired. These data will be processed and interpreted to highlight structural features related to the Cambro-Ordovician section and basement. A basement structure map will be prepared using state-of-the-art magnetic analysis software (STARMAG™) incorporating all deep-well control. This map will cover, in part, known Cambro-Ordovician natural-gas reservoirs and undrilled anomalies (identified by geological or other geophysical techniques) for comparison and provide a template for future hydrocarbon exploration and development in the survey area. Should the technique prove valid and anomalies be located, the New York State natural-gas industry will invest in more targeted exploration in the Cambro-Ordovician section of Erie and Wyoming counties, as well as new aeromagnetic surveys.

BENEFITS

This technique has the potential to reduce the cost of finding deep natural-gas resources in the State. The 3D seismic technique costs nearly $30,000 per square mile, and identifying where to apply 3D is difficult, so its application has to be very specific. The great promise of aeromagnetics is that for as little as $15 per square mile, a large area can be surveyed to identify potential targets for 2D and 3D seismic, saving considerably on exploration costs.

SCHEDULE AND STATUS

The survey has been completed and the final case study is expected by May 1997.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$40,000	0	$40,000
Ardent Resources, Inc.	51,568	0	51,568
TOTALS	$91,568	0	$91,568

Contractor: Ardent Resources, Inc.
Site: Erie and Wyoming counties
Contract Duration: 2/96 - 5/96
Key Words: assist business, gas, exploration
Project Manager: John Martin (518) 862-1090, ext. 3265
Program: Energy Resources
Subprogram: Indigenous Resources
Contract No.: 4365-ERTER-ER-96

-> Assessing Geothermal Energy Potential in Upstate New York

Evaluate geothermal energy's potential to produce electricity in upstate New York.

BACKGROUND

While New York State has vast potential geothermal resources, tapping this resource has proven too costly. A NYSERDA project in the early 1980s led to the first geothermal well in the eastern U.S.; however, follow-up has been limited. Periodic reassessments that incorporate technological changes, new geologic data, and changing economics are essential if geothermal energy is ever to be developed in New York State.

ACCOMPLISHMENTS

The study identified and modeled a geothermal reservoir for electric power generation.

FINDINGS AND CONCLUSIONS

Electricity can be produced from New York State's geothermal resources for an estimated $.184/Kwh for a 5MW capacity $.148/Kwh for a 15MW capacity facility.

REALIZED OR ANTICIPATED BENEFITS

Though not economic at this time, New York State's geothermal resources could provide a future source of electrical generation.

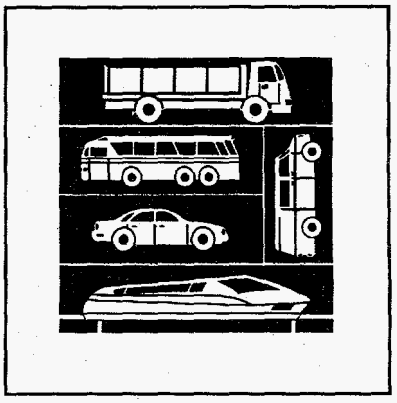
TECHNOLOGY TRANSFER ACTIVITIES

A report will be issued.

FUNDING	TOTALS
NYSERDA	$71,873
Los Alamos National Laboratory	35,937
TOTALS	$107,810

Contractor: Research Foundation of the State University of New York on behalf of SUNY/Buffalo
Site: Amherst, Erie County, and Alexandria, VA
Contract Duration: 5/95 - 8/96
Key Words: renewable, utilities, electricity, alternative fuels
Project Manager: John Martin (518) 862-1090 ext. 3265
Program: Energy Resources
Subprogram: Indigenous Resources
Contract No.: 4023-ERTER-ER-96

TRANSPORTATION



Benefits and Rationale

The transportation sector consumes 39% of the energy used in New York, causes 55% of the State's air-quality problems, and remains 99% petroleum-dependent. Over the next 20 years, highway transportation miles are projected to increase by 40% and traffic congestion is forecast to triple. If no actions are taken to reduce current trends, the cost to New Yorkers in terms of increased fuel expenses, deterioration of air quality, and lost mobility will be substantial.

In the early 1990s, three pieces of national legislation contributed to the impetus for improved transportation technologies: the Clean Air Act Amendments of 1990, the Intermodal Surface Transportation Efficiency Act of 1991, and the Energy Policy Act of 1992. These actions, combined with a significant investment in clean vehicle research at the national level and by electric and gas utilities, provided a strong incentive to develop alternative-fuel vehicles. The national research focus has been on working with only the largest auto manufacturers to develop technologies that will result in production prototypes early in the next century.

As we enter the late 1990s, utility restructuring has motivated utilities to look at near-term competition and profitability and has curtailed a once strong mid-term utility-funded R&D program in alternative-fuel vehicle technology. This has left a gap in research and product development activity designed to accelerate the commercialization of emerging technologies. NYSERDA's transportation program is primarily directed at this gap between deployment of yesterday's technology and nationally funded long-term research by investing in emerging technologies that offer the potential to become products that could have a significant beneficial impact on the State's energy and environmental problems during the next 10 years.

Improved transportation technologies and systems are required if we are to minimize the energy consumption associated with the predicted growth in vehicle miles traveled and to meet the State's air-quality goals, particularly in urban areas. This program develops and demonstrates new technologies to meet these needs and provides opportunities for New York businesses in transportation industries.

With the development of new technologies, New York has an opportunity to both increase compliance and establish new industries. Within this framework, NYSERDA's Transportation program includes a technology development and applications component, to develop new products to meet specific New York needs; an advanced-technology vehicle demonstration component, to evaluate emerging ultra-clean and efficient vehicle technologies in real-world applications; and a complementary effort to evaluate the costs and benefits of advanced public-sector transportation systems that will be our alternatives for the coming decades.

The *technology development and applications program* supports New York firms in developing technologies for national and world markets, with an emphasis on those technologies that have the greatest potential to meet the State's specific needs involving severe urban driving cycles and heavy-duty vehicles. New York's industrial base and technology businesses are well-positioned to develop products that can meet these transportation needs. Success in this program area is measured in terms of new products developed, the energy and environmental advantage of the product over existing alternatives; and, ultimately, commercial sales.

The *advanced technology vehicle (ATV) demonstration program* is an effort to evaluate the energy and environmental benefits associated with new and emerging ultra-clean, super-efficient vehicle technology. The program builds on NYSERDA's experience managing the State's Alternative Fuels for Vehicle Fleet Demonstration Program. That program, completed in 1996, placed 257 alternative-fuel vehicles (AFV) in service, provided technical support to the early users of those vehicles, and documented the performance of emerging fuel options and their energy and environmental benefits for dissemination to the public and policy makers. A key lesson learned in that experience is that technical support to the early users of new technology is critical to its success as a commercial product. The ATV demonstration program focuses on moving ultra-clean, super-efficient vehicle technology such as electric, hybrid-electric, and fuel-cell systems out of the laboratory and into real-world demonstration. The program supports the early deployment of products developed in the technology development and applications sub-program area. Success in this program area is measured in terms of reduced fuel consumption, tailpipe emissions, and vehicle maintenance costs.

Traffic congestion wastes millions of dollars in lost time, decreases fuel-use efficiency, and increases emissions in the transportation sector. To address these problems, NYSERDA sponsors research on *advanced transportation systems and infrastructure*. This initiative also addresses improved public infrastructure transportation technologies, including high-speed rail, advanced traffic controls for traffic-demand management, and electrified commuter and transit systems. Technical evaluations and demonstrations of these and other options are necessary to assess costs and benefits and guide the State in improving transportation energy efficiency and mobility and reducing transportation-related environmental impacts. Success in this program area is measured by improved transit ridership, and reduced travel times, congestion, tailpipe emissions, and fuel consumption.

Goals

- Expand opportunities for New York businesses to develop and introduce new technologies in the transportation sector.
- Reduce the State's petroleum dependence by developing super-energy-efficient propulsion systems and a range of economical alternative-fuel options.
- Improve efficiency and reduce emissions in the transportation sector.
- Provide research to help the State comply with the Clean Air Act Amendments.

Alternative-Fuel Vehicle Program Summary

Provide technical and financial support for NYSERDA's Alternative Fuels for Vehicles Fleet Demonstration Program and support research and development projects in the area of alternative fuels.

BACKGROUND

New York State has reduced industrial, residential, and commercial dependence on petroleum; however, transportation is still 99-percent petroleum-dependent. Transportation is also a major cause of urban air pollution. Alternative-fuel vehicles (AFVs) may reduce petroleum dependence while improving urban air quality through reduced vehicle emissions.

OBJECTIVE

NYSERDA's Alternative-Fuel Vehicle Program includes the Alternative Fuels for Vehicles Fleet Demonstration Program (AFV-FDP) and a complementary R&D project portion. The goals of the AFV-FDP have included fielding 257 AFVs in fleets operated by municipalities, county governments, and State agencies to provide data so the State can develop strategies to meet scheduled reductions in air pollution. The R&D component develops state-of-the-art technology.

RESEARCH EFFORT

NYSERDA has provided technical and financial support to acquire, operate, and maintain a variety of AFVs, ranging from cars and light trucks to transit buses. Fuels include methanol, natural gas, propane, ethanol, and electricity. Projects that develop components and/or systems technologies also are supported.

BENEFITS

New York State will benefit through reduced dependence on petroleum-based fuel, improved air quality, and mitigation of future fuel-price increases through diversification. Air-quality improvements made in the transportation sector may preclude the need to impose environmental constraints on other sectors of the economy.

SCHEDULE AND STATUS

See the individual contracts and task orders that follow.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$9,909,066	0	$9,909,066
Petroleum Overcharge Funds	2,201,897	0	2,201,897
Other co-funders[1]	30,385,652	0	30,385,652
TOTALS	$42,496,615	0	$42,496,615

[1] Includes vehicle acquisition and in-kind services.

Contractor: Various contractors
Site: Multiple sites throughout New York State
Contract Duration: 12/90 - 6/97
Key Words: transportation, alternative fuels, AFV
Project Managers: Karen Villeneuve, Larry Hudson, Joe Wagner
Program: Transportation
Subprogram: Advanced Transportation Systems, Alternative Fuels for Vehicles Demonstration, Petroleum Overcharge Funds, Technology Development and Applications
Contract Nos.: Multiple

Provide technical and financial support for selected fleet operators participating in NYSERDA's Alternative Fuels for Vehicles Fleet Demonstration Program.

BACKGROUND

New York State has reduced industrial, residential, and commercial dependence on petroleum; however, transportation is still 99-percent petroleum-dependent. Transportation is also a major cause of urban air pollution. Alternative-fuel vehicles (AFVs) may reduce petroleum dependence while improving urban air quality through reduced vehicle emissions.

OBJECTIVE

The Alternative Fuels for Vehicles Fleet Demonstration Program (AFV-FDP) has been a comprehensive technology assessment of alternative-fuel vehicles (AFVs) and fielded 257 AFVs in State and local government fleets to collect data on AFV performance, emissions, and cost. The data and hands-on experience help State and local decision-makers identify ways AFVs can assist in achieving energy, environmental and economic development goals, and in complying with federal air-quality and alternative-fuel mandates. Natural gas, methanol, ethanol, propane and electricity have been among the fuels evaluated in the AFV-FDP.

DESCRIPTION

NYSERDA has provided technical and financial support to selected State, county, and municipal fleets in New York to acquire, operate, and maintain a variety of AFVs, ranging from cars and light trucks to transit buses. Support included assistance with purchase or retrofit of vehicles, training of operating and maintenance personnel, safety inspection of maintenance facilities, emissions testing, data collection and analysis, and reporting of results.

BENEFITS

The AFV-FDP has provided data and field experience that assist decision-makers in defining appropriate roles for AFVs. New York State will benefit through reduced dependence on petroleum-based fuel, improved air quality, and mitigation of future fuel-price increases through diversification. Air-quality improvements made in the transportation sector may preclude both environmental constraints on other sectors of the economy and imposition of federal sanctions.

SCHEDULE AND STATUS

Field operations and data collection have been completed and a comprehensive final report is being prepared. See Task Order 23, and the completed task orders for this fiscal year that follow.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$2,937,406	0	$2,937,406
Petroleum Overcharge Funds	1,745,958	0	1,745,958
Other co-funders	12,943,925	0	12,943,925
TOTALS	$17,627,289	0	$17,627,289

Contractor: EA Engineering, Science, and Technology, Inc.
Site: Statewide
Contract Duration: 12/90 - 7/97
Key Words: transportation, alternative fuels, emissions control, diesel, ethanol (E85), flexible fuel (FFV), methanol (M85), natural gas (CNG), propane (LPG)
Project Managers: Joe Wagner (518) 862-1090, ext. 3228
Program: Transportation
Subprogram: Alternative Fuels for Vehicles Demonstration, Petroleum Overcharge Funds
Contract No.: 1614-ERER-ER-91

-> Alternative Fuels for Vehicles Fleet Demonstration Program - Task Order #15

Disseminate results of Alternative Fuels for Vehicles Fleet Demonstration Program.

BACKGROUND

The alternative fuels for vehicles fleet demonstration program (AFV-FD)P was a comprehensive technology assessment of alternative-fuel vehicles (AFVs) and fielded 257 AFVs in State and local government fleets to collect data on AFV performance, emissions, and cost. The data and hands-on experience help State and local decision-makers identify ways AFVs can assist in achieving energy, environmental and economic development goals, and in complying with federal air-quality and alternative-fuel mandates. Alternative fuels assessed in the AFV-FDP include compressed natural gas (CNG), methanol, ethanol, LPG/propane and electricity.

OBJECTIVE

To inform the general public, fleet operators, and other decision makers about AFVs and the results of the AFV-FDP.

DESCRIPTION

The approach entails: displaying AFVs and presenting introductory-level AFV information to fleet operators and the public; preparing materials for dissemination to the news media by NYSERDA; and providing assistance to technical experts to enable them to participate in dissemination of AFV information at fleet operator conferences, meetings of technical societies, alternative fuel-related conferences and other events.

BENEFITS

This Task Order disseminates data and field experience that will assist decision-makers in defining appropriate roles for AFVs. New York State may benefit through reduced dependence on petroleum-based fuel, improved air quality, and mitigation of future fuel-price increases through diversification. Air-quality improvements made in the transportation sector may preclude both environmental constraints on other sectors of the economy and imposition of federal sanctions.

SCHEDULE AND STATUS

The contractor has assisted NYSERDA in providing AFVs for display at events and has made presentations of AFV-FDP findings at various conferences across the State, including Clean Cities workshops, the New York Fire Institute in Montour Falls, and an NGV (natural gas vehicle) Cost Reduction Workshop sponsored by the New York Gas Group (NYGAS). Current activity focuses on completion of AFV-FDP documentation and final wrap-up of the program.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$140,789	0	$140,789
Petroleum Overcharge Funds	97,918	0	97,918
TOTALS	$238,707	0	$238,707

Contractor: EA Engineering, Science, and Technology, Inc.
Site: Multiple sites statewide
Contract Duration: 7/92 - 7/97
Key Words: transportation, alternative fuels, AFV, dissemination
Project Manager: Joe Wagner (518) 862-1090, ext. 3228
Program: Transportation
Subprogram: Alternative Fuels for Vehicles Demonstration, Petroleum Overcharge Funds
Contract No.: 1614-ERER-ER-91, TO #15

-> Electric Car Commuter Demonstration - Phase I

Place electric commuter car into service to test feasibility of zero-emission vehicle.

BACKGROUND

New York's adoption of California emission regulations requires the sale of zero-emission vehicles (ZEV) beginning in 1998. The bulk of ZEVs most likely will be electric vehicles, at least in the early years. Utilities in the State are testing van-sized and other electric vehicles to determine their feasibility for fleet applications. Fleet sales alone, however, are unlikely to meet the ZEV quantitative requirements (two percent of total vehicle sales in 1998, rising to 10 percent in 2003). Another likely market for ZEVs may be small commuter cars with limited range requirements. In order to learn whether electric cars can serve commuter needs of this type, NYSERDA will test a single in-house vehicle.

OBJECTIVE

NYSERDA purchased and is operating and testing a four-passenger lead-acid-battery electric car equipped with an on-board electric charger. The goal is to determine the degree to which vehicles of this type can serve practical short-range requirements.

DESCRIPTION

The charging sites, including the Empire State Plaza garage, will be monitored under NYSERDA's Alternative-Fuel Vehicle Fleet Demonstration Program to document the energy consumed by the vehicle. NYSERDA staff who drive the car will provide data on usage and vehicle behavior. Results will be shared with the New York State Department of Environmental Conservation. the Public Service Commission, and other interested organizations.

BENEFITS

This project will help NYSERDA and other State agencies better understand the feasibility of the 1998 ZEV requirement. If ZEVs prove feasible, the State's dependence on petroleum for transportation will be reduced and air quality will be improved.

SCHEDULE AND STATUS

The vehicle has been in service since December 1992. Batteries have been a source of difficulty, but the vehicle has been reliable in other respects. An experimental battery thermal-management system, intended to prevent low-temperature loss of battery power, was found to work well in cold weather but proved vulnerable to leakage of battery acid (from "leakproof" batteries). The vehicle was refurbished in the fall of 1996, including new batteries, and is operating up to specifications.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$42,250	$3,340	$45,590
TOTALS	$42,250	$3,340	$45,590

Contractor: Solectria, Inc., Wilmington, Massachusetts
Site: Albany, Albany County
Activity Duration: 12/92 - 12/97
Key Words: transportation, alternative fuels, electricity, electric car, battery, lead-acid, ZEV
Project Manager: Larry Hudson (518) 862-1090, ext. 3209
Program: Transportation
Subprogram: Alternative Fuels for Vehicles Demonstration
Contract No.: POA1405, POA2015, POR2033

-> Alternative Fuels for Vehicles Fleet Demonstration Program - Task Order #8

Demonstration and technical assessment of methanol and ethanol vehicles in White Plains.

BACKGROUND

The Alternative Fuels for Vehicles Fleet Demonstration Program (AFV-FDP) was a comprehensive technology assessment that fielded 257 alternative-fuel vehicles (AFVs) in State and local government fleets to collect data on AFV performance, emissions, and cost. The data and hands-on experience helped State and local decision-makers identify ways AFVs can assist in achieving energy, environmental, and economic development goals, and comply with federal air-quality and alternative-fuel mandates. Methanol and ethanol are liquid alcohols that were among the fuels evaluated in the AFV-FDP. Both fuels can be made from abundant domestic resource: methanol from natural gas and coal, and ethanol from grain crops such as corn.

This Task Order's goals were to demonstrate the feasibility and assess the costs and benefits of operating passenger cars on methanol and ethanol. NYSERDA teamed with the City of White Plains and New Energy Corporation in this demonstration.

ACCOMPLISHMENTS

NYSERDA assisted White Plains in acquiring Ford and other passenger cars that were factory-prepared to operate as flexible-fuel vehicles (FFVs, able to use alcohol and gasoline mixed together in any proportion). To support the FFVs, NYSERDA established a refueling station to dispense M100 (pure methanol), E85 (blend of 85% ethanol and 15% gasoline), and other fuel blends. NYSERDA also provided: assistance with training and fuel procurement; resolution of technical issues with fuel suppliers and equipment vendors; and, emissions testing, collection of vehicle operating data, and documentation of project results.

FINDINGS AND CONCLUSIONS

Operation of light-duty vehicles on methanol or ethanol was found to be practical and capable of providing emissions benefits, and to require relatively little capital as compared to other types of alternative fuels. The main disadvantages of both methanol and ethanol were their high cost. Other problems, such as cold-weather starting and difficulties in meeting specifications for fuel and refueling hardware, were solvable using the knowledge and techniques developed in this project.

REALIZED OR ANTICIPATED BENEFITS

This Task Order provided data and field experience that assist decision-makers in defining appropriate roles for AFVs. New York State may benefit through reduced dependence on petroleum-based fuel, improved air quality, and mitigation of future fuel-price increases through diversification. Air-quality improvements made in the transportation sector may preclude both environmental constraints on other sectors of the economy and imposition of federal sanctions.

TECHNOLOGY TRANSFER ACTIVITIES

Results have been incorporated into a comprehensive AFV-FDP final report.

FUNDING	TOTALS
NYSERDA	$77,881
Petroleum Overcharge Funds	174,940
City of White Plains[1]	30,500
New Energy Corp.[2]	2,000
TOTALS	$285,321

[1] Provided vehicles for conversion. [2] Donated ethanol.

Contractor: EA Engineering, Science, and Technology, Inc.
Site: White Plains, Westchester County
Contract Duration: 12/90 - 7/96
Key Words: transportation, alternative fuels, emissions control, AFV, methanol, ethanol
Project Manager: Joe Wagner (518) 862-1090, ext. 3228
Program: Transportation
Subprograms: Alternative Fuels for Vehicles, Petroleum Overcharge Funds
Contract No.: 1614-ERER-ER-91, Task Order #8

-> Alternative Fuels for Vehicles Fleet Demonstration Program - Task Order #9

Demonstration and technical assessment of methanol and CNG vehicles in Monroe County.

BACKGROUND

The Alternative Fuels for Vehicles Fleet Demonstration Program (AFV-FDP) was a comprehensive technology assessment that fielded 257 alternative-fuel vehicles (AFVs) in State and local government fleets to collect data on AFV performance, emissions, and cost. The data and hands-on experience helped State and local decision-makers identify ways AFVs can assist in achieving energy, environmental, and economic development goals, and comply with federal air-quality and alternative-fuel mandates. Natural gas and methanol were among the fuels evaluated in the AFV-FDP. Natural gas is an abundant domestic resource and methanol can be made from natural gas and other domestic resources.

This Task Order's goals were to demonstrate the feasibility and assess the costs and benefits of operating passenger cars on natural gas and methanol. NYSERDA teamed with Monroe County in this demonstration.

ACCOMPLISHMENTS

NYSERDA assisted Monroe County in acquiring Ford Taurus passenger cars that were factory-prepared to operate as flexible-fuel vehicles (FFVs, able to use methanol and gasoline mixed together in any proportion) and in converting other Tauruses to operate on compressed natural gas (CNG). To support the FFVs, NYSERDA established a refueling station to dispense M85 (blend of 85% methanol and 15% gasoline). The CNG vehicles refueled at a station operated by Rochester Gas and Electric Corporation. NYSERDA also provided: assistance with training and fuel procurement; resolution of technical issues with fuel suppliers and equipment vendors; and emissions testing, collection of vehicle operating data, and documentation of project results.

FINDINGS AND CONCLUSIONS

Operation of light-duty vehicles on methanol and CNG was found to be practical and capable of providing emissions benefits. The main disadvantage of methanol was found to be its high cost. The main disadvantages of CNG were the high cost of conversion equipment and the limited amount of CNG that could be stored onboard a vehicle.

REALIZED OR ANTICIPATED BENEFITS

This Task Order provided data and field experience that will assist decision-makers in defining appropriate roles for AFVs. New York State may benefit through reduced dependence on petroleum-based fuel, improved air quality, and mitigation of future fuel-price increases through diversification. Air-quality improvements made in the transportation sector may preclude both environmental constraints on other sectors of the economy and imposition of federal sanctions.

TECHNOLOGY TRANSFER ACTIVITIES

Results have been incorporated into a comprehensive AFV-FDP final report.

FUNDING	TOTALS
NYSERDA	$297,597
Petroleum Overcharge Funds	202,615
Monroe County[1]	80,000
TOTALS	$580,212

[1] Provided vehicles for conversion.

Contractor: EA Engineering, Science, and Technology, Inc.
Site: Rochester, Monroe County
Contract Duration: 10/91 - 7/96
Key Words: transportation, alternative fuels, emissions control, AFV, compressed natural gas (CNG), flexible-fuel vehicle (FFV), methanol (M85)
Project Manager: Joe Wagner (518) 862-1090, ext. 3228
Program: Transportation
Subprogram: Alternative Fuels for Vehicles Demonstration, Petroleum Overcharge Funds
Contract No.: 1614-ERER-ER-91, TO #9

-> Alternative Fuels for Vehicles Fleet Demonstration Program - Task Order #10

Demonstration and technical assessment of CNG vehicles at NYS Department of Environmental Conservation.

BACKGROUND

The Alternative Fuels for Vehicles Fleet Demonstration Program (AFV-FDP) was a comprehensive technology assessment that fielded 257 alternative-fuel vehicles (AFVs) in State and local government fleets to collect data on AFV performance, emissions, and cost. The data and hands-on experience helped State and local decision-makers identify ways AFVs can assist in achieving energy, environmental, and economic development goals, and comply with federal air-quality and alternative-fuel mandates. Natural gas is an abundant domestic resource and was among the fuels evaluated in the AFV-FDP.

This Task Order's goals were to demonstrate the feasibility and assess the costs and benefits of operating light-duty trucks, including pickup trucks and sport-utility vehicles (SUVs), on compressed natural gas (CNG). NYSERDA teamed with the New York State Department of Environmental Conservation (DEC) in this demonstration, based at DEC's headquarters in Colonie.

ACCOMPLISHMENTS

NYSERDA assisted DEC in converting pickup trucks and SUVs to operate as bifuel vehicles (able to operate on either gasoline or CNG) and provided support to enable a local gasoline station to dispense CNG to vehicles operated by DEC and others.

NYSERDA also provided: assistance with training; resolution of technical issues with fuel suppliers and equipment vendors; and emissions testing, collection of vehicle operating data, and documentation of project results.

FINDINGS AND CONCLUSIONS

Operation of light-duty vehicles on CNG was found to be practical and capable of providing emissions benefits. Disadvantages of CNG were the high cost of conversion equipment and the limited amount of CNG that could be stored onboard a vehicle.

REALIZED OR ANTICIPATED BENEFITS

This Task Order provided data and field experience that will assist decision-makers in defining appropriate roles for AFVs. New York State may benefit through reduced dependence on petroleum-based fuel, improved air quality, and mitigation of future fuel-price increases through diversification. Air-quality improvements made in the transportation sector may preclude both environmental constraints on other sectors of the economy and imposition of federal sanctions.

TECHNOLOGY TRANSFER ACTIVITIES

Results have been incorporated into a comprehensive AFV-FDP final report.

FUNDING	TOTALS
NYSERDA	$118,183
Petroleum Overcharge Funds	68,817
New York State DEC[1]	25,000
TOTALS	$212,000

[1] Provided vehicles for conversion.

Contractor: EA Engineering, Science, and Technology, Inc.
Site: Colonie, Albany County
Contract Duration: 4/91 - 7/96
Key Words: transportation, alternative fuels, emissions control, AFV, compressed natural gas (CNG)
Project Manager: Joe Wagner (518) 862-1090, ext. 3228
Program: Transportation
Subprogram: Alternative Fuels for Vehicles Demonstration, Petroleum Overcharge Funds
Contract No.: 1614-ERER-ER-91, TO #10

-> Alternative Fuels for Vehicles Fleet Demonstration Program - Task Order #12

Demonstration and technical assessment of CNG postal vans on Staten Island.

BACKGROUND

The Alternative Fuels for Vehicles Fleet Demonstration Program (AFV-FDP) was a comprehensive technology assessment that fielded 257 alternative-fuel vehicles (AFVs) in State and local government fleets to collect data on AFV performance, emissions, and cost. The data and hands-on experience helped State and local decision-makers identify ways AFVs can assist in achieving energy, environmental, and economic development goals, and comply with federal air-quality and alternative-fuel mandates. Natural gas is an abundant domestic resource and was among the fuels evaluated in the AFV-FDP.

This Task Order's goals were to demonstrate the feasibility and assess the costs and benefits of using compressed natural gas (CNG) as fuel for light-duty vans used by mail carriers on urban and suburban delivery routes. NYSERDA teamed with Brooklyn Union and the U.S. Postal Service (USPS) in this demonstration at the Post Office on Staten Island.

ACCOMPLISHMENTS

NYSERDA assisted USPS in converting 50 postal vans to operate on CNG, using fuel from a station provided by Brooklyn Union. NYSERDA also provided: assistance with training; resolution of technical issues; and emissions testing, collection of vehicle operating data, and documentation of project results. The project provided unique data for comparing the emissions and other attributes of four techniques for converting vehicles to CNG: (1) Dedicated (natural-gas-only), mechanical, open-loop carburetion; (2) Dedicated, electronic, closed-loop carburetion; (3) Bifuel (able to run on CNG or gasoline), mechanical, open-loop carburetion; and (4) Bifuel, electronic, closed-loop carburetion.

FINDINGS AND CONCLUSIONS

The electronic, closed-loop fuel systems provided significantly better emissions and performance compared to mechanical, open-loop systems. Operation of light-duty vehicles on CNG was found to be practical; the main disadvantages of CNG were the high cost of conversion equipment and the limited amount of CNG that could be stored onboard a vehicle.

REALIZED OR ANTICIPATED BENEFITS

This Task Order provided data and field experience that will assist decision-makers in defining appropriate roles for AFVs. New York State may benefit through reduced dependence on petroleum-based fuel, improved air quality, and mitigation of future fuel-price increases through diversification. Air-quality improvements made in the transportation sector may preclude both environmental constraints on other sectors of the economy and imposition of federal sanctions.

TECHNOLOGY TRANSFER ACTIVITIES

Results have been incorporated into a comprehensive AFV-FDP final report.

FUNDING	TOTALS
NYSERDA	$181,070
Petroleum Overcharge Funds	191,286
Brooklyn Union	571,425
U.S. Postal Service[1]	2,500,000
TOTALS	$3,443,781

[1] Provided vehicles for conversion.

Note: This project was started under 1761-ERER-ER-92

Contractor: EA Engineering, Science, and Technology, Inc.
Site: Staten Island, Richmond County
Contract Duration: 4/92 - 7/96
Key Words: transportation, alternative fuels, emissions control, AFV, compressed natural gas (CNG)
Project Manager: Joe Wagner (518) 862-1090, ext. 3228
Program: Transportation
Subprogram: Alternative Fuels for Vehicles Demonstration, Petroleum Overcharge Funds
Contract No.: 1614-ERER-ER-91, TO #12

-> Alternative Fuels for Vehicles Fleet Demonstration Program - Task Order #14

Demonstration and technical assessment of CNG vehicles used by fleet operators in the Buffalo area.

BACKGROUND

The Alternative Fuels for Vehicles Fleet Demonstration Program (AFV-FDP) was a comprehensive technology assessment that fielded 257 alternative-fuel vehicles (AFVs) in State and local government fleets to collect data on AFV performance, emissions, and cost. The data and hands-on experience helped State and local decision-makers identify ways AFVs can assist in achieving energy, environmental, and economic development goals, and comply with federal air-quality and alternative-fuel mandates. Natural gas is an abundant domestic resource and was among the fuels evaluated in the AFV-FDP.

This Task Order's goals were to demonstrate the feasibility and assess the costs and benefits of using compressed natural gas (CNG) as fuel for school buses, passenger cars, and light-duty trucks. NYSERDA teamed with the following Buffalo-area fleet operators to assess 54 CNG vehicles in this demonstration: City of Buffalo, Erie County, Kenmore-Tonawanda School District, NYS Public Service Commission, and Town of Tonawanda.

ACCOMPLISHMENTS

NYSERDA assisted in converting vehicles to operate on CNG, using fuel from stations operated by National Fuel Gas and the Town of Tonawanda. NYSERDA also provided: assistance in establishing a CNG refueling station at a Town of Tonawanda vehicle maintenance facility; assistance with training; resolution of technical issues; and emissions testing, collection of vehicle operating data, and documentation of project results.

FINDINGS AND CONCLUSIONS

Operation of light- and heavy-duty vehicles on CNG was found to be practical and capable of providing emissions benefits. The main disadvantages of CNG were the high cost of conversion equipment and the limited amount of CNG that could be stored onboard a vehicle.

REALIZED OR ANTICIPATED BENEFITS

This Task Order provided data and field experience that will assist decision-makers in defining appropriate roles for AFVs. New York State may benefit through reduced dependence on petroleum-based fuel, improved air quality, and mitigation of future fuel price increases through diversification. Air-quality improvements made in the transportation sector may preclude both environmental constraints on other sectors of the economy and imposition of federal sanctions.

TECHNOLOGY TRANSFER ACTIVITIES

Results have been incorporated into a comprehensive AFV-FDP final report.

FUNDING	TOTALS
NYSERDA	$284,116
Petroleum Overcharge Funds	501,553
Local contributions[1]	975,000
TOTALS	$1,760,669

[1] Provided vehicles for conversion.

Contractor: EA Engineering, Science, and Technology, Inc.
Site: Buffalo and Tonawanda, Erie County
Contract Duration: 6/92 - 7/96
Key Words: transportation, alternative fuels, emissions control, AFV, compressed natural gas (CNG)
Project Manager: Joe Wagner (518) 862-1090, ext. 3228
Program: Transportation
Subprogram: Alternative Fuels for Vehicles Demonstration, Petroleum Overcharge Funds
Contract No.: 1614-ERER-ER-91, TO #14

Demonstration and technical assessment of CNG vehicles at South Beach Psychiatric Center.

BACKGROUND

The Alternative Fuels for Vehicles Fleet Demonstration Program (AFV-FDP) was a comprehensive technology assessment that fielded 257 alternative-fuel vehicles (AFVs) in State and local government fleets to collect data on AFV performance, emissions, and cost. The data and hands-on experience helped State and local decision-makers identify ways AFVs can assist in achieving energy, environmental, and economic development goals, and comply with federal air-quality and alternative-fuel mandates. Natural gas is an abundant domestic resource and was among the fuels evaluated in the AFV-FDP.

This Task Order's goals were to demonstrate the feasibility and assess the costs and benefits of operating light-duty passenger vans on compressed natural gas (CNG). NYSERDA teamed with the New York State Office of Mental Health (OMH) in this demonstration, based at OMH's South Beach Psychiatric Center on Staten Island, and with Texaco's R&D Center in Beacon, Dutchess County.

ACCOMPLISHMENTS

NYSERDA assisted OMH in converting three existing Dodge passenger vans to operate as dedicated-CNG vehicles (the vehicles' gasoline fuel systems were removed) and in acquiring a factory-prepared Dodge dedicated-CNG passenger van.

NYSERDA also provided: assistance with training; resolution of technical issues with fuel suppliers and equipment vendors; and emissions testing, collection of vehicle operating data, and documentation of project results.

FINDINGS AND CONCLUSIONS

Operation of light-duty passenger vans on CNG was found to be practical and capable of providing emissions benefits. Disadvantages of CNG were the high cost of conversion equipment and the limited amount of CNG that could be stored onboard a vehicle.

REALIZED OR ANTICIPATED BENEFITS

This Task Order provided data and field experience that will assist decision-makers in defining appropriate roles for AFVs. New York State may benefit through reduced dependence on petroleum-based fuel, improved air quality, and mitigation of future fuel-price increases through diversification. Air-quality improvements made in the transportation sector may preclude both environmental constraints on other sectors of the economy and imposition of federal sanctions.

TECHNOLOGY TRANSFER ACTIVITIES

Results have been incorporated into a comprehensive AFV-FDP final report.

FUNDING	TOTALS
NYSERDA	$65,055
Petroleum Overcharge Funds	65,039
South Beach Psych. Center[1]	80,000
Texaco[2]	10,000
TOTALS	$220,094

[1] Provided vehicles for conversion.
[2] Provided emissions testing.

Contractor: EA Engineering, Science, and Technology, Inc.
Site: Staten Island, Richmond County
Contract Duration: 4/91 - 7/96
Key Words: transportation, alternative fuels, emissions control, AFV, compressed natural gas (CNG)
Project Manager: Joe Wagner (518) 862-1090, ext. 3228
Program: Transportation
Subprogram: Alternative Fuels for Vehicles Demonstration, Petroleum Overcharge Funds
Contract No.: 1614-ERER-ER-91, TO #16

-> Alternative Fuels for Vehicles Fleet Demonstration Program - Task Order #17

Demonstration and technical assessment of CNG transit buses at five transit authorities.

BACKGROUND

The Alternative Fuels for Vehicles Fleet Demonstration Program (AFV-FDP) was a comprehensive technology assessment that fielded 257 alternative-fuel vehicles (AFVs) in State and local government fleets to collect data on AFV performance, emissions, and cost. The data and hands-on experience helped State and local decision-makers identify ways AFVs can assist in achieving energy, environmental, and economic development goals, and comply with federal air-quality and alternative-fuel mandates. Natural gas is an abundant domestic resource and was among the fuels evaluated in the AFV-FDP.

This Task Order's goals were to demonstrate the feasibility and assess the costs and benefits of using compressed natural gas (CNG) as a fuel for urban transit buses. NYSERDA teamed with the Federal Transit Administration, NYS Department of Transportation, and five local transit authorities.

ACCOMPLISHMENTS

NYSERDA provided emissions testing, data collection, analysis and documentation for a cooperative effort whereby 31 CNG transit buses were acquired by five transit authorities:

Broome County	3
Niagara Frontier	5
Long Island Bus	10
Rochester-Genesee	5
Central New York	8
Total	31

The project provided unique data for comparing CNG buses to conventional diesel buses, in terms of emissions, efficiency, acceleration, maintenance, and infrastructure needs.

FINDINGS AND CONCLUSIONS

Operation of transit buses on CNG was found to be practical and capable of providing emissions benefits. The main disadvantages of CNG were the high cost of equipment and the limited amount of CNG that could be stored onboard a vehicle.

REALIZED OR ANTICIPATED BENEFITS

This Task Order provided data and field experience that will assist decision-makers in defining appropriate roles for AFVs. New York State may benefit through reduced dependence on petroleum-based fuel, improved air quality, and mitigation of future fuel-price increases through diversification. Air-quality improvements made in the transportation sector may preclude both environmental constraints on other sectors of the economy and imposition of federal sanctions.

TECHNOLOGY TRANSFER ACTIVITIES

Results have been incorporated into a comprehensive AFV-FDP final report.

FUNDING	TOTALS
NYSERDA	$203,620
Petroleum Overcharge Funds	174,657
Federal Transit Administration	5,812,500
NYS DOT and local sources	1,937,500
TOTALS	$8,128,277

Contractor: EA Engineering, Science, and Technology, Inc.
Site: Binghamton, Broome County; Buffalo, Erie County; Garden City, Nassau County; Rochester, Monroe County; and Syracuse, Onondaga County
Contract Duration: 10/92 - 7/96
Key Words: transportation, alternative fuels, emissions control, AFV, compressed natural gas (CNG), transit bus
Project Manager: Joe Wagner (518) 862-1090, ext. 3228
Program: Transportation
Subprogram: Alternative Fuels for Vehicles Demonstration, Petroleum Overcharge Funds
Contract No.: 1614-ERER-ER-91, TO #17

Demonstration and technical assessment of CNG vehicles operated by New York City.

BACKGROUND

The Alternative Fuels for Vehicles Fleet Demonstration Program (AFV-FDP) was a comprehensive technology assessment that fielded 257 alternative-fuel vehicles (AFVs) in State and local government fleets to collect data on AFV performance, emissions, and cost. The data and hands-on experience helped State and local decision-makers identify ways AFVs can assist in achieving energy, environmental, and economic development goals, and comply with federal air-quality and alternative-fuel mandates. Natural gas is an abundant domestic resource and was among the fuels evaluated in the AFV-FDP.

This Task Order's goals were to demonstrate the feasibility and assess the costs and benefits of using compressed natural gas (CNG) as fuel for light-duty vehicles in the New York City municipal fleet.

ACCOMPLISHMENTS

NYSERDA assisted in converting 15 vehicles to operate on CNG. Assistance included separate funding for advanced conversion kits (Agreement 1974-ERER-ER-93), plus assistance with training, resolution of technical issues, emissions testing, collection of vehicle operating data, and documentation of project results.

FINDINGS AND CONCLUSIONS

Operation of light-duty vehicles on CNG was found to be practical and capable of providing emissions benefits. The main disadvantages of CNG were the high cost of conversion equipment and the limited amount of CNG that could be stored onboard a vehicle.

REALIZED OR ANTICIPATED BENEFITS

This Task Order provided data and field experience that will assist decision-makers in defining appropriate roles for AFVs. New York State may benefit through reduced dependence on petroleum-based fuel, improved air quality, and mitigation of future fuel-price increases through diversification. Air-quality improvements made in the transportation sector may preclude both environmental constraints on other sectors of the economy and imposition of federal sanctions.

TECHNOLOGY TRANSFER ACTIVITIES

Results have been incorporated into a comprehensive AFV-FDP final report.

FUNDING	TOTALS
NYSERDA	$41,256
TOTALS	$41,256

Contractor: EA Engineering, Science, and Technology, Inc.
Site: Bronx, Kings, New York, Queens, Richmond and counties
Contract Duration: 9/92 - 7/96
Key Words: transportation, alternative fuels, emissions control, AFV, compressed natural gas (CNG)
Project Manager: Joe Wagner (518) 862-1090, ext. 3228
Program: Transportation
Subprogram: Alternative Fuels for Vehicles Demonstration
Contract No.: 1614-ERER-ER-91, TO #18

-> Alternative Fuels for Vehicles Fleet Demonstration Program (AFV-FDP) - Task Order #19

Demonstration and technical assessment of methanol vehicles operated by New York State Thruway Authority.

BACKGROUND

The Alternative Fuels for Vehicles Fleet Demonstration Program (AFV-FDP) was a comprehensive technology assessment that fielded 257 alternative-fuel vehicles (AFVs) in State and local government fleets to collect data on AFV performance, emissions, and cost. The data and hands-on experience helped State and local decision-makers identify ways AFVs can assist in achieving energy, environmental, and economic development goals, and comply with federal air-quality and alternative-fuel mandates. Methanol was among the fuels evaluated in the AFV-FDP. Methanol is a liquid alcohol that can be made from natural gas, coal, and other abundant domestic resources.

This Task Order's goals were to demonstrate the feasibility and assess the costs and benefits of operating passenger cars on methanol. NYSERDA teamed with the New York State Thruway Authority and Ford Motor Company.

ACCOMPLISHMENTS

NYSERDA assisted the Thruway Authority in obtaining Ford passenger cars that were factory-prepared to operate as flexible-fuel vehicles (FFVs, able to use methanol and gasoline mixed together in any proportion). NYSERDA established eight methanol refueling stations at rest areas along the Thruway, from Buffalo to New York City, and provided station maintenance, training, emissions testing, data collection, analysis, and documentation of project results. In return for this support, Ford provided 45 prototype methanol FFV Taurus sedans at no charge to the Thruway Authority for field demonstration. The vehicles used a range of blends from M85 (85% methanol and 15% gasoline) to straight gasoline, per a test protocol developed by Ford. The resulting data assisted Ford in refining its designs for a production FFV.

FINDINGS AND CONCLUSIONS

Operation of light-duty FFVs on blends of methanol and gasoline was found to be practical and to require relatively little capital as compared to other types of alternative fuels. Emissions of the FFVs were very low regardless of fuel blend. The main disadvantage of methanol was found to be its high cost. Other problems, such as cold-weather starting and difficulties in meeting specifications for fuel and refueling hardware, were solvable using the knowledge and techniques developed in this project.

REALIZED OR ANTICIPATED BENEFITS

This Task Order provided data and field experience that will assist decision-makers in defining appropriate roles for AFVs. New York State may benefit through reduced dependence on petroleum-based fuel, improved air quality, and mitigation of future fuel-price increases through diversification. Air-quality improvements made in the transportation sector may preclude both environmental constraints on other sectors of the economy and imposition of federal sanctions.

TECHNOLOGY TRANSFER ACTIVITIES

Results have been incorporated into a comprehensive AFV-FDP final report.

FUNDING	TOTALS
NYSERDA	$281,551
Petroleum Overcharge Funds	130,155
Ford Motor Company[1]	720,000
TOTALS	$1,131,706

[1] Provided vehicles.

Contractor: EA Engineering, Science, and Technology, Inc.
Site: Albany, Albany County, and Statewide
Contract Duration: 11/92 - 7/96
Key Words: transportation, alternative fuels, emissions control, AFV, methanol, FFV
Project Manager: Joe Wagner (518) 862-1090, ext. 3228
Program: Transportation
Subprograms: Alternative Fuels for Vehicles, Petroleum Overcharge Funds
Contract No.: 1614-ERER-ER-91, Task Order #19

-> Alternative Fuels for Vehicles Fleet Demonstration Program - Task Order #20

Help NYSERDA with planning and reporting activities arising from Alternative Fuels for Vehicles Fleet Demonstration Program.

BACKGROUND

The Alternative Fuels for Vehicles Fleet Demonstration Program (AFV-FDP) was a comprehensive technology assessment that fielded 257 alternative-fuel vehicles (AFVs) in State and local government fleets to collect data on AFV performance, emissions, and cost. The data and hands-on experience helped State and local decision-makers identify ways AFVs can assist in achieving energy, environmental, and economic development goals, and comply with federal air-quality and alternative-fuel mandates. Natural gas, methanol, ethanol, LPG/propane and electricity were among the fuels evaluated in the AFV-FDP.

This Task Order's goals were to assist NYSERDA in developing plans for performing the AFV-FDP, defining documentation requirements, preparing annual reports and other reports over the course of the program, and initiating preparation of the final report.

ACCOMPLISHMENTS

This Task Order provided the following AFV-FDP support resources: comprehensive emissions test plan covering all AFV-FDP vehicles, and periodic updates; surveys of participating fleet operators and preparation of resulting experience reports; AFV-FDP annual reports; and, a draft AFV-FDP final report.

FINDINGS AND CONCLUSIONS

Careful planning and thorough implementation are necessary to successfully conduct technical assessments like the AFV-FDP, that are very broad in scope and involve field evaluation of a large population of heterogeneous vehicles deployed in multiple fleets over a wide geographic area. This planning and follow-through enabled the AFV-FDP to efficiently gather a large quantity of unique and valuable information about AFVs.

REALIZED OR ANTICIPATED BENEFITS

This Task Order provided data and field experience that will assist decision-makers in defining appropriate roles for AFVs. New York State may benefit through reduced dependence on petroleum-based fuel, improved air quality, and mitigation of future fuel-price increases through diversification. Air-quality improvements made in the transportation sector may preclude both environmental constraints on other sectors of the economy and imposition of federal sanctions.

TECHNOLOGY TRANSFER ACTIVITIES

Results have been incorporated into a comprehensive AFV-FDP final report.

FUNDING	TOTALS
NYSERDA	$323,482
TOTALS	$323,482

Contractor: EA Engineering, Science, and Technology, Inc.
Site: Statewide
Contract Duration: 2/93 - 7/96
Key Words: transportation, alternative fuels, emissions control, AFV
Project Manager: Joe Wagner (518) 862-1090, ext. 3228
Program: Transportation
Subprogram: Alternative Fuels for Vehicles Demonstration
Contract No.: 1614-ERER-ER-91, TO #20

-> Alternative Fuels for Vehicles Fleet Demonstration Program - Task Order #22

Demonstration and technical assessment of propane vehicles at NYS Office of Parks, Recreation and Historic Preservation.

BACKGROUND

The Alternative Fuels for Vehicles Fleet Demonstration Program (AFV-FDP) was a comprehensive technology assessment that fielded 257 alternative-fuel vehicles (AFVs) in State and local government fleets to collect data on AFV performance, emissions, and cost. The data and hands-on experience helped State and local decision-makers identify ways AFVs can assist in achieving energy, environmental, and economic development goals, and comply with federal air-quality and alternative-fuel mandates. Propane is an abundant domestic resource produced as a by-product of natural gas production and also by petroleum refineries.

This Task Order's goals were to demonstrate the feasibility and assess the costs and benefits of converting light-duty trucks, including pickup trucks and sport-utility vehicles (SUVs), to operate on propane. NYSERDA teamed with the New York Propane Gas Association (NYPGA), Texaco, and the New York State Office of Parks, Recreation, and Historic Preservation (OPR) in this demonstration at OPR's James Baird State Park.

ACCOMPLISHMENTS

NYSERDA organized a team of public and private organizations to perform this technical assessment. NYPGA provided the conversions and refueling facilities, Texaco provided emissions testing at its research facility in Beacon (Dutchess County), and OPR provided the vehicles and daily operational data collection. NYSERDA provided: data-collection equipment, assistance with training, resolution of technical issues among all parties, data analysis, and documentation of project results.

FINDINGS AND CONCLUSIONS

Operation of light-duty vehicles on propane was found to be practical and capable of providing emissions benefits. Disadvantages of propane included reduction in vehicle driving range and high cost of conversion equipment.

REALIZED OR ANTICIPATED BENEFITS

This Task Order provided data and field experience that will assist decision-makers in defining appropriate roles for AFVs. New York State may benefit through reduced dependence on petroleum-based fuel, improved air quality, and mitigation of future fuel-price increases through diversification. Air-quality improvements made in the transportation sector may preclude both environmental constraints on other sectors of the economy and imposition of federal sanctions.

TECHNOLOGY TRANSFER ACTIVITIES

Results have been incorporated into a comprehensive AFV-FDP final report.

FUNDING	TOTALS
NYSERDA	$137,146
New York State OPR[1]	100,000
Texaco	75,000
New York Propane Gas Association	25,000
TOTALS	$337,146

[1] Provided vehicles for conversion.

Contractor: EA Engineering, Science, and Technology, Inc.
Site: James Baird State Park, La Grange, Dutchess County
Contract Duration: 7/93 - 7/96
Key Words: transportation, alternative fuels, emissions control, AFV, propane
Project Manager: Joe Wagner (518) 862-1090, ext. 3228
Program: Transportation
Subprogram: Alternative Fuels for Vehicles Demonstration
Contract No.: 1614-ERER-ER-91, TO #22

-> Alternative Fuels for Vehicles Fleet Demonstration Program - Task Order #23

Provided technical assistance to deploy 600 CNG taxis in New York City.

BACKGROUND

The Alternative Fuels for Vehicles Fleet Demonstration Program (AFV-FDP) was a comprehensive technology assessment that fielded 257 alternative-fuel vehicles (AFVs) in State and local government fleets to collect data on AFV performance, emissions, and cost. The data and hands-on experience helped State and local decision-makers identify ways AFVs can assist in achieving energy, environmental, and economic development goals, and comply with federal air-quality and alternative-fuel mandates. Natural gas is an abundant domestic resource and was among the fuels evaluated in the AFV-FDP.

This Task Order's goals were to assist New York City in implementing a $3.2-million federal CMAQ (Congestion Mitigation and Air Quality Improvement) grant program to help the NYC taxi industry transition to use of compressed natural gas (CNG), thereby reducing the air pollution produced by NYC's 12,000 medallion taxis, which presently account for an estimated 35% of the City's mobile-source emissions. NYSERDA previously assisted by deploying a pilot fleet of 17 CNG taxis to help identify appropriate equipment for this application, and NYC then asked that NYSERDA manage implementation of the overall CMAQ grant. Parties assisting in this effort included Brooklyn Union, the NYC Taxi & Limousine Commission, and the NYC Departments of Environmental Protection and Transportation.

ACCOMPLISHMENTS

NYSERDA assisted in developing specifications for equipment to be purchased under the CMAQ program, resolving technical issues among participants, and developing procedures and standards for qualifying vendors to participate in converting vehicles. Based on this assistance, the CMAQ program has started and more than 100 taxis had been converted by May 1997.

FINDINGS AND CONCLUSIONS

Careful planning and thorough implementation are necessary to successfully execute large-scale AFV conversion programs. This planning and follow-through should enable the CMAQ program to accomplish its goals efficiently.

REALIZED OR ANTICIPATED BENEFITS

This Task Order provided technical assistance that assisted decision-makers in implementing a significant AFV deployment program. New York State may benefit through reduced dependence on petroleum-based fuel, improved air quality, and mitigation of future fuel-price increases through diversification. Air-quality improvements made in the transportation sector may preclude both environmental constraints on other sectors of the economy and imposition of federal sanctions.

TECHNOLOGY TRANSFER ACTIVITIES

The CMAQ program is continuing.

FUNDING	TOTALS
NYSERDA	$592,000
Federal (CMAQ) funds	3,152,000
Brooklyn Union	100,000
Other Co-funders	815,900
TOTALS	$4,659,900

Contractor: EA Engineering, Science, and Technology, Inc.
Site: Bronx, Kings, New York, Queens, and Richmond counties
Contract Duration: 9/96 - 3/97
Key Words: transportation, alternative fuels, emissions control, AFV, compressed natural gas (CNG)
Project Manager: Joe Wagner (518) 862-1090, ext. 3228
Program: Transportation
Subprogram: Alternative Fuels for Vehicles Demonstration
Contract No.: 1614-ERER-ER-91, TO #23

-> Ford PEM Fuel-Cell

Develop 50-kilowatt proton-exchange-membrane fuel cell for a Ford vehicle.

BACKGROUND

Proton-exchange-membrane (PEM) fuel cells convert hydrogen to electricity. They are very efficient, environmentally clean, lightweight, and have been proposed as on-board electrical generators for electric vehicles. The federal Partnership for a New Generation of Vehicles (PNGV) regards PEM fuel cells as prime candidates to achieve the goal of an 80-mile-per-gallon automobile. The U.S. Department of Energy (U.S. DOE) has contracted with Ford Motor Company to develop this vehicle, and Ford has contracted with Mechanical Technology, Inc. (MTI) to develop a 50-kilowatt prototype unit for testing by Ford in a Taurus-sized vehicle.

OBJECTIVE

To design and construct a 50 kilowatt PEM fuel cell system and deliver it to Ford.

DESCRIPTION

Key developments include fabrication of internal components and design of a compressor-expander (compander) to supply pressurized air. The completed fuel cell will be installed in a Ford aluminum-intensive vehicle (AIV), a Mercury Sable (similar to Taurus), for testing.

BENEFITS

If the program is successful, vehicles powered by hydrogen will achieve very high fuel efficiency and emit only water vapor from the vehicle when operating. This will help reduce dependency on petroleum for transportation and will improve urban air quality. In addition, a New York State firm will become a supplier to Ford, and may eventually earn more than $1 billion a year in new sales revenue.

SCHEDULE AND STATUS

The 50-kW PEM fuel cell is scheduled for completion and delivery to Ford in February 1998.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$375,425	$256,578	$888,581
Mechanical Technology, Inc.	275,000	1,021,000	1,296,000
Ford Motor Company	183,000	2,052,622	2,235,622
TOTALS	$833,425	$3,330,200	$4,420,203

Contractor: Mechanical Technology, Inc.
Site: Latham, Albany County
Contract Duration: 3/97 - 2/98
Key Words: transportation, product development, alternative fuels, electricity, fuel cells, PEM, PNGV
Project Manager: Larry Hudson (518) 862-1090, ext. 3209
Program: Transportation
Subprogram: Technology Development and Applications
Contract No.: 4540-ERTER-TR-97

Construct and test hybrid-electric vehicle brassboard models using hydrogen-powered fuel cell and free-piston Stirling engine.

BACKGROUND
Hybrid-electric vehicles have the potential to reduce emissions and fuel consumption and provide range and performance competitive with conventional vehicles in urban service while using non-petroleum fuels.

OBJECTIVE
To demonstrate and characterize a hydrogen-powered fuel cell and a free-piston Stirling engine (FPSE) alternator integrated with hybrid-electric-vehicle components and necessary controls and supervisory functions. Tests will simulate hybrid-electric-vehicle operation under various duty cycles. The characterization tests will compare advantages and disadvantages of each system. If results are satisfactory, fuel-cell components may be installed in an electric vehicle as a separate project.

DESCRIPTION
Computer modeling will be used to determine the approximate optimum split between batteries and the hybrid-electric power source for various duty cycles using two advanced power sources: a proton-exchange-membrane (PEM) fuel cell; and an FPSE. The contractor then will construct and test a bench-scale hybrid-electric-vehicle power system using a 10-kW PEM fuel cell, a 10-kW electric motor, and a bank of load-leveling batteries. A 2-kW FPSE also will be tested using a computer-simulated load and load-leveler.

BENEFITS
Hybrid-electric vehicles have the potential to significantly conserve petroleum-based fuels, reduce emissions per mile, and overcome the range limitations of today's battery-electric vehicles. Advanced power sources such as fuel cells and FPSEs would enable hybrid-electric-vehicles to perform with even greater efficiency and cleanliness.

SCHEDULE AND STATUS
A prototype control system was designed, built, and tested for the 2-kW FPSE. The system performed as required. Follow-on work to develop a generic hybrid-electric system controller as a commercial product is being pursued under NYSERDA Project 4350.

A 10-kW PEM fuel cell was built by Mechanical Technology, Inc. (MTI) and delivered to Ford Motor Company under the U.S. Department of Energy's Partnership for a Next Generation of Vehicles (PNGV), with assistance from NYSERDA under Project 4087. A similar 10-kW unit will be built by MTI, at its own cost, for use in evaluating the brassboard hybrid-electric propulsion system and possible subsequent applications.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$559,475	0	$559,475
Mechanical Technology, Inc.	277,227	0	277,227
TOTALS	$836,702	0	$836,702

Contractor: Mechanical Technology, Inc.
Site: Latham, Albany County
Contract Duration: 11/92 - 12/97
Key Words: product development, transportation, alternative fuels, hybrid-electric, fuel cell, PEM
Project Manager: Larry Hudson (518) 862-1090 ext. 3209
Program: Transportation
Subprogram: Technology Development and Applications
Contract No.: 1791-ERER-ER-92

-> Hybrid-Electric Taxi

Design, construct, and test hybrid-electric taxi.

BACKGROUND

Hybrid-electric technology offers improved fuel efficiency, reduced emissions, and lower maintenance costs when used in an urban driving cycle. Large vehicles such as transit buses, school buses, delivery trucks, and taxis currently are the best candidates because hybrid-electric components are heavier and bulkier than conventional drive systems. NYSERDA has been involved in three hybrid-electric bus projects.

OBJECTIVE

A hybrid-electric taxi, powered by natural gas, will be designed and a prototype vehicle constructed and tested. If successful, the vehicle will be placed in demonstration service within a New York City taxi fleet under a separate follow-on project.

DESCRIPTION

The drive motor is a 125 hp AC-induction unit similar to wheel-motors used on a NYSERDA-sponsored hybrid-electric transit bus and chassis-mounted drive motors used on a NYSERDA-sponsored hybrid-electric Class 6 truck. The generator is a compact permanent-magnet-rotor type produced for NYSERDA by BF Goodrich Aerospace Engine Electrical Systems Division in Norwich, NY. A conventional but small internal combustion engine, operated on natural gas, is used to drive the generator, providing approximately the average power requirement, while a load-leveling maintenance-free lead-acid battery pack provides additional power for acceleration. The battery is charged through regenerative braking and by the engine-generator. The vehicle running gear and suspension are derived from existing GM light trucks by GSM Design of Montreal. Body panels and bumpers are made of a resilient tough plastic to resist small dents, and are easily replaceable from a minimum inventory of body parts that do not require painting. After it is fully assembled, the vehicle will be tested on a dynamometer, a track, and the road. Several State firms that produce potentially suitable components and are interested in assembling a hybrid-electric taxi on a commercial basis are providing technical assistance. Potential users, including taxi fleet operators and the New York City Taxi & Limousine Commission, are advising in project management.

BENEFITS

If successful, this project will result in the production of cost-effective, fuel-efficient, clean, low-maintenance taxis for urban applications. Synergy between natural gas and hybrid-electric drive will result in extremely low emissions. Many New York State firms will have an opportunity to share in what may become an important growth market.

SCHEDULE AND STATUS

The electric drive motor and controller, batteries, engine-generator, and natural-gas fuel system have been installed. The generator has been tested successfully. By May 1, 1997 it is expected that the vehicle will undergo its first operational track test, and by September 1 it is expected to be ready for limited field demonstration.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$627,911	$136,500	$764,411
New York State Electric & Gas Corp.	0	25,000	$25,000
GSM	36,010	0	36,010
Lockheed/Martin	1,000,000	79,500	1,079,500
EDO Corporation	15,170	0	15,170
TOTALS	$1,679,091	$241,000	$1,920,091

Contractor: EDO Corporation
Site: College Point, Queens County; Johnson City, Broome County; and Norwich, Chenango County
Contract Duration: 3/96 - 10/97
Key Words: transportation, product development, electricity, hybrid, alternative fuels, natural gas
Project Manager: Larry Hudson (518) 862-1090, ext. 3209
Program: Transportation
Subprogram: Technology Development and Applications
Contract No.: 4117M-ERTER-TRN-96

-> Hybrid-Electric School Bus

Develop and test hybrid-electric school bus powered by natural gas.

BACKGROUND

Matthews Buses, Inc. is a builder and remanufacturer of school buses based in Ballston Spa, New York. Among the company's current products is natural-gas-powered school bus with a conventional power train. Urban school buses are prime candidates for hybrid-electric drive because of their stop-and-go duty cycle. Hybrids offer improved fuel economy, reduced emissions, and lower maintenance costs in urban service.

OBJECTIVE

To assist a New York State school bus builder in developing an advanced hybrid-electric product that could be manufactured at a competitive price. The vehicle will incorporate major components also manufactured in New York State, including a powerful new electric-drive motor under development in a separate NYSERDA project.

DESCRIPTION

This project will design, build, and test a natural-gas-powered hybrid-electric school bus. Upon completion, the bus will be delivered to the Syracuse City School District for extended field-testing.

BENEFITS

Hybrid-electric propulsion offers improved fuel efficiency, reduced emissions, and lower maintenance costs in urban service. The maintenance savings accrue mainly from reduced brake wear through regenerative braking. If successful, this project will create new economic opportunity in New York State.

SCHEDULE AND STATUS

An appropriate duty cycle has been documented for use in design and testing. Work has been suspended due to financial reorganization by the contractor. It is expected that new technical arrangements, resulting in lower cost, will enable the contractor to resume the project in the fall of 1997.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$328,567	0	$328,567
Matthews Buses, Inc.	235,515	0	235,515
U.S. Dept. of Energy	65,000	0	65,000
Syracuse City School District	0	$55,000	55,000
TOTALS	$629,082	$55,000	$684,082

Contractor: Matthews Buses, Inc.
Site: Ballston Spa, Saratoga County, and Syracuse, Onondaga County
Contract Duration: 2/96 - 3/98
Key Words: transportation, product development, electricity, alternative fuels, natural gas, hybrid
Project Manager: Larry Hudson (518) 862-1090, ext. 3209
Program: Transportation
Subprogram: Technology Development and Applications
Contract No.: 4229-ERTER-TRN-96

-> Hybrid-Electric Vehicle Energy Management System

Design, build, and test a hybrid-electric vehicle energy-management system.

BACKGROUND

Hybrid-electric vehicles can operate with greater efficiency, cleaner emissions, and lower maintenance costs in urban service than conventional vehicles. Significant improvements are possible through use of an on-board energy-management system consisting of a specialized computer that translates driver control inputs into appropriate actions by the power and propulsion systems, while also managing energy-consuming auxiliary systems such as air-conditioning and air brakes. An energy-management system also can give a hybrid vehicle the "feel" necessary to allow relatively untrained drivers to operate the vehicle with competence.

Existing energy management systems are integrally built into power control systems associated with high-technology relatively expensive drive motors. A discrete system controller, usable with a wide variety of drive motors and power controllers, would bring "open architecture" to hybrid-electric vehicles. This could significantly reduce cost by enhancing competition, as has occurred in the personal computer market.

OBJECTIVE

To design, build, and test a discrete energy-management system for hybrid-electric vehicles. The resulting device is intended to be usable in a broad range of potential hybrid-electric vehicles, including school buses, taxis, transit buses, and delivery vehicles.

DESCRIPTION

This project will design, build, and test an energy-management system for hybrid-electric vehicles. After bench-testing, the energy-management system will be installed, road-tested, and optimized in a hybrid-electric vehicle.

BENEFITS

Hybrid-electric propulsion offers improved fuel efficiency, reduced emissions, and lower maintenance costs in urban service. Significant additional energy and emission savings can accrue from use of an energy-management system. Significant cost savings can accrue from a discrete controller, as described above. If successful, the energy-management controller will be manufactured in New York State and can enhance the market for low-cost electric drive motors made in New York.

SCHEDULE AND STATUS

A bench model controller has been constructed and is awaiting availability of a suitable hybrid-electric platform for road testing and optimization. Originally intended platforms turned out not to be available through no fault of the contractor.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	0	$233,590	$233,590
Mechanical Technology, Inc.	0	207,835	207,835
TOTALS	0	$441,425	$441,425

Contractor: Mechanical Technology, Inc.
Site: Latham, Albany County
Contract Duration: 6/96 - 12/97
Key Words: transportation, product development, electricity, alternative fuels, hybrid
Project Manager: Larry Hudson (518) 862-1090, ext. 3209
Program: Transportation
Subprogram: Technology Development and Applications
Contract No.: 4350-ERTER-TRN-97

-> Low-Cost Hybrid-Electric Drive

Develop and demonstrate low-cost hybrid-electric drive train for Class 6 school busses and trucks.

BACKGROUND

Hybrid-electric drives offer the capability of recovering energy when a vehicle is braking to a stop or moving down a hill. This energy is stored and then made available to accelerate the vehicle. In previous projects, NYSERDA has demonstrated the advantages of hybrid-electric technology in urban-duty transit busses.

OBJECTIVE

To develop a Class 6 hybrid-electric drive train and evaluate the drive's performance in class 6 truck and school bus chassis. The goal of the program is to produce a hybrid-electric drive that meets the operational performance of a conventional direct-diesel drive with significant improvement in emissions and fuel economy. The hybrid-electric drive will be producible at a cost premium of no more than 30 percent above the conventional diesel.

DESCRIPTION

The research effort focuses on the development of a low-cost, integrated, system controller, battery charger, generator/motor controller. The contractor will work closely with Navistar to assure that the performance of the hybrid drive meets or exceeds that of the conventional engine drive. Navistar will offer the hybrid-drive in its Class 5, 6 and 7 vehicles following performance and durability testing.

BENEFITS

Previous hybrid-electric drive implementations have demonstrated 50 percent reductions in vehicle emissions and 30 percent improvements in fuel efficiency. The goal of this development effort to meet or exceed these improvements at a cost premium of less than 30% over a conventional engine-transmission drive.

SCHEDULE AND STATUS

Operational evaluation of the first hybrid chassis began in late mid-1996. In early tests the vehicle exceeded all goals. Performance and durability evaluations will continue through 1996. A second hybrid chassis was completed in the third quarter of 1996. Testing is continuing through mid 1997.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$300,000	$350,000	$650,000
Lockheed Martin	300,000	429,883	729,883
Navistar	300,000	300,000	600,000
TOTALS	$900,000	$1,079,883	$1,979,883

Contractor: Lockheed Martin
Site: Johnson City, Broome County
Contract Duration: 12/95 - 9/97
Key Words: transportation, product, hybrid-electric
Project Manager: Richard Drake (518) 862-1090, ext. 3258
Program: Transportation
Subprogram: Technology Development and Applications
Contract No.: 4345-ERTER-TRN-96

-> Hybrid-Electric Vehicle Component Production

Design and fabricate improved hybrid-electric vehicle components and install them in a Class 6 heavy-duty truck.

BACKGROUND

Hybrid-electric drives recover energy when a vehicle is braking to a stop or moving down a hill. This energy is stored and then made available to accelerate the vehicle. In previous projects, NYSERDA has demonstrated the advantages of hybrid-electric technology in urban-duty transit buses. In a previous project with Lockheed Martin, NYSERDA assisted in the design, construction, and testing of a proof-of-concept heavy-duty hybrid-electric Class 6 (26,000-lb gross-vehicle-weight [GVW] truck. Navistar International, a major heavy-duty vehicle manufacturer, has challenged the contractor to bring this technology to a market-competitive level.

OBJECTIVE

To design and build improved hybrid-electric components, producible at potentially competitive cost, and suitable for field service, and install them in at least five vocational heavy-duty trucks for field testing by fleet operators.

DESCRIPTION

The work consists of redesigning the hybrid-electric components (generator, engine-control system, electric-drive motor and controller, and battery energy-management system), fabricating and testing each component to determine reliability, and installing the resulting components in a Class 6 heavy-duty truck in cooperation with Navistar. This is part of a larger activity by the contractor in which a total of five vehicles (package delivery, recycling, garbage, and utility trucks; and a school bus), will be built for fleet-testing by customers.

BENEFITS

If the program is successful, heavy-duty hybrid-electric vehicles will come to market starting in 1999. These vehicles will operate with improved fuel efficiency and reduced emissions and maintenance costs. In addition, a New York State firm will supply hybrid-electric drive trains to Navistar and may eventually earn more than $1 billion a year in new sales revenue.

SCHEDULE AND STATUS

Redesign and fabrication of components is expected to be completed by the fall of 1997. Customer evaluation of vehicles is scheduled to begin in the winter of 1997-98.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$650,000	$300,000	$950,000
Lockheed Martin	729,883	1,647,000	2,376,883
Navistar	600,000	0	600,000
TOTALS	$1,979,883	$1,947,000	$3,926,883

Contractor: Lockheed Martin
Site: Johnson City, Broome County
Contract Duration: 2/97 - 3/98
Key Words: transportation, product development, hybrid-electric
Project Manager: Joe Wagner (518) 862-1090, ext. 3228
Program: Transportation
Subprogram: Technology Development and Applications
Contract No.: 4539-ERTER-TRN-97

-> Cost-Effective Free-Piston Stirling Engine System for Hybrid-Electric Vehicles

Develop cost-effective, low-emission power-generation unit for hybrid-electric vehicles.

BACKGROUND

Clever Fellows Innovation Consortium, Inc. developed a low-cost free-piston Stirling engine (FPSE) for solar collectors. The engine technology also applies to vehicles and free-standing generators when coupled with an alternative energy source. This system will provide an efficient, quiet, low-maintenance, and low-emission power-generation unit that can use a variety of fuels.

OBJECTIVES

To design, construct, and test an external combustion system and controls as a heat source for the FPSE.

DESCRIPTION

The contractor will analyze potential fuels for suitability to this application. The combustion system will be designed and optimized for the selected fuels, resulting in the lowest possible emissions for the heat produced. System interface requirements will be defined. The FPSE design will be modified to accommodate a liquid-metal pool-boiler interface to the heat source. Safety issues will be identified and mitigated. The concept will be tested and demonstrated with a gaseous fuel and a seven kilowatt engine.

BENEFITS

Benefits of this system compared to an internal combustion engine include: improved emissions; improved reliability and ease of maintenance due to fewer moving parts, a more fully sealed system, and the lack of lubricated/wear components; more fuel diversity at less cost; and quieter operation. The technology will transfer directly to the free-standing generator market.

SCHEDULE AND STATUS

The system has been designed for gaseous fuels. Prototype testing is under way.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$275,450	0	$275,450
Clever Fellows Innovation Consortium, Inc.	120,000	0	120,000
TOTALS	$395,450	0	$395,450

Contractor: Clever Fellows Innovation Consortium, Inc.
Site: Troy, Rensselaer County
Contract Duration: 5/95 - 8/97
Key Words: transportation, product development, alternative fuels, Stirling engine
Project Manager: Karen Villeneuve (518) 862-1090, ext. 3275
Program: Transportation
Subprogram: Technology Development and Applications
Contract No.: 4082L-ERTER-TR-95

-> Development of an Ultracapacitor for Hybrid-Electric Vehicles

Design, build, and test ultracapacitor stacks for hybrid-electric vehicle applications.

BACKGROUND

General Electric Corporate Research and Development (GE-CRD) was awarded a contract by Ford Motor Company to participate in the U.S. Department of Energy (U.S. DOE)-sponsored hybrid-electric vehicle development project. GECRD is developing an ultracapacitor as part of the power-handling system of the vehicle. Other firms are developing competing technologies under the U.S. DOE/Ford program.

OBJECTIVE

To develop a cost-effective ultracapacitor system for hybrid-electric vehicles.

DESCRIPTION

This project has three phases: (1) single-cell development and stack modeling, (2) sub-scale ultracapacitor stack development and packaging design, and (3) full-scale stack construction. The full-scale system is expected to be used by Ford in a vehicle demonstration. The following tasks are included: (1) model a single cell and stacked cells; (2) design, build, and test a single cell; (3) modify the model based on performance data; (4) design and develop a small stack; (5) estimate manufacturing costs; and (6) develop appropriate packaging for the system. The greatest challenge is to develop a cost-competitive system.

BENEFITS

Successful development of this technology would dramatically improve performance of hybrid and electric vehicles. An ultracapacitor system can be used in conjunction with batteries or other power sources to provide bursts of power and a reservoir to accept energy from regenerative braking at a high rate. The results are more energy-efficient vehicle drive systems, reduced emissions, and better performance. Based on current cost projections, this technology is expected to have wide application in medium- to heavy-duty vehicles. If cost-effective, applications will extend to light-duty vehicles.

SCHEDULE AND STATUS

The first and second sub-scale stacks have been delivered to Ford. Packaging issues are currently being addressed. Cost continues to be reduced through careful materials selection. Manufacturing processes are being evaluated.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$325,000	$258,556	$583,556
General Electric CRD	202,000	102,287	472,427
U.S. Department of Energy/Ford	587,000	300,842	1,406,302
TOTALS	$1,114,000	$661,685	$2,462,285

Contractor: General Electric Corporate Research and Development
Site: Schenectady, Schenectady County
Contract Duration: 3/94-8/97
Key Words: transportation, product development, ultracapacitor, electric vehicles, hybrid-electric vehicles
Project Manager: Karen Villeneuve (518) 862-1090, ext. 3275
Program: Transportation
Subprogram: Technology Development and Applications
Contract No.: 4114-ERTER-TR-95

-> Ultracapacitor Controller

Develop controller as interface between ultracapacitor and drive systems of hybrid-electric vehicle.

BACKGROUND

General Electric Company's Industrial Capacitor Division in Fort Edward, New York, is developing an ultracapacitor to use with hybrid-electric vehicles. Although ultracapacitors offer very high specific power, they decline rapidly in voltage as energy is extracted, requiring a special controller as an interface.

OBJECTIVE

To help a New York State manufacturer of large capacitors develop an advanced controller for an ultracapacitor for use in hybrid-electric vehicles. The controller will be usable with ultracapacitors now being developed in a separate NYSERDA project with GE, but also can be used with other ultracapacitors being developed elsewhere.

DESCRIPTION

This project will design, build, and test two 25-kilowatt controllers for use with ultracapacitors. One unit will be delivered to the U.S. Department of Energy for testing with ultracapacitors being developed in other projects. The other may be tested in a NYSERDA-developed hybrid-electric vehicle.

BENEFITS

Hybrid-electric propulsion offers improved fuel efficiency and reduced emissions in urban service. The controller developed in this project will allow ultracapacitors to be used effectively in hybrid-electric vehicles such as transit buses, delivery trucks, and taxis. Ultracapacitors perform the load-leveling function needed in hybrid-electric vehicles, but with significantly lower weight and longer life than batteries. The GE ultracapacitor is expected to be manufactured in New York State.

SCHEDULE AND STATUS

Preliminary engineering has been completed. Long-lead-time parts have been received, and construction of a bench-model controller is under way.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	0	$216,684	$216,684
U.S. Department of Energy	0	267,610	267,610
TOTALS	0	$484,294	$484,294

Contractor: General Electric Corporate Research and Development
Site: Niskayuna, Schenectady County
Contract Duration: 5/96 - 12/97
Key Words: transportation, product development, electricity, alternative fuels, natural gas, hybrid, ultracapacitor, controller
Project Manager: Larry Hudson (518) 862-1090, ext. 3209
Program: Transportation
Subprogram: Technology Development and Applications
Contract No.: 4352-ERTER-TRN-97

-> Low-Cost Transportation Fuel Cell

Develop and demonstrate low-cost proton-exchange-membrane fuel cell that uses new materials and processes.

BACKGROUND

Fuel cells convert hydrogen to electricity in a safe, quiet, efficient, and environmentally acceptable manner. However, the high cost of fuel-cell materials has prevented their widespread use. The contractor has developed and patented new materials that will offer a cost-effective option.

OBJECTIVE

To build prototype proton-exchange-membrane (PEM) fuel cells that incorporate new electrode and membrane materials to use hydrogen and ambient air as fuels.

DESCRIPTION

The contractor will optimize electrode and membrane materials, develop assembly processes, and build a 100-watt prototype. Systems will be tested for performance and durability. Market analysis, and development of manufacturing and marketing strategies will begin.

BENEFITS

Fuel cells that use hydrogen produce only water emissions. Using this technology for lawn and garden equipment, transportation, and emergency home generators would reduce emissions and noise in urban environments, as well as our nation's dependence on imported oil. In addition, a small New York State firm will expand, creating new jobs.

SCHEDULE AND STATUS

A redesign effort is underway to address manufacturing issues. A 50-watt prototype of the new design should be completed by June 1997. System testing will take place from June to October 1997.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$200,000	0	$200,000
DAIS Corporation	68,161	0	68,161
Wright-Malta Corporation	164,000	0	164,000
TOTALS	$432,161	0	$432,161

Contractor: DAIS Corporation
Site: Ballston Spa, Saratoga County, and Troy, Rensselaer County
Contract Duration: 10/95 - 6/97
Key Words: transportation, product development, hybrid-electric vehicles, fuel cells
Project Manager: Karen Villeneuve (518) 862-1090, ext. 3275
Program: Transportation
Subprogram: Technology Development and Applications
Contract No.: 4210-ERTER-TR-96

Develop natural gas engine for large trucks and buses.

BACKGROUND

Diesel engines in heavy-duty vehicles generate significant emissions, including about half the particulates, that cause significant air-quality problems in New York City and elsewhere. Substitution of compressed natural gas (CNG) for diesel fuel in these engines would greatly reduce output of particulates and other emissions, and also would reduce dependence on imported petroleum.

Cummins produces the L10 diesel engine for large trucks and buses, and also has developed the L10G, a version of the L10 capable of using natural gas and which has become popular in the transit-bus market. To broaden its natural gas engine product line, Cummins plans to develop improved versions of the L10G that will produce more power and be more economical to buy and operate. Cummins has formed a consortium to defray research and development costs, and to assist in demonstration projects. Consortium members include: NYSERDA; New York Gas Group; Gas Research Institute; Columbia Gas of Ohio, Inc.; Southern California Gas Company; Consolidated Natural Gas Company; and, Gas Technology Canada.

OBJECTIVE

To develop and commercialize L10G natural gas engine variations that, compared to the current L10G, provide increased power, increased fuel efficiency, reduced cost, and extremely low emissions. Advanced versions of the L10G are to be "slipstreamed" into production, helping sustain production volumes of the L10 engine family at Cummins' Jamestown, New York, plant.

DESCRIPTION

The design concept for improved natural gas engines entails using many parts from the base diesel engine, so that the new engines require fewer unique (i.e., expensive) parts and so they can be manufactured on the same assembly line as the diesel engine. Also, the natural-gas components are designed for use across a family of engines that satisfy the needs of many vehicle types, further reducing the number of unique parts that must be designed and manufactured. Major technical developments include improved engine-control electronics and other hardware designed to meet both performance, emissions, and cost objectives. Specific tasks include: (1) Definition of functional requirements and design, (2) performance modeling, (3) engine builds, (4) durability evaluations, (5) field tests, and (6) emissions certification, presently defined by the ULEV (ultra low-emission vehicle) standards promulgated by the California Air Resources Board.

BENEFITS

The approach taken will allow natural gas engines to gain wider market acceptance by increasing their power range and reducing their cost. This in turn will produce environmental, fuel diversity, and economic development benefits.

SCHEDULE AND STATUS

Cummins has started work and plans to be able to accept commercial orders for the improved natural gas engines by January 1998.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$300,000	0	$300,000
Cummins Engine Company	4,982,481	0	4,982,481
Other Consortium Members	1,680,000	0	1,680,000
TOTALS	$6,962,481	0	$6,962,481

Contractor: Cummins Engine Company, Inc.
Site: Jamestown, Chautauqua County
Contract Duration: 3/96 - 3/98
Key Words: transportation, product development, alternative fuels, CNG
Project Manager: Joe Wagner (518) 862-1090, ext. 3228
Program: Transportation
Subprogram: Technology Development and Applications
Contract No.: 4357-ERTER-TR-96

-> Combustion of Alcohol Fuels

Investigate combustion behavior of methanol, ethanol, and blends of these alcohols with other hydrocarbons.

BACKGROUND

When used as vehicle fuel, alcohols such as methanol and ethanol have potential to reduce emissions and petroleum imports. Disadvantages presently include high per-gallon cost and poor cold-starting, problems made worse by the present practice of using alcohol fuels in vehicles originally designed to run on gasoline. This project analyzes basic combustion characteristics of alcohol fuels and develops computer models that may enable researchers to design improved alcohol-fueled engines. The new engines would have improved performance and higher efficiency, thereby increasing the functionality and reducing the cost of using alcohol fuels.

OBJECTIVE

To develop laboratory data and computer models useful for designing improved alternative-fuel engines and other combustion and emissions-control systems.

DESCRIPTION

Experimental tests in this program are performed using two test apparatuses: a combustion-reactor system and an autoignition chamber. Both systems were upgraded to enable performance of project work. Parametric studies are conducted to determine the effects that temperature, pressure, and air/fuel mixture ratio have on the combustion process. The experimental data then are used to develop and validate chemical kinetic and ignition models. The researchers test the models against other available, independent data.

BENEFITS

As a result of this project, alcohol fuels may have a better chance of making significant contributions to reducing both vehicular emissions and petroleum consumption.

SCHEDULE AND STATUS

The contractor has made good progress, has presented results at national conferences, and now is preparing final technical reports.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$55,179	0	$55,179
Petroleum Overcharge Funds	74,076	0	74,076
TOTALS	$129,255	0	$129,255

Contractor: Union College
Site: Schenectady, Schenectady County
Contract Duration: 4/93 - 7/97
Key Words: transportation, university, alternative fuels, AFV, alcohol, ethanol, methanol (M85)
Project Manager: Joe Wagner (518) 862-1090, ext. 3228
Program: Transportation
Subprograms: Technology Development and Applications, Petroleum Overcharge
Contract No.: 3010-ERER-POP-94

-> Advanced Rotary Compressor: Phase 2

Develop new type of compressor for CNG refueling stations.

BACKGROUND

Using compressed natural gas (CNG) as a vehicle fuel potentially can provide significant environmental, energy diversification, and economic development benefits. Unfortunately, the capital and operating costs of CNG refueling stations are high and represent significant barriers to increased penetration into the highway fuels market. The high costs are partly due to the size, complexity, and maintenance requirements of conventional reciprocating compressors. Aurora Technology Corporation, a packager of CNG stations, has suggested a more cost-effective alternative, the advanced rotary compressor (ARC), a device that uses rotary motion for all major moving parts, as compared to conventional compressors that use reciprocating pistons. The ARC allows a major reduction in the number of compressor parts and in overall compressor size, and in turn yields significant reductions in capital and maintenance costs.

OBJECTIVE

Phase 1 objectives were to design an ARC prototype and to build and run the prototype to demonstrate proof-of-concept. Test-stand operation of the prototype was aimed at generating data for use in defining ARC capabilities, identifying potential design enhancements, and designing compressor auxiliaries. Phase 2 goals include optimizing the ARC and its auxiliaries, building and operating field-test units, and starting commercialization efforts.

DESCRIPTION

Phase 2 requires development of design improvements leading to a Second Generation ARC suitable for field tests. The existing ARC test stand includes a rudimentary set of auxiliaries that were sufficient for Phase 1 testing. New auxiliaries, suitable for field demonstration and later commercialization will be designed and fabricated, and along with an upgraded data acquisition system and other improvements, will be incorporated into a new test stand that will be used for performance and durability testing of the ARC before field tests at two sites in New York State.

BENEFITS

The approach taken may reduce the cost of CNG refueling stations, leading to greater adoption of CNG vehicles and resulting environmental, energy diversification, and economic development benefits. Commercialization plans call for the ARC to be manufactured by a New York State firm for sale to Aurora and other CNG station packagers.

SCHEDULE AND STATUS

The researchers have assembled the initial ARC prototype compressor and test stand, performed tests to verify performance, and were successful in receiving a patent for the basic mechanical design of the ARC. Field tests for the second generation ARC units are scheduled to begin in autumn 1997 and a final report will be completed in 1998.

FUNDING	Past Years	FY 1997-98	Total Anticipated
NYSERDA	$103,511	0	$278,013
New York Gas Group	149,797	0	149,797
Aurora Technology Corp.	190,924	0	271,719
TOTALS	$444,232	0	$699,529

Contractor: Aurora Technology Corporation
Site: East Aurora, Erie County
Contract Duration: 3/96 - 3/98
Key Words: transportation, product development, alternative fuels, CNG, compressor
Project Manager: Joe Wagner (518) 862-1090, ext. 3228
Program: Transportation
Subprogram: Technology Development and Applications
Contract No.: 4349-ERTER-TR-96

-> CNG Station Auxiliaries

Improve cost and performance of compressed natural gas (CNG) refueling stations with advanced auxiliaries.

BACKGROUND

The high capital and operating costs of conventional CNG refueling stations are obstacles to introduction of natural gas as a vehicular fuel. The compressor module is an expensive element of such stations and has been the subject of research efforts to improve economics. Another factor in the high cost of CNG stations is the current practice of using auxiliary systems developed for non-CNG applications, and which have not been optimized for CNG service. This lack of optimization increases cost and impairs performance. More cost-effective auxiliaries are needed.

OBJECTIVE

To design and develop auxiliary systems that will improve the cost and performance of CNG refueling stations, and increase the manufacturing base for CNG components in New York State. The project addresses the major components of a CNG station, including control system software, but not including the compressor module.

DESCRIPTION

This project examines conventional practices used in CNG station design. New approaches will be investigated, encompassing consideration of advanced electronics and improved control techniques. Some of the investigations involve fabrication of bench-scale prototypes and laboratory testing of prototype components and systems.

BENEFITS

This project will enable construction of CNG stations having lower capital and operating costs, thus increasing the potential for greater use of CNG as a highway fuel and providing air-quality and petroleum displacement benefits. New products developed in this project should provide additional revenue and jobs in the manufacture of CNG components in New York State.

SCHEDULE AND STATUS

The contractor has completed analysis of several refueling station subsystems and has developed new designs for auxiliaries that yield significant energy and cost savings when compared to standard industry components. Products developed in this project include a new type of station controller and an improved CNG dispenser. A separately funded field test in 1997 will evaluate prototypes from this project.

FUNDING	Past Years	FY 1997-98	Total Anticipated
NYSERDA	$200,000	0	$200,000
New York Gas Group	201,331	0	201,331
Niagara Mohawk Power Corp.	200,000	0	200,000
Aurora Technology Corp.	201,593	0	201,593
TOTALS	$802,924	0	$802,924

Contractor: Aurora Technology Corporation
Site: East Aurora, Erie County
Contract Duration: 12/93-8/97
Key Words: transportation, product development, alternative fuels, AFV, CNG, refueling station, natural gas
Project Manager: Joe Wagner (518) 862-1090, ext. 3228
Program: Transportation
Subprogram: Technology Development and Applications
Contract No.: 3022-ERTER-TRN-94

-> Compressed Natural Gas Diesel Conversions

Demonstrate conversion of truck and bus diesel engines to run on natural gas.

BACKGROUND

Diesel engines in heavy-duty vehicles generate significant emissions, including about half the particulates, that cause significant air-quality problems in New York City and elsewhere. Substitution of compressed natural gas (CNG) for diesel fuel in these engines would greatly reduce their production of particulates and other emissions, and also would reduce dependence on imported petroleum. Unfortunately, the cost of new CNG engines is very high, representing a significant obstacle to adoption of CNG as a vehicle fuel. Moreover, diesel engines tend to be long-lived and, even if the cost of conversion could be reduced, many vehicle owners would prefer to delay a switch to CNG until the current generation of diesel engines wears out.

OBJECTIVE

To develop, demonstrate, and commercialize a way to convert heavy-duty diesel engines to CNG fuel in a manner that reduces the vehicle owner's capital outlay and avoids early retirement of existing engines.

DESCRIPTION

The contractor will demonstrate kits and procedures for converting in-service diesel engines to operate on CNG for truck and bus applications. The project team includes a subcontractor, Vinyard Engine Systems, Inc., that is an acknowledged leader in CNG engine-conversion technology. Specific tasks include: (1) selection of approximately three vehicles, representing a range of vehicle types and engine manufacturers, for demonstration of conversion equipment and procedures; (2) installation of conversion equipment on the selected vehicles; (3) vehicle operation and monitoring, including emissions testing by the New York City Department of Environmental Protection, (DEP), and recording of fuel economy and maintenance data for at least one year; (4) reporting; and (5) development of local vendor capabilities so that by the end of the project, local diesel service organizations can sell, install, and service kits as part of a major program to convert in-service diesel engines to CNG fuel.

BENEFITS

If successful, this project will hasten the adoption of CNG and thereby accelerate achievement of air-quality benefits and reduction of petroleum imports. At the peak level of marketing activity, 50 New York mechanics and technicians may be employed in converting diesel engines in heavy-duty vehicles.

SCHEDULE AND STATUS

The project is under way.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	0	$50,000	$50,000
New York City Dept. of Env. Protection	0	30,000	30,000
Brooklyn Union	0	82,000	82,000
TOTALS	0	$162,000	$162,000

Contractor: Brooklyn Union
Site: Brooklyn, Kings County
Contract Duration: 10/96 - 3/99
Key Words: transportation, product development, alternative fuels, CNG
Project Manager: Joe Wagner (518) 862-1090, ext. 3228
Program: Transportation
Subprogram: Technology Development and Applications
Contract No.: 4355-ERTER-TR-97

-> Compressed Natural Gas Component Manufacturing Venture

Design and commercialize improved compressed natural gas conversion kit for taxis.

BACKGROUND

The 12,000 taxis in New York City emit a significant portion of the City's mobile-source pollutants and consume large amounts of gasoline. To reduce emissions, New York City has secured $3.2 million in federal funding to assist in converting taxis to compressed natural gas (CNG). However, before this money can be used, functional, economic, and emissions shortcomings of typical bifuel CNG conversion kits need to be overcome.

San Marino Engineering (SME) has defined a technical approach that potentially overcomes problems with existing CNG conversion hardware, specifically in complying with the U.S. Environmental Protection Agency (U.S. EPA) requirement that any aftermarket fuel system be compatible with the vehicle's OBD-II emissions control system. (OBD stands for onboard diagnostics, the electronic system that continuously monitors the performance of the emissions-control system on late-model gasoline vehicles.)

OBJECTIVE

To design and commercialize a CNG conversion kit optimized for taxis and suitable for other vehicles equipped with spark-ignition engines. First sales are planned in conjunction with the federally funded CNG taxi program, and will require obtaining certification from various standards and regulatory bodies, including U.S. EPA.

DESCRIPTION

Project work will focus on design, fabrication, testing, and certification of a kit installed on a Ford Crown Victoria. The primary kit components that require additional development and certification are the pressure reducer, fuel-metering valve, fuel-control electronics, and software. The fuel-storage system, including fuel tanks, will be obtained from a third party. SME will: (1) develop an integrated kit design, (2) fabricate components (3) acquire a vehicle for prototyping, (4) acquire a CNG tank package, (5) install all equipment on the prototype vehicle, (6) perform extensive emissions tests and other tests to support design optimization and certification efforts, (7) obtain certifications from U.S. EPA and other organizations, and (8) demonstrate the prototype in on-road field-tests.

BENEFITS

This project will displace petroleum and reduce emissions in a high-visibility application in an emissions-sensitive location. The resulting CNG conversion kits will provide technical options facilitating implementation of the federally funded CNG conversion program for NYC taxis. SME plans to initiate manufacturing at a site in New York State and to sell equipment to major domestic and international markets.

SCHEDULE AND STATUS

The project has just begun.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	0	$75,000	$75,000
San Marino Engineering	0	129,800	129,800
Brooklyn Union	0	15,000	15,000
NYC Dept. of Env. Protection	0	20,000	20,000
EDO Corporation	0	4,000	4,000
TOTALS	0	$243,800	$243,800

Contractor: San Marino Engineering
Site: Glendale, Queens County
Contract Duration: 3/97 - 1/98
Key Words: transportation, product development, alternative fuels, CNG
Project Manager: Joe Wagner (518) 862-1090, ext. 3228
Program: Transportation
Subprogram: Technology Development and Applications
Contract No.: 4544-ERTER-TRN-97

-> Hybrid CNG Station

Field-test and accelerate commercialization of improved CNG refueling station.

BACKGROUND

Under two ongoing projects, Aurora Technology Corporation has developed designs for advanced compressed natural gas (CNG) station auxiliaries and the first two stages of its four-stage advanced CNG compressor. The Hybrid CNG Station uses these advances, plus a conventional compressor to provide the third and fourth stages of compression, in an integrated skid-mounted package. New York State Electric & Gas Corporation (NYSEG) operates CNG stations and wishes to field-test Aurora's concept, which shows promise for reducing capital costs and improving station performance. Amoco Oil Company has provided technical and financial assistance because of its interest in finding cost-effective equipment for serving the alternative fuels market.

OBJECTIVE

To build and demonstrate a prototype CNG station that embodies advanced components developed under two separate research efforts, one that developed a new type of compressor and another that developed a new type of control system and other station auxiliary systems. The demonstration is intended to accelerate commercialization of new CNG station components that are made in New York State and that facilitate adoption of CNG vehicles.

DESCRIPTION

The contractor is fabricating a prototype Hybrid CNG Station for field-testing at a site provided by NYSEG in Binghamton, where the unit will operate next to a conventional system used to fuel CNG transit buses operated by Broome County Transit. NYSEG will provide site preparation and support, and Aurora and NYSEG will acquire data to assess the benefits of the Hybrid CNG Station as compared to the conventional unit. The Hybrid CNG station incorporates components, including a new type of compressor, station controller, and fuel dispenser, developed under two separate research efforts. In this project, the contractor will integrate the advanced components into an integrated package and will perform field tests to refine the package, demonstrate system capabilities, and to solicit commercial orders.

BENEFITS

CNG vehicles help reduce petroleum consumption and air pollution. This project will assist in the market penetration of CNG vehicles by demonstrating a CNG-refueling station with improved economic and technical performance compared to conventional CNG-refueling equipment. Moreover, this project assists a small New York State manufacturer in launching a product line with national and international sales potential.

SCHEDULE AND STATUS

The contractor has built production versions of the various components and has started fabrication of an integrated, skid-mounted, fully enclosed module suitable for installation at the test site.

FUNDING	Past Years	FY 1997-98	Total Anticipated
NYSERDA	$315,213	0	$315,213
Aurora Technology Corporation	74,134	0	74,134
NYS Electric & Gas Corp.	91,364	0	91,364
Amoco	243,000	0	243,000
TOTALS	$723,711	0	$723,711

Contractor: Aurora Technology Corporation
Site: Binghamton, Broome County
Contract Duration: 9/95 - 12/97
Key Words: transportation, product development, alternative fuels, air quality, emissions control, natural gas, CNG, compressor
Project Manager: Joe Wagner (518) 862-1090, ext. 3228
Program: Transportation
Subprogram: Technology Development and Applications
Contract No.: 4246-ERTER-TRN-96

-> Engine-Driven CNG Station

Design and build a compressed natural gas (CNG) vehicle-refueling station, using engine-driven compressors.

BACKGROUND

Compressed natural gas (CNG) is an alternative fuel for vehicles that can potentially improve air quality and reduce dependence on petroleum. Since air-quality improvements are most needed in cities, and because the range restrictions of CNG vehicles are less problematic in urban areas, it is logical to concentrate on cities when beginning the establishment of a CNG-fueling infrastructure. Unfortunately, siting new facilities is typically more difficult in urban areas, and costs can be very high compared to installing equipment in rural settings.

OBJECTIVE

To design, develop, test, and field-demonstrate a self-contained CNG station that can be used in a variety of existing automotive fuel-dispensing sites. Based on evaluation of design, cost, operability, and marketability, a decision will be made whether to initiate commercial production of such a station.

DESCRIPTION

The design concept focuses on using natural-gas-fueled engines to drive the CNG compressors, eliminating use of large electric motors and their associated need for large-capacity electric service lines. In addition, the design concept features a minimal "footprint" and other features to further reduce installation problems and costs. The contractor is developing several designs for potential build and test. Prototype stations may be installed in the Brooklyn Union service area for operation as public-access fueling facilities.

BENEFITS

A standardized engine-driven CNG refueling module with a minimal footprint would potentially improve the economics and reduce the problems associated with adding CNG-refueling capability to existing gasoline stations. This would overcome some of the hurdles limiting expansion of the CNG infrastructure, especially in urban areas. In turn, this would make it easier to tap the potential air-quality and petroleum-displacement benefits of CNG vehicles.

SCHEDULE AND STATUS

The contractor has assembled a prototype and is planning field tests.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$200,000	0	$200,000
Brooklyn Union	$1,100,000	0	1,100,000
TOTALS	$1,300,000	0	$1,300,000

Contractor: Brooklyn Union
Site: Brooklyn, Kings County
Contract Duration: 11/93 - 6/97
Key Words: product development, transportation, alternative fuels, AFV, CNG, fueling station, natural gas
Project Manager: Joe Wagner (518) 862-1090, ext. 3228
Program: Transportation
Subprogram: Technology Development and Applications
Contract No.: 3023-ERER-ER-94

-> CNG Taxi Pilot Fleet

Design, build, and field-test improved compressed natural gas conversion kits optimized for taxis.

BACKGROUND

Taxis consume significant amounts of fuel and emit pollution in urban cores. The 12,000 taxis in New York City account for approximately 10 percent of the City's vehicle miles traveled. In view of a taxi's limited area of operation and intensive use, this high-profile application warrants rapid development for alternative-fuels use, with emphasis on air-quality enhancement. New York City has secured $3.2 million in federal funding to assist in converting taxis to compressed natural gas (CNG); before this money can be used it is necessary to define a technical approach that overcomes functional, economic, and emissions shortcomings of typical bifuel CNG conversion kits.

OBJECTIVE

The objective is to design, develop, and demonstrate CNG conversion kits optimized for vehicles approved or proposed for approval as NYC taxis. The resulting designs, validated in revenue service in a test fleet of about 18 vehicles and via emissions testing, would be available to the balance of NYC's fleet.

DESCRIPTION

The contractor will convert a pilot group of about 18 taxis to CNG, using advanced components integrated into configurations optimized for taxi application. A unique aspect will be onboard storage of relatively large amounts of CNG (approximately 16 gasoline-equivalent gallons), while adding only about 150 pounds to vehicle weight and preserving adequate trunk space. The resulting conversion will enable a taxi to store enough fuel in one fueling stop to meet functional requirements and to generate fuel-cost savings large enough to be financially attractive. The converted vehicles will be placed in service to validate the design and allow users to become familiar with the technology. Improvements in CNG components are expected to become available from component manufacturers throughout the course of the project, and these will be incorporated in the conversion kits to the extent possible.

BENEFITS

This project will displace petroleum and reduce emissions in a high-visibility application in an emissions-sensitive location. The resulting CNG conversion kits will provide technical options facilitating implementation of the federally-funded CNG conversion program for NYC taxis.

SCHEDULE AND STATUS

The contractor has completed the planned CNG conversions and has collected operating data. The contractor is using project results to assist taxi owners in selecting equipment for additional conversions, and is preparing a final report.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$192,011	0	$192,011
EDO Corporation	55,000	0	55,000
NYC Dept. of Env. Protection	135,000	0	135,000
U.S. DOT/EPA	1,065,000	0	1,065,000
TOTALS	$1,447,011	0	$1,447,011

Contractor: EDO Corporation
Site: College Point, Queens County
Contract Duration: 3/95 - 6/97
Key Words: transportation, product development, alternative fuels, air quality, emissions control, natural gas, CNG, AFV
Project Manager: Joe Wagner (518) 862-1090, ext. 3228
Program: Transportation
Subprogram: Technology Development and Applications
Contract No.: 4097-ERTER-ER-95

-> Development of a Vehicle-Fleet Fuel/Maintenance Management System

Develop and test software that will integrate all areas of vehicle-fleet management to achieve fuel savings.

BACKGROUND

The contractor has developed and markets a vehicle-maintenance software system that is used by approximately 50 vehicle-fleet operators nationwide. Research has shown that vehicle-fuel savings of up to 10 percent can be achieved through driver feedback and fleet-management activities. This project will develop and add features to the existing software to achieve these savings.

OBJECTIVE

This project will develop a compatible product to permit on-line analysis of fleet operations based on fuel consumption. To assure that a real market need is met, the product-development process will include design consultation and testing with sample vehicle-fleet operators. Product-development testing will increase the ease of use and effectiveness of the product. Field-testing activities will provide quantitative data on the fuel-saving effectiveness of maintenance activities and increased driver training. Product-marketing efforts will include a brochure describing the results of field-testing, a demo disk, and a telephone marketing campaign targeting vehicle-fleet operators.

DESCRIPTION

The objective is to develop, test, and introduce to the market computer software aimed at improving the fuel efficiency of vehicle fleets. The software provides a recording-keeping and monitoring system for refueling and maintaining fleet vehicles. The product includes a module for tracking fuel consumption and mileage of individual vehicles and drivers.

BENEFITS

More than 40 percent of New York State's energy use is consumed by transportation. Previous studies have indicated that fleet fuel savings approaching 10 percent are possible with proper vehicle-maintenance programs and driver education. This product would integrate all areas of vehicle-fleet management, including driver training and maintenance, so that energy savings can be achieved by on-site managers. Additional benefits may accrue due to the decreased emissions per gallon that accompany increased fuel-efficiency and a properly maintained vehicle.

SCHEDULE AND STATUS

Testing is complete and product introduction is being made in early 1997.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$56,361	0	$56,361
Roger Creighton Associates, Inc.	61,136	0	61,136
TOTALS	$117,497	0	$117,497

Contractor: Roger Creighton Associates, Inc.
Site: Delmar, Albany County
Contract Duration: 4/92 - 9/97
Key Words: transportation, product development, software
Project Manager: Richard Drake (518) 862-1090, ext. 3258
Program: Transportation
Subprogram: Technology Development and Applications
Contract No.: 1822-EEED-IEA-92

-> Advanced Pavement Quality Indicator (PQI)

Develop and demonstrate method for real-time evaluation of pavement quality.

BACKGROUND

Nationwide, there is a need to improve the quality of road-paving, extending the life of the pavement and reducing the need for rehabilitative maintenance. Real-time pavement-density measurements are available through nuclear measurement techniques, requiring costly equipment and specially licensed personnel. The contractor has identified two other promising approaches to measure the percentage of air voids, and therefore the quality, of asphalt: Capacitance Energy Dissipation (CED), and Micro-Power Impulse Radar (MIR.) The contractor has designed, built, and tested a breadboard CED device with promising results. The MIR approach was developed at Lawrence Livermore National Laboratory (LLNL).

OBJECTIVE

To evaluate two technologies, CED and MIR, for measuring the density of asphalt pavement. The program is expected to demonstrate that relative compaction (density) of an asphalt mat can be measured in real time, and the information used to feed back in-process corrections in paving and rolling operations.

DESCRIPTION

The contractor will: (1) construct initial prototype systems, (2) evaluate their performance under varying environmental conditions, and (3) demonstrate their performance in the field. The contractor also will perform marketing and cost/benefit analyses of the products.

BENEFITS

These new technologies will make real-time feedback more widely available at a reduced cost and with increased safety. The result will be reduced construction, less rework of paving operations, and improved pavement durability. An estimated energy savings of 23 trillion Btu per year is expected at peak deployment through reducing the use and trucking of asphalt paving mix, paving fuel consumption, and traffic congestion. In addition, eliminating the use of radioactive material in the process will provide significant environmental and health benefits, and eliminate energy costs for storage, use, and transport of that material. Manufacturing will take place in New York State.

SCHEDULE AND STATUS

The contractor has completed the development and laboratory evaluation of several prototype sensors. Field demonstrations have been completed, and data analysis is under way.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$84,699	$114,509	$199,208
TransTech Systems, Inc	54,802	0	54,802
Army COE WES	61,399	83,007	144,406
TOTALS	$200,900	$197,516	$398,416

Contractor: TransTech Systems, Inc
Site: Latham, Albany County
Contract Duration: 11/95 - 6/97
Key Words: transportation, product development, infrastructure, construction
Project Manager: Karen Villeneuve (518) 862-1090, ext. 3275
Program: Transportation
Subprogram: Technology Development and Applications
Contract No.: 4354-ERTER-TR-96

-> Composite Materials for Transportation - TEMPEST Aircraft

Use innovative composite/aluminum material to build low-cost, fuel-efficient airplane.

BACKGROUND

The recently stagnant general aviation industry, suffering from declining aircraft numbers, an aging fleet, and expensive maintenance, is poised for rapid growth due to economic and administrative changes. The contractor has taken advantage of improved aerodynamics, materials, and construction techniques to design a lighter, more fuel-efficient, quieter, lower-cost airplane. The unique approach uses an aluminum skeleton that carries all significant structural loads, and composite panels integrally joined to the aluminum parts to complete the aerodynamic envelope. This approach not only overcomes objections to prior aircraft design that incorporated composites, but also is directly transferable to construction of advanced ground vehicles.

OBJECTIVES

To: (1) design, fabricate, and test a prototype low-cost, four-seat airplane made of aluminum and composite materials; and (2) submit test plans, reports, and specifications to the Federal Aviation Administration (FAA) for aircraft certification.

DESCRIPTION

Project scope includes: (1) preliminary design, (2) detailed design and construction of tooling, (3) component construction and testing, (4) documentation development and control, and (5) airplane fabrication.

BENEFITS

The plane will reduce fuel consumption by 20%. Annual fuel savings based on a 20% market share will be 1.5 million gallons of fuel. Over time, with 20% fleet penetration, this represents an annual savings of approximately 50 million gallons of gasoline annually, with related emissions benefits. Additionally, this low-energy, high-strength, low-weight composite manufacturing process is directly transferable to ground-based advanced vehicles and could be expected to provide significant energy benefits in the future. NYS would benefit through the addition of up to 500 manufacturing jobs, and the expertise acquired in fabrication of composite structures needed in the transportation industry.

SCHEDULE AND STATUS

Preliminary design has been completed, parts design and fabrication are under way, and the FAA certification process has begun. The contractor plans on the first flight in mid-1997.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	0	$150,000	$150,000
Jaran Aerospace Corp.	$325,000	485,654	810,654
TOTALS	$325,000	$635,654	$960,654

Contractor: Jaran Aerospace Corporation
Site: Ballston Spa, Saratoga County
Contract Duration: 2/97 - 9/97
Key Words: transportation, product development, composite materials, aircraft
Project Manager: Karen Villeneuve (518) 862-1090, ext. 3275
Program: Transportation
Subprogram: Technology Development and Applications
Contract No.: 4543-ERTER-TR-97

-> Upgrade of Bus Industries of America/General Electric Company Hybrid-Electric Bus

Upgrade 40-foot hybrid-electric transit bus for extended demonstration.

BACKGROUND

Hybrid-electric power trains are especially well-suited to the urban duty cycle, and offer reduced petroleum dependence, improved emissions, and reduced maintenance costs. A 40-foot low-floor hybrid-electric transit bus was constructed in Phase I of this project.

ACCOMPLISHMENTS

A 40-foot low-floor Orion VI hybrid-electric transit bus, built by Orion Bus Industries of Oriskany, New York, was designed, built, tested, and demonstrated. The New York City Metropolitan Transit Authority (MTA) demonstrated the bus for an extended period.

FINDINGS AND CONCLUSIONS

Hybrid-electric propulsion systems offer robust solutions to improve the efficiency and cleanliness of heavy-duty urban-cycle vehicles. Improvements on the order of 20-30% in fuel efficiency and 50% in emissions have been seen in chassis dynamometer tests. Projected improvements in brake life, arising from regenerative braking, are expected to reduce overall costs of bus maintenance.

REALIZED OR ANTICIPATED BENEFITS

As a result of this project, the MTA is planning to order several buses of this type from Orion. Orion Bus Industries, in cooperation with Lockheed Martin Control Systems of Johnson City, New York, is planning to build 100 such buses, the first five of which have been sold to New Jersey Transit. Other heavy-duty platforms, ranging from Class 4 to Class 8 trucks, will also benefit due to a modular approach to power-train design and construction. This will reduce unit costs and speed the introduction of heavy-duty hybrid-electric vehicles. A major portion of the economic benefit will take place in New York.

TECHNOLOGY TRANSFER ACTIVITIES

Orion and Lockheed are pursuing commercial opportunities as a result of this project. NYSERDA is following up with support of technical activities to help reduce the manufacturing cost of future units. NYSERDA staff have made presentations at several technical conferences, and the prototype bus has been shown at various conferences and energy fairs.

FUNDING	TOTALS
NYSERDA	$415,000
New York Power Authority	340,000
Federal Transit Authority	3,050,0000
Con Edison	275,000
Niagara Mohawk Power Corp.	225,000
ESEERCO	450,000
Electric Power Research Institute	300,000
Bus Industries of America*	300,000
General Electric Company*	400,000
Metropolitan Transit Authority*	327,000
TOTALS	$6,082,000

* Contributor of material and services.

Contractor: Metropolitan Transit Authority
Site: Oriskany, Oneida County, and Schenectady, Schenectady County
Contract Duration: 12/95 - 12/96
Key Words: transportation, product development, alternative fuels, hybrid-electric, bus, emissions
Project Manager: Larry Hudson (518) 862-1090, ext. 3209
Program: Transportation
Subprogram: Technology Development and Applications
Contract No.: 1953B-ERER-ER-96

-> Turbocharged Methanol Flexible-Fuel Vehicle

Test methanol-vehicle engine modifications designed to improve economics, performance, and emissions.

BACKGROUND

Due to their potential for reducing emissions and petroleum consumption, alcohol fuels such as methanol and ethanol are candidates for widespread use as highway vehicle fuels. Disadvantages of alcohol fuels include high cost and poor cold-starting. These problems are exacerbated by using these fuels in vehicles originally designed to run on gasoline with minimal modifications. This project explored additional modifications that would enable a vehicle to make more efficient use of alcohol, thus reducing $/mile fuel cost, and that also would improve cold-starting. Further emissions reductions also may result from the modifications.

ACCOMPLISHMENTS

The contractor established technical liaison with Volkswagen of America and developed several strategies for modifying a factory-built methanol flexible-fuel vehicle (FFV) to improve its performance on methanol, while preserving its ability to run on gasoline. The contractor developed increased familiarity with alcohol engine systems and has been able to use this knowledge in follow-on programs that build on the technology base that this project helped to establish.

FINDINGS AND CONCLUSIONS

Modifications required to improve the performance of alcohol-fueled vehicles are achievable by using a variety of off-the-shelf components and innovative control strategies. Modifications can exploit alcohol's high octane rating, allowing an increase in engine compression ratio (CR). Higher CR, achieved in part by adding a turbocharger, improves performance and can directly and indirectly improve fuel efficiency. The modified engine can be further improved by features that enable it to retain the ability to operate on gasoline, and that allow it to easily cold-start on alcohol fuels. The design effort was focused on integrating new or modified components into a standard gasoline engine.

REALIZED OR ANTICIPATED BENEFITS

This project identified engine modifications that could improve the operating economics and other characteristics of alcohol-fueled vehicles. If implemented, these innovations can increase the market potential for methanol and ethanol, leading to reduced pollution and petroleum consumption.

TECHNOLOGY TRANSFER ACTIVITIES

The contractor has continued to acquire innovative alcohol-fueled vehicles and has made good use of refueling equipment supplied under NYSERDA's AFV Fleet Demonstration Program.

FUNDING	TOTALS
NYSERDA	$11,000[1]
City of White Plains	62,500
Methanol Institute of America, Inc.	1,000
Volkswagen of America, Inc.	1,000
TOTALS	$75,500

[1]The contractor was able to complete the project without using NYSERDA's budgeted support.

Contractor: City of White Plains
Site: City of White Plains D.P.W. Municipal Garage, Westchester County
Contract Duration: 4/92 - 6/96
Key Words: transportation, alternative fuels, air quality, emissions control, methanol, turbocharging
Project Manager: Joe Wagner (518) 862-1090, ext. 3228
Program: Transportation
Subprogram: Technology Development and Applications
Contract No.: 1834-ERER-ER-92

-> Monitoring Subway-Car Energy Use

Monitor energy use of major electrical components of subway car under actual operating conditions.

BACKGROUND

The New York City subway system consumes enormous amounts of power (450 MW peak). A good time to incorporate improvements that lead to more energy-efficient operation is at scheduled maintenance points, when components and subsystems that have reached the end of their useful life are replaced. However, the cost-effectiveness of potential improvements must be determined before commitments can be made to using them.

ACCOMPLISHMENTS

An R-62A subway car was instrumented with an automated vehicle data acquisition system (VDAS) for one summer season and for two winter months. Monitored end-uses include the traction motor, lighting, HVAC, and dynamic braking.

FINDINGS AND CONCLUSIONS

The predominant use of energy was for the traction motor (91.9% in the summer and 95.9% in the winter). The next largest energy user was air-conditioning, at 5.8%. All other energy uses were relatively minor. It was also concluded that most efficient operations generally occurred at speeds below 25 miles per hour. Finally, it was found that the potential exists for dynamic braking to be used in the regeneration of a significant amount of electrical power.

REALIZED OR ANTICIPATED BENEFITS

At the conclusion of the project, Metropolitan Transit continued to use the subway monitoring equipment to determine the energy savings resulting from an acceleration-control protocol change that was implemented for safety reasons. Comparing the post-change data with those obtained in this project it was determined that the change resulted in more than 30% traction motor energy savings.

TECHNOLOGY TRANSFER ACTIVITIES

A final report will be published and distributed.

FUNDING	TOTALS
NYSERDA	$99,730
ESEERCO	94,731
New York Power Authority	99,731
TOTALS	$294,192

Contractor: Science Applications International Corporation/The Fleming Group
Site: Metropolitan Transit subway, New York and Bronx counties
Contract Duration: 1/94-5/97
Key Words: transportation, HVAC, lighting, subway, monitoring
Project Manager: Karen Villeneuve and Mary Ann Bowers, (518) 862-1090, exts. 3275 and 3254
Program: Transportation; and Buildings Research
Subprogram: Advanced Transportation Systems; Electrical and Control Systems
Contract No.: 3131L-ERTER-TRN-94

-> Hybrid-Electric Bus Upgrade and Field Support

Upgrade and demonstrate natural gas-powered hybrid-electric transit bus built in previous NYSERDA project.

BACKGROUND

Hybrid-electric drive can provide greater fuel efficiency, reduced emissions, quieter operation, and reduced maintenance costs in urban conditions. A hybrid-electric transit bus powered by a natural gas-fueled engine generator and load-leveling batteries was constructed in a previous NYSERDA project in cooperation with the Ontario Ministry of Energy and Environment and others. The bus is an Orion II, built in original form by Bus Industries of America (now known as Orion Bus Industries) at Oriskany, New York. Conversion to hybrid-electric drive was accomplished by Unique Mobility of Golden, Colorado. Built originally as a proof-of-concept vehicle, the bus was later upgraded to allow transit operators to demonstrate it in the field.

ACCOMPLISHMENTS

The upgrades began in November 1994 and the completed bus was delivered to NYSERDA in June 1995. Field demonstrations in seven New York State transit districts were conducted from June to December 1995. Participating sites included Long Island Bus, Garden City; Triboro Coach Corporation and Queens Surface Transit, Queens; Ithaca Transit; Bee Line, Westchester County; Niagara Frontier Transportation Authority, Niagara Falls; and Capital District Transportation Authority, Albany. The bus was also placed in shuttle service at Rensselaer Polytechnic Institute from February to April 1996.

FINDINGS AND CONCLUSIONS

The bus experienced initial problems with motor-controller and alternator overheating, but these were resolved by September 1995 and subsequent operation was highly reliable. Hill-climbing and continuous highway-speed capabilities were found to be below the requirements of several operators. Other problems were minor, and the bus turned in many weeks of successful passenger service. Drivers, passengers, supervisors, and mechanics all provided useful feedback. Subsequent designs of heavy-duty hybrid-electric vehicle prototypes in follow-on NYSERDA projects provide for greater hill-climbing ability and higher sustainable highway speeds.

REALIZED OR ANTICIPATED BENEFITS

This vehicle was the first hybrid-electric natural-gas-powered heavy-duty transit bus to be demonstrated in North America. It proved that the hybrid-electric concept is workable, and encouraged the bus builder, Orion Bus Industries, to enter the hybrid-electric bus business. Together with Lockheed Martin Control Systems of Johnson City, New York, Orion has begun the construction of 100 full-size hybrid-electric transit buses.

TECHNOLOGY TRANSFER ACTIVITIES

The prototype bus will be returned to its owner, Unique Mobility, which may demonstrate it elsewhere. While in New York, in addition to its demonstration duties described above, the bus was used for participant transportation at several conferences and fairs, including the New York State Special Olympics. NYSERDA staff presented technical aspects of the project at various conferences.

FUNDING	TOTALS
NYSERDA	$592,541
Utilities and transit operators	150,000
Others	1,000,000
TOTALS	$1,742,541

Contractor: Unique Mobility, Inc.
Sites: Albany, Albany County; Saratoga Springs, Saratoga County; Elmsford, Westchester County; Niagara Falls, Niagara County; Garden City, Nassau County; Ithaca, Tompkins County; Borough of Queens, Queens County; Borough of Manhattan, New York County; Troy, Rensselaer County
Contract Duration: 11/94 - 3/97
Key Words: transportation, product development, electricity, alternative fuels, natural gas, CNG, hybrid-electric
Project Manager: Larry Hudson (518) 862-1090, ext. 3209
Program: Transportation
Subprogram: Technology Development and Applications
Contract No.: 4004-ERTER-TRN-95

-> High-Efficiency/High-Voltage Direct-Current Motor for Hybrid and Electric Vehicles

Design, build, test, and demonstrate improved direct-current motor and controller.

BACKGROUND

Electric-drive vehicles need lower costs and improved performance. Direct-current (DC) motors and controllers have traditionally provided good performance at low cost, but their operating characteristics need enhancement. Alternating-current (AC) systems achieve the desired performance, but at a relatively high cost. The goal of this project was to bring the performance of DC systems to a level comparable to state-of-the-art AC systems, while providing the cost advantage historically associated with DC systems. The technology applies to commercial and military vehicles.

ACCOMPLISHMENTS

The motor was built, laboratory-tested, and demonstrated in two vehicles, with good performance results. The motor and controller are now part of the contractor's product catalog.

FINDINGS AND CONCLUSIONS

While efficiency improvements were not as significant as expected, the motor does provide improvements over existing DC motors for these applications. It is an appropriate motor/controller for light- to medium-duty vehicle applications using regenerative braking.

REALIZED OR ANTICIPATED BENEFITS

Vehicle manufacturers will have an option for achieving good performance with lower cost, improved durability, and lower maintenance of the electric-drive system. The improvements will help make electric-drive vehicles a marketable alternative. The New York State contractor has added a new product to its line of motor/controller systems.

TECHNOLOGY TRANSFER ACTIVITIES

The contractor is marketing the product through its normal channels. Information about the motor appears on the Internet at locations frequented by the electric vehicle community. NYSERDA project managers are making hybrid-electric vehicle developers aware of the new motor. Project results were presented at the Defense Advanced Research Projects Agency (DARPA) program reviews, and to the Northeast Alternative Vehicle Consortium (NAVC.)

FUNDING	TOTALS
NYSERDA	$126,600
Advanced DC Motors	183,630
DARPA/NAVC	200,000
TOTALS	$510,230

Contractor: Advanced DC Motors
Site: Syracuse, Onondaga County
Contract Duration: 2/95 - 12/96
Key Words: transportation, product development, electric vehicles, hybrid vehicles, electric motors, propulsion, electric drive
Project Manager: Karen Villeneuve (518) 862-1090, ext. 3275
Program: Transportation
Subprogram: Technology Development and Applications
Contract No.: 4083L-ERTER-TR-95

-> MTI/Ford PEM Fuel Cell Development

Develop proton-exchange-membrane fuel cell for transportation applications.

BACKGROUND

Proton-exchange-membrane (PEM) fuel cells convert hydrogen to electricity. They are very efficient, environmentally acceptable, lightweight, and have been proposed as on-board electrical generators for hybrid-electric vehicles. The federal Partnership for a New Generation of Vehicles (PNGV) regards PEM fuel cells as prime candidates to achieve the goal of an 80-mile-per-gallon automobile. The U.S. Department of Energy (U.S. DOE) contracted with Ford Motor Company to develop a PEM vehicle, and Ford contracted with Mechanical Technology, Inc. (MTI) to develop a 10-kilowatt prototype unit for testing by Ford.

ACCOMPLISHMENTS

MTI constructed a 10-kilowatt PEM fuel cell stack and delivered it to Ford Motor Company for evaluation in May 1996. As a result, Ford selected MTI to participate in the next phase of the program, construction of a 50-kilowatt fuel cell to power a special lightweight Ford Taurus-type hybrid-electric vehicle. The latter PEM fuel cell effort was proposed to NYSERDA as a follow-on project under a competitive solicitation (PON 347), was approved (Agreement 4540), and is under way.

FINDINGS AND CONCLUSIONS

MTI's PEM fuel cell technology was evaluated against those of the leading developers worldwide and was found to be highly competitive. Key advantages are high specific power (kilowatts per kilogram) and potentially low manufacturing cost.

REALIZED OR ANTICIPATED BENEFITS

If the follow-on 50-kw PEM fuel cell project is successful, MTI will become a major supplier of next-generation transportation products to Ford Motor Company. This will help reduce dependency on petroleum for transportation and will improve urban air quality. In addition, a New York State firm may earn more than $1 billion a year in new sales revenue.

TECHNOLOGY TRANSFER ACTIVITIES

MTI is working intensively with Ford to commercialize its PEM fuel cell technology. Models of the 10-kw unit (non-functional) have been shown at various technical conferences and energy fairs.

FUNDING	TOTALS
NYSERDA	$375,425
Mechanical Technology, Inc.	275,000
Ford Motor Company	183,000
TOTALS	$833,425

Contractor: Mechanical Technology, Inc.
Site: Latham, Albany County
Contract Duration: 3/95 - 4/97
Key Words: transportation, product development, alternative fuels, electricity, fuel cells, PEM, PNGV
Project Manager: Larry Hudson (518) 862-1090, ext. 3209
Program: Transportation
Subprogram: Technology Development and Applications
Contract No.: 4087-ERTER-TRN-95

-> Electric Generator for Hybrid-Electric Vehicles

Design, build, and test compact, lightweight generator for hybrid-electric vehicles.

BACKGROUND

Hybrid-electric vehicles need an electric generator to drive the traction motors, charge the batteries, and provide power to other on-board systems. Off-the-shelf generators with the required output, based on conventional, wound-rotor technology, are large and heavy. A smaller, lightweight generator would better meet the requirements of hybrid-electric vehicles. Permanent-magnet generator (PMG) technology is used successfully in aircraft applications. PMGs have not been used by the automotive industry because the advantages were not perceived to outweigh the disadvantages. The unique requirements of a generator for hybrid-electric vehicles are expected to make PMGs a cost-effective alternative.

ACCOMPLISHMENTS

A trade study was completed of generator designs. A PMG was designed, built, tested, and installed on an engine for use in a prototype hybrid-electric vehicle.

FINDINGS AND CONCLUSIONS

Field evaluation of the PMG will be accomplished during vehicle testing and demonstration under NYSERDA agreement #4117-ERTER-TRN-96. Preliminary results of laboratory testing indicate the PMG is a viable alternative for some hybrid-electric vehicle applications.

REALIZED OR ANTICIPATED BENEFITS

A PMG is expected to be 10 times lighter and smaller in volume than a conventional generator supplying the same amount of power. This technology will further reduce vehicle weight by eliminating a conventional starter and alternator, and reducing structural support requirements. Vehicle performance and reliability will improve as a result.

TECHNOLOGY TRANSFER ACTIVITIES

The PMG will be evaluated and decisions made regarding commercialization during the vehicle demonstration program.

FUNDING	TOTALS
NYSERDA	$134,986
BFGoodrich Aerospace	266,649
TOTALS	$401,635

Contractor: BFGoodrich Aerospace, Engine Electrical Systems Division (Simmonds Precision Engine Systems, Inc.)
Site: Norwich, Chenango County
Contract Duration: 2/95 - 12/96
Key Words: transportation, product development, alternative fuels, hybrid vehicles
Project Manager: Karen Villeneuve (518) 862-1090, ext. 3275
Program: Transportation
Subprogram: Technology Development and Applications
Contract No.: 4098-ERTER-TR-95

Develop optimized flywheel rotor design for energy storage in Ford/DOE hybrid vehicle program.

BACKGROUND

Ford Motor Company is performing a five-year, $122-million, 50/50 cost-share project with the U.S. Department of Energy (U.S. DOE) to develop a variety of light-duty hybrid vehicles. In support of this effort, Ford is enlisting the help of Mechanical Technology, Incorporated (MTI) and MTI's subcontractor, Flywheel Energy Systems Incorporated (FESI), to integrate flywheels into hybrid vehicles. Batteries are a technical alternative to flywheels, but preliminary work suggests that flywheels may be cheaper, lighter, and more durable. After evaluating a wide variety of component technologies, Ford will design and build an assortment of prototype vehicles that may emerge as commercial products in the 2000-2010 time frame. This project augmented NYSERDA's efforts with MTI to develop a flywheel energy storage system (FESS) for stationary power-quality applications.

ACCOMPLISHMENTS

A design concept was developed for an FESS large enough to serve as a load-leveling device in light-duty hybrid vehicles (passenger cars and light trucks). The 2-kWh, 50-kW device employs proven materials and assembly techniques, and can be modified to meet a wide range of vehicle load profiles.

FINDINGS AND CONCLUSIONS

The final FESS design was determined to be a viable energy storage device for hybrid vehicles, however, the FESS will need to incorporate lower-cost materials if it is to be marketable, and this will require additional design work. Development of an optimized design also will require the vehicle manufacturer to further refine specifications for the hybrid vehicle's load profile. In addition, work must be done to optimize the FESS's bearings and other subsystems and to demonstrate the ability of the containment system to accommodate a worst-case accident situation.

REALIZED OR ANTICIPATED BENEFITS

This project strengthened the existing NYS technology base in flywheel systems and increased the potential for NYS firms to apply FESS designs to a variety of markets. The project also improved the likelihood that hybrid vehicles will become commercially viable and thus potentially provide significant savings in fuel consumption, operating costs, and emissions.

TECHNOLOGY TRANSFER ACTIVITIES

Commercialization of this technology is being pursued by the Contractor through continued involvement with the Ford/DOE team and through product research aimed at the stationary power-conditioning market.

FUNDING	TOTALS
NYSERDA	$179,000
U.S. DOE/Ford	224,591
MTI/FESI (in kind)	54,000
TOTALS	$457,591

Contractor: Mechanical Technology Incorporated
Site: Latham, Albany County
Contract Duration: 5/95 - 4/96
Key Words: transportation, product development, materials, air quality
Project Manager: Joe Wagner (518) 862-1090, ext. 3228
Program: Transportation
Subprogram: Technology Development and Applications
Contract No.: 4226-ERTER-ER-96

-> New York Wide-Area Information Network System (NY-WINS)

Design system to collect and disperse real-time traffic data.

BACKGROUND

Traffic congestion in urban areas results in wasted fuel, increased vehicle emissions, and travel time, traffic incidents, and driver frustration. The New York Wide-Area Information Network System (NY-WINS) will provide information to motorists through in-vehicle messages (IVM), highway advisory radio (HAR), and variable-message signs (VMS.) The system builds on electronic toll-collection technology and the TRANSMIT data-collection system already deployed in the New York City area. NY-WINS will take the technology one step further, using two-way communication to identify vehicle location and feed information back to the vehicle regarding traffic conditions. In addition, the HAR and VMS systems will be tied into the TRANSMIT system, providing accurate real-time information to all motorists.

OBJECTIVES

To: (1) provide real-time traffic information to motorists, (2) reduce traffic congestion, and (3) develop a data and communications system that could be used as a platform for a Statewide traffic-management system. Maintain compatibility with national intelligent transportation systems (ITS) standards and architecture, as well as other systems.

DESCRIPTION

The project consists of three phases: (1) design, (2) implementation, and (3) enhancement. Phase 1 includes extensive requirements analysis based on the needs of transportation agencies and commercial/private vehicle operators, as well as system design. Phase 2 consists of deployment of read/write hardware in selected demonstration vehicles, information transmission, and integration of HAR with the TRANSMIT system. Phase 3 consists of integrating VMS with the TRANSMIT system and systems enhancement as needed to improve performance. The NY-WINS program will be implemented within the existing TRANSMIT system coverage area (18 miles along the New York State Thruway and Garden State Parkway). Later phases of the project may expand the operating area, as TRANSMIT and other data-collection systems expand.

BENEFITS

Accurate, real-time information on road and traffic conditions will allow travellers to make informed choices. Fuel consumption will be reduced by 1,500 gallons per day, and travel time by 53,000 person-hours per day. Vehicle hydrocarbon emissions will be reduced by 8 percent, and carbon monoxide by 15 percent. After successfully implementing the program in this corridor, funding will be sought to expand the system locally, to other metropolitan areas in the Northeast, and to other locations already using or planning to use electronic toll collection.

SCHEDULE AND STATUS

A draft design document has been completed. The next phase of development is currently being definitized, and should be under way by August 1997.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$129,975	0	$129,975
PBQD	24,995	0	24,995
Mark IV IVHS, Inc.	20,512	0	20,512
NYS Thruway Authority	20,137	0	20,137
TOTALS	$195,619	0	$195,619

Contractor: Parsons, Brinckerhoff, Quade & Douglas (PBQD)
Site: Rockland County; Westchester County; and Bergen, NJ
Contract Duration: 3/96 - 9/97
Key Words: transportation, product development, ITS, traffic management, IVHS
Project Manager: Karen Villeneuve (518) 862-1090, ext. 3275
Program: Transportation
Subprogram: Advanced Transportation Systems
Contract No.: 4371-ERTER-TR-96

-> Automated Highway Oversize/Overweight Permitting System

Develop, demonstrate, and deploy automated highway-permitting and route-selection system.

BACKGROUND

Oversize/overweight vehicles require permits that authorize specific routes for travel. Permitting systems are unique for each state, and even for individual transportation departments or authorities within a state. In New York, the process is manually intensive and time-consuming, and has a high (approximately 15-percent) application error rate. Trucking firms waste large amounts of fuel and time each year due to both inefficient or incorrect trip routing and working within a complicated system. Some trucking firms fail to obtain permits at all due to the complexity of the process, and use unauthorized routes, sometimes causing damage to roads and bridges.

OBJECTIVES

To: (1) develop an electronic permit application and automated routing system using commercial off-the-shelf software, based on the requirements set forth by the New York State Department of Transportation (DOT) and the New York State Thruway Authority (TA), (2) deploy the system at two New York State permitting authorities, and (3) bring two permitting organizations on-line for testing.

DESCRIPTION

The contractor will: (1) analyze the permitting processes currently used by DOT and TA, and recommend one process and application format that will meet the needs of both organizations; (2) develop system requirements; (3) design and develop or customize appropriate data-processing and route-selection software; (4) deploy the systems at DOT and TA, and demonstrate system operation; and (5) develop training material and a "new user" introduction kit to expand the automated permit process to all potential users. The system will be presented to other states through the contractor's participation in the Northeast Organization of Permitting Authorities (NOOPA).

BENEFITS

Automated, accurate, and efficient routing based on road/bridge limitations, load size and type, and status of construction and maintenance will significantly reduce commercial-vehicle fuel consumption. Reducing unpermitted or improperly permitted vehicles will reduce the number of traffic incidents and road/bridge damage and provide significant energy savings from reduced congestion and maintenance and repair activities. Automating the permitting process will reduce both workload and paper use. In addition, DOT's and TA's permitting operational costs will be reduced, and New York will benefit from an improved business climate.

SCHEDULE AND STATUS

Electronic permitting systems, including the automated routing function, were deployed at DOT and TA in December 1996. The routing database will be updated with street and road information through the summer of 1997. Presentation of the system to other interested permitting authorities will begin during the winter of 1997.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$158,800	$15,000	$173,800
Lockheed Martin Federal Systems	83,900	57,400	141,300
DOT, TA, and others	74,900	8,735	83,635
TOTALS	$317,600	$81,135	$398,735

Contractor: Lockheed Martin Federal Systems, Inc.
Site: Owego, Tioga County, and Albany, Albany County
Contract Duration: 1/96 - 10/97
Key Words: transportation, product development, transportation management, transportation services
Project Manager: Karen Villeneuve (518) 862-1090, ext. 3275
Program: Transportation
Subprogram: Advanced Transportation Systems
Contract No.: 4372L-ERTER-TR-96

-> Rail-Based Wheel Gauge

Design and develop wheel-measurement system mounted on rails.

BACKGROUND

One of the most time-consuming, expensive, and error-prone components of rail-car maintenance is wheel inspection. Automation of the process in the field will reduce unscheduled down-time of rail cars, improve safety, reduce inspection cost and time, and improve the competitiveness of rail for freight operations. In addition, automatic inspection yielding safety improvements will be an enabling technology for high-speed rail.

OBJECTIVE

To: (1) develop a field prototype rail-based wheel gauge that can accurately measure wheels at speeds of 10 mph or greater, and (2) install the system at a local rail yard for field evaluation.

DESCRIPTION

The contractor will perform market research to identify system performance, form, fit, and function requirements; and will develop a system specification. The contractor will design and build prototypes for field evaluation, and make necessary changes to the system design to prepare for commercialization.

BENEFITS

By increasing the competitiveness of rail through lower costs and increased safety, more freight can be moved off the highways, reducing energy costs of moving that freight by two-thirds. Commuters switching from vehicles to rail save an average of 200 gallons of fuel annually per person. Improved wheel maintenance results in fewer train incidents and more efficient wheel re-manufacturing, lowering the energy cost of operating rail systems.

SCHEDULE AND STATUS

Only Phase 1 is authorized at this time. Laboratory evaluations are expected to be complete by August 1997. Completion of field evaluations (Phase 2) is scheduled for June 1998.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	0	$100,000	$130,898
IEM	0	62,845	62,846
Simmons Machine Tools	0	40,285	40,285
Transportation Research Board	0	28,228	28,228
TOTALS	0	$231,358	$262,257

Contractor: International Electronic Machines, Inc
Site: Albany, Albany County
Contract Duration: 2/97 - 8/97
Key Words: transportation, product development, rail, inspection
Project Manager: Karen Villeneuve (518) 862-1090, ext. 3275
Program: Transportation
Subprogram: Advanced Transportation Systems
Contract No.: 4464-ERTER-TR-97

-> Energy-Efficient Traffic Control through Wide-Area Detection and Fuzzy Logic

Develop and demonstrate traffic-control algorithm using fuzzy logic.

BACKGROUND

Estimated losses in productive staff time and wasted fuel due to traffic congestion exceed $1 billion per year for the New York City area alone. Computers and communications technologies make advanced traffic-control systems incorporating adaptive optimization possible. Fuzzy logic is a control strategy that simulates human responses to non-exact data.

ACCOMPLISHMENTS

A prototype fuzzy-logic control system was developed and field-tested.

FINDINGS AND CONCLUSIONS

The prototype control system performed better than standard control algorithms. Future implementation of the systems depends on the availability of inexpensive wide-area detection sensors.

REALIZED OR ANTICIPATED BENEFITS

Adaptive traffic control would benefit all New Yorkers by reducing traffic congestion, delays, and travel time. Significant savings in human resources, energy, and equipment wear-and-tear can result. The State also would benefit from reduced emissions from idling vehicles.

TECHNOLOGY TRANSFER ACTIVITIES

Several articles were published in technical journals. In addition, the New York City Department of Transportation was very involved in the project.

FUNDING	TOTALS
NYSERDA	$248,829
Polytechnic University	87,137
NYC Dept. of Transportation	20,000
TOTALS	$355,966

Contractor: Polytechnic University
Site: Brooklyn, Kings County
Contract Duration: 9/92 - 6/96
Key Words: transportation, university, DSM, traffic control, fuzzy logic
Project Manager: Ed Kear (518) 862-1090, ext. 3269
Program: Transportation
Subprogram: Advanced Transportation Systems, Petroleum Overcharge Program
Contract No.: 1935-EEED-POP-93

-> Real-Time Control System for Signalized Traffic-Control Networks

Develop prototype system to demonstrate real-time control strategy for multiple-intersection traffic-control networks.

BACKGROUND

Rensselaer Polytechnic Institute has been developing fully distributed, real-time traffic-signal control strategies. The most advanced of these, OFSET (On-line, Flow Sensitive Timing), is particularly well-suited for the State's small-to-medium signalized networks. A computer model of OFSET has been developed and tested.

ACCOMPLISHMENTS

A real-time control system for signalized networks was developed and demonstrated using traffic-simulation software. The control system is based on Petri-net concepts. Preliminary design and specifications for control hardware also were developed. The hardware design takes advantage of recent developments in computer communication/control technology.

FINDINGS AND CONCLUSIONS

A traffic-control system was developed for small-to-medium signalized networks. Computer simulations indicate this system would offer significant improvements in performance over current practice. The communications hardware needed to construct such a system is currently available and should become cost-competitive as the technology matures.

REALIZED OR ANTICIPATED BENEFITS

Real-time optimizing traffic-control technologies will benefit New York State by reducing transportation energy consumption, and delay and travel time. The State also will benefit through reduced emissions from unnecessarily idling vehicles.

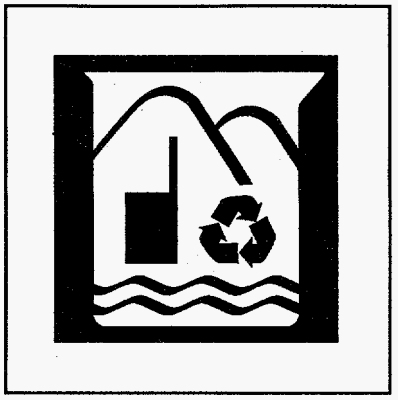
TECHNOLOGY TRANSFER ACTIVITIES

Several papers have been published in relevant technical journals.

FUNDING	TOTALS
NYSERDA Petroleum Overcharge Funds	$294,726
TOTALS	$294,726

Contractor: Rensselaer Polytechnic Institute
Site: Troy, Rensselaer County
Contract Duration: 4/93 - 6/96
Key Words: transportation, university, industry, transportation DSM, traffic control, signalized networks, real-time control
Project Manager: Ed Kear (518) 862-1090, ext. 3269
Program: Transportation
Subprograms: Advanced Transportation Systems, Petroleum Overcharge
Contract No.: 1936-EEED-POP-93

ENVIRONMENT



Benefits and Rationale

The Environment program develops and demonstrates technologies associated with waste management and pollution control. The program responds to the needs of municipalities, industries, and utilities that are end-users of technologies, and facilitates business opportunities associated with manufacturing environmental products, controlling pollution, and managing wastes to meet customer needs. Principal areas include water and wastewater treatment, solid waste, sludge and process residuals management, and air-pollution control.

Benefits accruing to communities and businesses in the State from the use of efficient waste-management and pollution-control technologies include energy savings, increased plant capacity, lower costs, improved air and water quality, diversified fuel use in the energy supply mix, and new economic development opportunities. Also, helping the State's environmental products industry to develop and commercialize innovative products will create direct economic benefits and new jobs.

Increasingly stringent federal and State standards have created the need to better manage solid wastes and sludges, treat drinking water and wastewater, and control air pollutants. New regulations can mean higher costs to municipalities, industries, utilities, and residents. However, they also can mean new business opportunities for companies that recycle and compost wastes, control pollution through performance contracting, or can develop and commercialize cost-effective technologies to meet new requirements. In addition, reliable and affordable drinking water and wastewater treatment are essential to new economic development in communities throughout the State, and many industries require clean air and water as inputs to a wide variety of processes and for boiler and cooling water requirements.

More than 400 companies in New York manufacture equipment, chemicals, and software to manage wastes or control pollution. Estimated technology needs for a variety of municipal and industrial end-users nationally will exceed several hundred billion dollars, with a global market estimated at $500 billion by the year 2010. Helping New York manufacturers improve energy efficiency and reduce the cost of their environmental products will help improve sales and create more jobs.

All methods to control air and water pollution use energy, and unit requirements tend to increase exponentially as emission standards become more stringent. Recycling, composting, and disposal of solid wastes and sludges requires energy. Consequently, energy efficiency is an important consideration when developing cost-effective technologies to manage wastes and control pollution.

Retrofitting with energy-efficient technologies often results in the ability to treat more water or air, and manage more waste or manufacture more recycled product without additional capital improvements. The 1997 Environmental Bond Act will result in the investment of several hundred million dollars in water and wastewater treatment. Innovative, energy-efficient technology will enable more communities to use these funds and enable them to pay back loans quicker because of reduced energy costs.

New York continues to face *solid-waste-management* challenges as it progresses from primary reliance on traditional landfills to a materials-management strategy based on source-separation and integrated systems. About one quarter of the 25 million tons of waste produced annually is recycled or composted, or half the State's policy goal. More than 22,000 people in about 600 companies are employed in the State's waste-collection and recycling industries. Nearly half the collected recyclable waste is shipped out of State for remanufacturing, with attendant loss of jobs and added value. About 15% of all waste generated is shipped out of State for landfilling, representing about $260 million per year that leaves the State. To maintain or increase this commercial base, retain more dollars in-State, and create more jobs, the State's municipalities and industries must increase material-collection efficiencies, lower processing costs, and produce higher-valued recycled and composted products. This will be especially important when the Fresh Kills landfill closes in 2001.

Innovative *municipal wastewater treatment* can improve energy efficiency, increase treatment capacity, and reduce costs. Some 575 facilities rely on aerobic biological processes, using approximately 3 billion kWh per year of electricity to treat the wastes. An additional 750 million Kwh per year is consumed to manage the resulting sludge.

This energy use is expected to increase due to the need to meet more stringent effluent limits, control toxics, remove nutrients, treat storm water, and control air pollution. New York municipalities are expected to spend approximately $6 billion to improve operations and reduce pollutant discharges, with accompanying substantial energy-use increases. Sludge produced from wastewater treatment also presents energy and economic challenges. Processed sludge from New York City, for example, is shipped out-of-State at a cost exceeding $100 million annually due to a limited market for sludge products in-State. Finally, many communities have inadequate or non-existent capacity to treat sewage, which limits their ability to grow and attract new economic development.

Drinking water quality is essential for public health, industrial process use, heating and cooling, and economic development. New York municipalities and industries use about 4 billion gallons of water daily. Pumping and treating this water requires about 2.5 billion kWh of electricity per year. New drinking water standards have been proposed that will require more communities to filter water, clean or replace piping, remove or prevent toxics, minimize the use of chlorine while improving disinfection for microorganisms such as giardia and cryptosporidium, and manage reservoirs to prevent algae formation and associated tastes and odors, at a capital cost that may exceed $1.2 billion per year for the next 10 years. To accomplish this, chemicals for treating water will be replaced with electrotechnologies such as ozone and ultraviolet light, with an increase in electricity use at treatment facilities.

All waste-management and combustion sources produce *air pollution.* Improving combustion efficiency can reduce many pollutants, such as carbon monoxide and particulates, as well as save fuel. More efficient, low-cost control technologies are needed to reduce acid gas, ozone precursors (nitrogen oxides and volatile organic compounds), and particulates to meet the requirements of the 1990 Clean Air Act Amendments and possibly the recently proposed small particulate matter (PM-2.5) standards. Control technologies can consume up to 9% of generated electric power. Also, coordinated national and State research efforts are required to address *environmental impacts and equitable control-cost distribution* among the states due to acid rain, mercury and other trace airborne toxics; ozone; global warming; and other cross-cutting aspects of energy production and use.

Environment program results will be of value to all utilities and consumers in a restructured, competitive environment. Municipalities and businesses can use energy-efficient environmental technology to lower taxes and operating costs, or manufacture new products, thus creating an opportunity for growth and new economic development. In addition, because environmental technology generally uses electricity, utilities will have an incentive to help transfer the results of projects to their customers. This has begun to take place already and should increase in the future.

Success in the Environment program will be measured in several ways. Saving energy, reducing costs, increasing the capacity of facilities through energy efficiency, and replication are the primary measures for end-users of environmental technology. Manufacturers of environmental products will increase both sales and jobs. Pollutant avoidance or reduction and waste reduction or disposal will be measured in tons not emitted. Environmental policy and impact projects will be qualitatively judged by the role they play in helping actual policy and law to be created.

Goals

- Promote economical use of waste and energy-efficient pollution control.
- Reduce environmental compliance costs for municipalities, industries, and utilities.
- Keep waste-management expenditures in the State.
- Assist the State's environmental-products manufacturing base in developing and commercializing new energy-efficient products.
- Maintain and improve the State's waste-management infrastructure.

-> Weight- and Volume-Based Billing for Commercial Solid-Waste Collection

Demonstrate waste-reduction impacts of billing commercial waste generators based on weight and volume.

BACKGROUND

Commercial waste-collection services in most cities currently bill based on scheduled pick-ups of the collection container. Commercial-waste customers usually are charged a fixed amount for each container, with the rate depending on container volume. These customers have an incentive to reduce their waste volume, as the lowest cost is charged for servicing the smallest number of the smallest containers. According to some pilot residential collection systems, the amount of waste discarded can be reduced when residents are billed based on the weight of discarded waste. Reducing the quantity of waste should reduce energy and other costs required to manufacture, collect, transfer, and dispose of the waste products.

OBJECTIVES

To: (1) demonstrate a system for commercial waste-collection and billing that relates the charges billed to the weight and volume of waste generated;
(2) quantify the total amount of waste-reduction that results from providing information to test customers about future changes based on weight and volume and opportunities for waste-reduction; and
(3) document the waste-reduction measures used and evaluate the program's effectiveness in reducing waste-generation, energy-use, and waste-management costs.

DESCRIPTION

Rochester will install truck-mounted equipment to weigh waste in individual containers of known volume. About 125 commercial customers will be informed about the weight and volume of their discards, the potential impact on their bills, and waste-reduction techniques. A control group also will have its waste weighed and volume recorded, but will not be informed of the weight or given technical assistance. Waste-reduction impacts will be evaluated based on data collected from these customers for a year. Results will be disseminated through a literature search, summary, technical paper, and final report.

BENEFITS

If the weight- and volume-based billing method encourages commercial businesses to institute practices that produce less waste, then significant energy benefits are possible. Demand for wasteful products will decrease, with the energy and materials used to manufacture them conserved for more marketable products. More direct benefits could be realized by reducing the energy and costs of waste-collection, transfer, and disposal. Both commercial businesses and local government would benefit from lower waste-management costs.

SCHEDULE AND STATUS

The scales have been installed and commercial routes revised for the project. Collection of waste-generation data has begun and an improved billing system is being developed.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$49,720	0	$49,720
City of Rochester	51,520	0	51,520
Eastern On-Board Scales	1,500	0	1,500
TOTALS	$102,740	0	$102,740

Contractor: City of Rochester
Site: Rochester, Monroe County
Contract Duration: 3/95 - 12/97
Key Words: environmental, assist business, transportation, solid waste, municipal, commercial
Project Manager: Tom Fiesinger (518) 862-1090, ext. 3218
Program: Environmental Research
Subprogram: Municipal Solid Wastes
Contract No.: 4135-ERTER-ER-95

-> Designing, Constructing, and Testing a Model Mercury-Recycling Facility

Recycle mercury in energy-efficient and environmentally sound manner.

BACKGROUND

Current processes to recycle mercury from batteries and other consumer and industrial products and wastes produce emissions that can cause pollution problems near the recycling plant.

OBJECTIVES

To demonstrate that a model mercury-recycling facility can be constructed and operated in a manner that is cost-effective, minimizes energy use, and meets or exceeds all applicable environmental standards.

DESCRIPTION

This project includes the design, construction, and testing of a mercury-recycling facility that will minimize stack and fugitive dust emissions, eliminate hazardous process wastewater discharges, and minimize the amount of process solid waste requiring disposal. The plant will include mercury emissions monitors, advanced air- and water-pollution control, emergency power-control equipment, heat exchangers and a cooling tower to minimize the use of natural gas and electricity, and a computer-control system to minimize both energy use and the potential for human error during plant operations. Retort condenser solids and process wastewater will be treated to remove mercury, enabling remaining water and solids to be disposed of as non-hazardous wastes. All equipment will be tested for performance and reliability, stack emissions will be measured, and an ambient air and stormwater run-off program will be tested. Energy use in virgin- and recycled-mercury processing will be evaluated. Site visits will be conducted as part of a planned technology transfer effort.

BENEFITS

A successful project will demonstrate that mercury can be recycled safely and cost-effectively. This will enable recycling of more consumer and industrial mercury-bearing wastes such as batteries, transducers, and thermometers, instead of landfilling or incinerating them.

SCHEDULE AND STATUS

The project is scheduled to be completed in the summer of 1997.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$585,000	0	$585,000
Mercury Refining Company, Inc.	1,273,000	0	1,273,000
TOTALS	$1,858,000	0	$1,858,000

Contractor: Mercury Refining Company, Inc.
Site: Colonie, Albany County
Contract Duration: 11/91 - 8/97
Key Words: environmental, assist business, industrial process, recycling, mercury, batteries, industrial, solid waste
Project Manager: Joe Visalli (518) 862-1090, ext. 3205
Programs: Environmental Research; Industrial Applications
Subprogram: Solid Waste; Industrial Process Improvements
Contract No.: 1760-ERER-MW-92; 1760-EEED-AEP-92

-> Evaluating Pulverized-Glass Sand for Environmental Applications

Test pulverized waste-glass for water-filtration and other environmental applications.

BACKGROUND

Recycling municipal solid-waste materials such as glass is expensive for local governments. When recyclable glass is collected and handled at materials-recovery facilities (MRF), significant quantities of mixed colored glass, broken into unsortable pieces, remain as a process residue. Green glass is difficult to recycle due to low market value. Recycling costs increase when municipalities lose revenues due to broken and green glass and have to pay to dispose of them. To address such problems, NYSERDA is working to improve the efficiency of waste-processing and recovery, and developing new and higher-value end-uses for recovered materials.

OBJECTIVES

To find a higher-value market for glass sand produced from marketable glass and from residue remaining after processing at a MRF, particularly to examine environmental uses, such as a filter medium for wastewater treatment. The project also will examine methods to screen or wash the pulverized glass to produce a more marketable product.

DESCRIPTION

The contractor will: (1) compile data and literature to guide test selection; (2) analyze several grades of glass-sand product; and (3) test material characteristics. Bench-scale tests will examine the capabilities of selected glass sands for removing turbidity, coliform bacteria, and parasitic cysts. The energy impact and economic feasibility of producing a marketable glass sand will be assessed. A final report will document the results.

BENEFITS

Finding a high-value market for this glass residue can reduce the quantity of waste requiring disposal. This can reduce the fuel required to transport waste to a distant landfill and reduce the cost of waste management to local governments.

SCHEDULE AND STATUS

Testing has been completed. Glass sand particle size, solubility and filtration capabilities appear promising. The final report is being completed.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$49,045	$13,070	$62,115
Andela Tool & Machine, Inc.	37,282	3,950	41,232
Syracuse University	10,830	0	10,830
Erie County Water Authority	0	8,000	8,000
Great Lakes Instruments	0	10,325	10,325
TOTALS	$97,157	$35,345	$132,502

Contractor: Syracuse University
Site: Syracuse, Onondaga County; Utica, Oneida County; Richfield Springs, Otsego County
Contract Duration: 4/95 - 8/97
Key Words: environmental, university, solid waste, municipal, product development
Project Manager: Tom Fiesinger (518) 862-1090, ext. 3218
Program: Environmental Research
Subprogram: Municipal Solid Wastes
Contract No.: 4048-ERTER-ER-95

-> Evaluating Processing Equipment and Markets for Mixed-Color Broken Glass from the Westchester County Material Recovery Facility

Test equipment for pulverizing glass residue and develop markets for resulting product.

BACKGROUND

The high costs associated with trying to increase recycling of municipal solid wastes such as glass can deter local governments that want to expand their recycling programs. When recyclable glass is collected and handled at material-recovery facilities, significant quantities of mixed-color glass are broken into unsortable pieces that remain as a process residue. Municipal recycling costs increase when revenue from broken glass is lost and municipalities have to pay for its disposal. Costs can be reduced if municipalities work with potential customers to develop uses for beneficiated mixed-color glass.

OBJECTIVES

To find better markets for pulverized glass produced from mixed-color broken glass residue, particularly to test and evaluate equipment for processing the waste glass to make these products.

DESCRIPTION

Initially Westchester County will: (1) solicit expressions of interest from processing-equipment suppliers and glass markets, including aggregate users and manufacturers of fiberglass, building products, filter media, abrasives, and surface coatings; (2) evaluate feasibility; and (3) develop test plans and requests for proposals for potential end-users and equipment testing. In the next phases of the project, the County will: (1) demonstrate the selected technologies; (2) evaluate process energy use and economic feasibility; (3) provide product samples to potential markets; and (4) include technology transfer conferences. The County also will conduct activities to transfer project findings to key stakeholders, including other communities in the State.

BENEFITS

Finding a market for mixed-color glass residue can reduce the quantity of waste requiring disposal, in turn lessening the fuel required to transport waste to a distant landfill and the cost of waste management for local governments.

SCHEDULE AND STATUS

Markets have been researched and initial processing has begun with optical sorting equipment and a glass crushing machine. A workshop was held to transfer information on the capabilities of the optical sorting system. Presentations were made at two solid waste management conferences.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$300,000	0	$300,000
Westchester County	172,015	0	172,015
TOTALS	$472,015	0	$472,015

Contractor: Westchester County
Site: Yonkers, Westchester County
Contract Duration: 6/95 - 3/98
Key Words: environmental, solid waste, product development, municipal, recycling
Project Manager: Tom Fiesinger (518) 862-1090, ext. 3218
Program: Environmental Research
Subprogram: Solid Waste Management
Contract No.: 4134-ERTER-ER-96

-> Recycling Expandable Polystyrene Foam

Test and evaluate recyclability of scrap expandable polystyrene foam.

BACKGROUND

A number of building-insulation products are made with expandable polystyrene (EPS) foam board. Energy and cost savings could be realized if scrap EPS were cleaned up sufficiently to be used as an ingredient in EPS products. However, the upgraded scrap EPS must not contain significant amounts of undesirable materials and sufficient quantities of suitable EPS scrap must be identified. Methods also need to be found for classifying different EPS scrap grades. Work is needed to ensure market acceptance at commercial-production rates. Shelter Enterprises has successfully recycled small amounts of relatively clean scrap EPS and would like to develop a system for recycling less-pure types of scrap EPS, such as those containing tapes, paper, adhesives, or metal-foil coatings.

OBJECTIVES

To evaluate the potential for collecting, processing, and mixing scrap EPS to make marketable products used in building construction and, if the process is feasible, to prepare plans to advance commercialization.

DESCRIPTION

The contractor will identify potential building products to be made from scrap EPS and potential customers for these products. Samples of scrap EPS will be tested for density, homogeneity, and degree of contamination. Sample products will be made using various percentages of scrap EPS. These products will be tested for density, homogeneity, thermal insulating properties, strength, and other important qualities. The project also will evaluate the economic potential for a 2,000-pound-per-day recycling operation and the energy, environmental, and employment impacts of successful implementation. If the products meet specifications and market approval, and the process is determined to be economically viable, a commercialization plan will be developed.

BENEFITS

This effort would increase the amount of scrap EPS recycled and sold in New York State. Initial projections are that using scrap EPS would use less than half the energy required by more expensive virgin-chemical feedstocks.

SCHEDULE AND STATUS

A proposed test plan has been developed and is being revised.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$49,875	0	$49,875
Shelter Enterprises, Inc	49,875	0	49,875
TOTALS	$99,750	0	$99,750

Contractor: Shelter Enterprises, Inc.
Site: Cohoes, Albany County
Contract Duration: 6/95 - 8/98
Key Words: product development, environmental, buildings, solid waste
Project Manager: Tom Fiesinger (518) 862-1090, ext. 3218
Program: Environmental Research
Subprogram: Solid Waste Management
Contract No.: 4160-ERTER-ER-96

-> Demonstration of a Small-Scale Repulping and De-inking System

Demonstrate 25-ton-per-day scrap paper pulping and de-inking system.

BACKGROUND

Scrap-paper processors face large fluctuations in the value of recyclable paper. If New York State's paper processors could convert recovered paper into a higher-valued product than paper bales, their economic health could be improved and they would be able to offer greater incentives to increase the quantities of paper recovered for recycling. An innovative small-scale pulping technology developed by Regenex, LLC shows economic promise for use by scrap-paper processors.

OBJECTIVE

To determine the economic feasibility of the Regenex system. Subsequent phases would involve constructing and installing the system, operating it successfully, collecting operating data for one year, and describing the system's ability to meet projections.

DESCRIPTION

The first phase will include pulping scrap-paper samples in a Regenex test facility, securing sources of scrap-paper, and ascertaining markets for the pulp product. A financial and business plan will be produced. If this plan confirms the anticipated economic benefits, the system will be constructed and monitored for its first year of operation to document its economic, energy, and environmental benefits.

BENEFITS

The primary benefit would be to increase the product value of New York State scrap-paper processors, thereby improving their economic health. The net costs of municipal paper-collection programs could be decreased if paper processors were able to pay more for paper collected. The system itself promises reduced use of energy, water, and chemicals, generation of sludge, and overall cost per ton compared to other pulping methods. This also can improve the economic health of New York paper mills that buy market pulp.

SCHEDULE AND STATUS

Paper pulping test runs have been undertaken at the Regenex factory test site. The economic feasibility analysis is expected to be completed by June 1997. If found feasible, construction would begin in August 1997, with full operation scheduled for October 1997. Monitoring and data reporting are expected to be completed in December 1998.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	0	$250,000	$250,000
Empire Recycling	0	4,891,099	4,891,099
Regenex, LLC	0	30,000	30,000
TOTALS	0	$5,171,099	$5,171,099

Contractor: Empire Recycling Corporation
Site: Utica area, Oneida County
Contract Duration: 8/96 - 12/98
Key Words: assist business, solid waste
Project Manager: Tom Fiesinger (518) 862-1090, ext. 3218
Program: Environmental Research
Subprogram: Municipal Wastes
Contract No.: 4449-ERTER-ER-97

-> Interim Storage of Recyclable Materials

Determine how different storage options affect recyclability of waste materials.

BACKGROUND

New York State's Solid Waste Management Act of 1988 mandates that every municipality adopt a law requiring recycling of materials for which recycling markets exist. However, the supply of recyclables increases more quickly than market demand, reducing the value of the recyclables, and raising the cost of recycling to a point where it becomes infeasible. Finding inexpensive but effective ways to store recyclables until they are needed would help ensure that the cost of recycling does not exceed the cost of disposal.

OBJECTIVE

To store covered and uncovered bales of recyclables and determine maximum allowable storage periods and determine how extended storage affects the quality of recycled materials.

DESCRIPTION

A plan for a storage facility was developed using literature searches and experts knowledgeable in the end-uses of recyclable materials. Materials such as rubber, plastics, and paper for recycling and other uses are being stored for varying durations using different techniques to determine optimum storage conditions. The contractor will: (1) monitor emissions from the various storage-facility types to measure the odors or leachates generated; (2) monitor product quality; (3) test the product quality over time to determine any adverse effects of different storage techniques; (4) conduct tours and give presentations to various industry associations; (5) produce a video to distribute to other New York State municipalities; and (6) investigate various energy benefits and costs of selected storage techniques, and how these techniques generally affect the energy balance of the recycling process. The investigation will focus on paper and plastics, materials for which strong markets currently do not exist, as well as materials that are currently recycled but are subject to normal business cycles and price fluctuations.

BENEFITS

Balancing the supply and demand of the recycling market will help municipal planners accurately estimate costs/revenues. Municipalities will be able to market recyclables when revenues exceed landfilling costs.

SCHEDULE AND STATUS

The facility is operating and will be monitored for two years. The final report is due in December 1997.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$304,496	0	$304,496
Oswego County	101,499	0	101,499
TOTALS	$405,995	0	$405,995

Contractor: Oswego County Department of Public Works, DSW
Site: Bristol Hill Landfill, Town of Volney, Oswego County
Contract Duration: 4/92 - 12/97
Key Words: environmental, solid waste, municipal, recycling, landfill
Project Manager: Jim Reis (518) 862-1090, ext. 3251
Program: Environmental Research
Subprogram: Municipal Solid Wastes
Contract No.: 1926-ERER-MW-93

-> Used Oil-Filter Recycling Program in Erie County

Demonstrate oil-filter crushing and marketing.

BACKGROUND

This program's goal is to educate generators of and potential customers for used-oil filters. Erie County will use the information and data gathered about oil-filter collection and processing to encourage service stations and vehicle-maintenance garages to adopt a recycling strategy that reduces waste in New York State and demonstrates energy savings.

OBJECTIVES

To: (1) develop and demonstrate a used oil-filter-recycling process; (2) develop a market for collected filters; (3) quantify the costs and efficiency of the process; and (4) determine the energy benefits and cost impacts to both used-oil-filter generators and scrap-metal processors in New York State.

DESCRIPTION

Erie County will establish a pilot program to collect, crush, and market oil filters from businesses such as local vehicle-service stations and fleet-maintenance garages. The project will test and evaluate the ability of an oil-filter crusher to remove oil from the filter according to specifications established by the steel industry. Also, the researchers will determine the crusher's labor requirements, waste-reduction impacts, energy use, potential environmental impact, and economic viability. Surveys will: (1) determine current oil-filter disposal practices of vehicle-service and maintenance businesses; (2) develop an inventory of facilities accepting oil filters for materials recycling, including acceptance criteria; and (3) identify available crushing and cleaning devices. Survey results will be used to: (1) solicit participation in the program, (2) assess specifications that processed filters should meet, (3) identify potential barriers to the program, and (4) identify a steel mill or foundry that will accept the crushed materials for recycling. A database will be developed to aid Erie County in managing survey results. The cost of transporting filters will be assessed. Whole-filter disposal options will be evaluated and compared to filter-processing. Filter components will be analyzed chemically for heavy metals and other regulated compounds.

BENEFITS

Programs that recycle used oil and filters can keep free-flowing oil out of New York State's municipal landfills; avoid groundwater contamination, and the costs and energy use associated with remediation; and avoid unnecessary and costly disposal in hazardous-waste landfills. Each year, some 49 million automotive oil filters are generated Statewide; however, few are recycled. Potentially, 3.5 million gallons of used oil and 37 million pounds of high-quality steel could be recycled.

SCHEDULE AND STATUS

Filter generators were surveyed and markets located. A contractor was retained to collect used-oil filters and to crush them for marketing. The final report is being completed.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$113,321	0	$113,321
Petroleum Overcharge Funds	60,000	0	60,000
Erie County	57,774	0	57,774
TOTALS	$231,095	0	$231,095

Contractor: Erie County
Site: Erie County
Contract Duration: 10/92 - 8/97
Key Words: environmental, solid waste, oil, municipal, recycling, oil filters, collection
Project Manager: Tom Fiesinger (518) 862-1090, ext. 3218
Program: Environmental Research
Subprogram: Municipal Solid Wastes
Contract No.: 1976-ERER-MW-92

-> Develop and Commercialize a Waste-Fuel Burner Unit

Design and build feed mechanism and burner system to dispose of waste-oil residuals in rotary kiln.

BACKGROUND

The waste-oil residual from oil-storage-tank cleaning and waste-oil storage is a solid material and is difficult to manage due to its ignitability and its sandy, gritty nature. Therefore, most waste-oil residual is landfilled at a very high cost to industry. Finding a way to feed this material effectively as fuel in a rotary kiln, paper mill, or cement plant would reduce costs to these operations and save fossil fuels. Using this material as fuel in lieu of disposing of it also would save landfill space.

OBJECTIVE

To construct a solid-fuel feed system and modify the burner system in a rotary kiln to facilitate using waste-oil residual as an auxiliary fuel source.

DESCRIPTION

The contractor will: (1) design, install, and demonstrate an innovative feed system and waste-fuel burner system in a rotary kiln; (2) process and condition the waste-oil residual to enhance handling characteristics and then mix it with fuel oil; (3) feed the mixture into a kiln using a screw-feeder system with a motive fluid eductor; and test the system to determine cost-effectiveness and energy savings; (4) determine the amount of waste-oil residual burned the fossil-fuel saved; (5) monitor system performance and compare it to other alternatives; (6) evaluate and note operational difficulties over time; (7) conduct a market study to determine the volume of waste-oil residual available for fuel use and its regional availability; (8) determine the number of rotary kilns or fluidized-bed units currently in use that could take advantage of the technology; and (9) determine which New York State parts suppliers could build the systems.

BENEFITS

The project will lower costs for businesses in New York that either produce waste fuel or use low-grade fuel in production. This system could replace up to 10 percent of the fuel used in rotary kilns. Any non-combustible inerts or heavy metals in the residual will be bound up and incorporated into the final product, protecting the environment from possible impacts that would be associated with disposal of the residual. The feed system is expected to be able to handle various types of solid fuel, thereby increasing the potential for replacing virgin fuel with other types of solid-waste fuel. This project could reduce operating costs at the Norlite Company and make this currently marginal business more cost-competitive, thus saving 80-100 jobs.

SCHEDULE AND STATUS

The feed system has been installed and will be tested in June 1997. The final report is due in October 1997.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	0	$57,284	$57,284
Consulting Engineering Associates	0	57,284	57,284
TOTALS	0	$114,568	$114,568

Contractor: Consulting Engineering Associates
Site: Norlite Company, Cohoes, Albany County
Contract Duration: 7/96-10/97
Key Words: product development, environmental, industrial waste
Project Manager: Jim Reis (518) 862-1090, ext. 3251
Program: Environmental Research
Subprogram: Solid Waste Management
Contract No.: 4447-ERTER-ER-97

-> Backyard Composting Waste-Reduction Demonstration and Evaluation

Demonstrate waste reduction through residential on-site composting.

BACKGROUND
This program's goal is to demonstrate the extent to which source-separation, recycling, and backyard composting can reduce the amount of material needing to be landfilled.

OBJECTIVE
To demonstrate and economically evaluate backyard compost as a way to reduce the quantities of food waste and yard clippings entering the municipal waste stream.

DESCRIPTION
The contractor will: (1) conduct a pilot study to determine the benefits of backyard composting to reduce yard wastes as well as food and paper wastes, (2) enlist 40-60 volunteers who will weigh and keep records on the generation of at least four categories of wastes in addition to their compost, (3) enlist an additional 100-150 participants to record compost data only, (4) verify the weight and volume measurements of various fractions of solid waste made by householders, and (5) estimate potential energy and economic benefits based on the percentage of waste reduced and fuel savings.

BENEFITS
Widespread implementation of these innovations could reduce New York State's waste streams and the energy used to produce and manage them. Waste reduction can conserve energy equal to about four million barrels of oil annually. If successful, this backyard composting demonstration will reduce the collection of yard and food wastes in mostly rural and suburban Orange County by about six percent (12,000 tons/year), assuming 50 percent of those wastes can be recycled.

SCHEDULE AND STATUS
The draft final report is being reviewed.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$155,778	0	$155,778
Orange County	52,075	0	52,075
TOTALS	$207,853	0	$207,853

Contractor: Orange County
Site: Orange County (multiple sites)
Contract Duration: 10/92 - 6/97
Key Words: environmental, municipal, compost, yard waste, waste reduction, solid waste
Project Manager: Barry Liebowitz (518) 862-1090, ext. 3248
Program: Environmental Research
Subprogram: Municipal Solid Wastes
Contract No.: 1980-ERER-MW-92

-> Controlling Odors and Stabilizing Waste in Composting Systems through Process Design, Analysis, and Monitoring

Develop better engineering-design models and monitoring and process-control strategies to reduce odor and accelerate compost stabilization.

BACKGROUND

Converting the organic fraction of municipal solid waste (MSW) to a usable product in an economical and environmentally acceptable manner is preferable to disposal. About 63 percent of the paper, paperboard, yard , and food waste in New York State not burned in waste-to-energy facilities, or 11.5 million tons per year, is compostable. Sewage sludge, septage, food processing, and brewery and winery waste solids and sludges increase the compostable amount to about 14 million tons per year. Barriers to increased use of composting include large energy and space requirements, odors, and a minimum 50-day compost/curing period.

OBJECTIVES

To develop better engineering-design models, and operational and process-control strategies for composting that reduce odor, increase process throughput, and increase compost-product stability.

DESCRIPTION

The contractor will: (1) conduct bench- and pilot-scale experiments to determine the kinetics of waste composting using sewage sludge and a solid-waste mixture of known nutrient content; (2) during kinetics experiments monitor the evolution of odorous gases, and postulated antecedent-odor gases including: carbon dioxide, carbon monoxide, hydrogen, methane, oxygen, nitric oxide, and low-molecular-weight odorous compounds; (3) develop a compost-process model based on biological kinetics, and heat- and mass-transfer considerations appropriate for aerated static-pile and agitated beds; (4) conduct experiments to determine effects of moisture content, temperature, and nutrients on compost stability; (5) conduct compost-drying experiments and determine energy requirements; (6) evaluate the costs and benefits of moisture addition, heating and drying compost from a system perspective; and (7) hold periodic meetings with a Technical Advisory Committee (TAC) comprising technology providers, end-users, and appropriate members of the scientific community.

BENEFITS

Better engineering knowledge of process design, monitoring, and factors affecting compost stability will improve compost economics, reduce energy needs, and mitigate environmental impacts.

SCHEDULE AND STATUS

The experimental work is complete and work on a cost/benefit analysis is under way.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$350,000	0	$350,000
Cornell-WMI	100,000	0	100,000
Niagara Mohawk Gas	109,000	0	109,000
New York State Electric & Gas Corp.	109,000	0	109,000
Rochester Gas and Electric Corp.	50,000	0	50,000
Cornell University	123,584	0	123,584
Empire State Development	99,459	0	99,459
TOTALS	$941,043	0	$941,043

Contractor: Cornell University
Site: Ithaca, Tompkins County
Contract Duration: 6/93 - 6/97
Key Words: environmental, municipal solid waste, composting, drying, modeling, kinetics
Project Manager: Barry Liebowitz (518) 862-1090, ext. 3248
Program: Environmental Research
Subprogram: Municipal Wastewater & Sludge
Contract No.: 3027M-ERER-MW-94

-> Commercialization of In-Vessel Organic Waste Composting

Demonstrate use of in-vessel organic-waste-composting facility.

BACKGROUND

Two thousand tons of solid waste are produced in the six-county Capital Region each day. Local disposal facilities are limited to the Albany and Colonie Landfills and the Adirondack Resource Recovery Facility, all of which are at capacity. Waste not going to these facilities must be shipped out of the area, along with $50-$65/ton of Capital Region revenue. The potential for a new landfill or waste-to-energy facility in the area is low; therefore, a local solid-waste-composting facility, in lieu of a disposal facility, may be an acceptable solution for some of the waste generated. Past attempts at operating a composting facility have failed due to high costs and odor problems. The proposed system would be in-vessel and use an energy-saving bio-filter system to control odors. This system is expected to be the lowest-cost system built to date.

OBJECTIVE

To construct and demonstrate an in-vessel source-separated organic-waste-composting system to be produced by New York State suppliers and manufacturers that will process a large portion of the waste stream into a salable, high-quality compost, (2) develop and sustain a feed source of organic waste and develop markets for the final compost, and (3) analyze the system and determine its energy, economic, and environmental benefits.

DESCRIPTION

The contractor will: (1) build a 50-ton-per-day (tpd) modular in-vessel composting facility to process organic waste from Capital Region supermarkets, restaurants, and institutions, using New York State suppliers and manufacturers to construct the system; (2) process the residual compost further into a soil amendment and fertilizer to be sold locally; (3) determine the costs and benefits of full-scale operation; and (4) determine the amounts of materials removed from the waste stream and beneficial compost produced, and the energy saved. A system to collect source-separated organic waste and education of haulers and waste producers is included in the project. This technology minimizes energy requirements for air-emission control, which can account for as much as 60 percent of the total energy costs for enclosed compost facilities. The initial system will have the potential to grow with an increased waste flow and residuals market and, if successful, will help commercialize the technology, increasing sales for Tougher Industries, Inc. of Menands.

BENEFITS

Energy for transporting waste out of the area will be saved. Less truck traffic will reduce emissions and impacts on highways. Innovative odor-control facilities will reduce energy use by as much as 35 percent. Disposal dollars that would have gone to out-of-State facilities will remain in the area. Six jobs will be created to run the facility and eight jobs will be created at Tougher Industries. Because the systems are modular, additional capacity can be added easily as waste flows increase. Measures of the project's success will include the number of New York State businesses that contribute to the project, reduction in waste to be disposed of out of State, energy saved, and the production of a marketable product.

SCHEDULE AND STATUS

The system will be constructed in the summer of 1997. Evaluation will continue until spring 1998.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	0	$250,000	$250,000
Capital Compost	0	2,750,000	2,750,000
TOTALS	0	$3,000,000	$3,000,000

Contractor: Capital Compost and Waste Reduction Services
Site: Menands, Albany County
Contract Duration: 7/96-5/98
Key Words: product development, environmental, solid waste
Project Manager: Jim Reis (518) 862-1090, ext. 3251
Program: Environmental Research
Subprogram: Solid Waste Management
Contract No.: 4451-ERTER-ER-97

-> Commercial Waste-Reduction Program

Demonstrate waste reduction through on-site audits of commercial enterprises.

BACKGROUND
This program's goal is to reduce waste production in New York State.

OBJECTIVES
To characterize the waste in each general business type, develop methods to reduce it, and assess the program's impact.

DESCRIPTION
Tompkins County will conduct a pilot study in cooperation with Cornell Waste Management Institute, Cornell Cooperative Extension, and Recourse Systems, Inc., to reduce commercial wastes through audits targeted at three main business sectors. The study will audit four percent of the County's businesses as follows: nine hotels/restaurants, 25 retail stores, and six financial/insurance businesses, totalling 40 audits. The people who will perform the audits will be trained by Recourse Systems. A slide show will be prepared. Technology transfer by Cornell Cooperative Extension will include manuals and workshops. For each business type, two sites will have demonstration audits, with wastes measured by category before and after the audit. In addition, businesses will be surveyed to determine the effectiveness of the technology-transfer efforts.

BENEFITS
Businesses in Tompkins County, as in the rest of New York State, generate approximately one-third of the total waste stream. If successful, this commercial-audit demonstration will reduce waste-collection in Tompkins County by about 17 percent, assuming 50 percent of the commercial wastes can be recycled.

Widespread implementation of these innovations could reduce New York State's waste streams and the energy used to produce and manage them. Waste reduction can conserve energy equal to about four million barrels of oil annually.

SCHEDULE AND STATUS
Waste audits and sorts have been completed. The workbook for waste assessments has been prepared and the final report is being completed.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$161,176	0	$161,176
Tompkins County	72,147	0	72,147
TOTALS	$233,323	0	$233,323

Contractor: Tompkins County
Site: Tompkins County (multiple sites)
Contract Duration: 11/92 - 8/97
Key Words: assist business, environmental, solid waste, municipal, commercial, waste reduction, audit
Project Manager: Tom Fiesinger (518) 862-1090, ext. 3218
Program: Environmental Research
Subprogram: Municipal Solid Wastes
Contract No.: 2026-ERER-MSW-92

-> Secondary Materials Development Program at SUNY/Stony Brook -- Demonstration and Technology Transfer of Marine Use of Plastic Lumber

Demonstrate use of recycled plastic in marine pier construction.

BACKGROUND

The Secondary Materials Development Program at SUNY/Stony Brook concluded that plastic lumber made from recycled plastic has potential for marine and highway applications. A program report noted that "New products such as plastic lumber... will not reduce the waste stream unless the public accepts them. Demonstration programs for testing and displaying the utility of secondary materials are needed."

OBJECTIVES

To demonstrate and evaluate marine applications of plastic lumber and to disseminate information about its effectiveness.

DESCRIPTION

The contractor will contact data sources for information about plastic lumber and other structural materials used for marine construction. A small pier will be built with lumber made from recycled plastic. A monitoring, testing, and evaluation program will be developed. Engineering properties will be measured over time. A plastic lumber bulkhead also will be installed in a freshwater pond, allowing for a comparison of properties in two water environments. Potential markets will be assessed. The project will examine the potential for conserving energy compared to other alternatives for disposal or recycling of the plastic waste. Project results will be disseminated through tours of the pier, a conference presentation, a journal paper, and the final technical report.

BENEFITS

Successful demonstration of this structural marine use for recycled plastic lumber would help develop a sustained New York State market.

SCHEDULE AND STATUS

The plastic lumber has been manufactured and used to construct the dock and bulkhead. Testing of the lumber has begun.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA			
Petroleum Overcharge Funds	$99,973	0	$99,973
SUNY/Stony Brook	52,902	0	52,902
TriMax of Long Island, Inc.	40,000	0	40,000
TOTALS	$192,875	0	$192,875

Contractor: State University of New York/Stony Brook,
Site: West Meadow Creek, Mill Pond, and Marine Sciences Research Center, Town of Brookhaven, Suffolk County
Contract Duration: 7/95 - 9/97
Key Words: environmental, solid waste, materials
Project Manager: Tom Fiesinger (518) 862-1090, ext. 3218
Program: Environmental Research
Subprogram: Municipal Solid Wastes
Contract No.: 4240-ERTER-POP-96

-> Evaluation of Establishing a Bottle Re-Use Business in New York State

Assess feasibility of collecting, washing, and marketing used wine bottles.

BACKGROUND
The amount of green glass in the waste stream could be reduced if whole wine bottles could be successfully recovered, washed, and re-used. Diamond Beverages, LTD, a soft drink company in Canada, has some experience washing wine bottles in Ontario and is considering expanding its operations into New York State.

OBJECTIVE
To find a higher-value market for used wine bottles than aggregate or other products made by crushing recovered green glass.

DESCRIPTION
The contractor will: (1) evaluate collection methods, (2) evaluate feasibility of the business opportunity, (3) prepare documentation to convince bottle sources to participate, and (4) develop a business plan for demonstrating and evaluating the first washing facility. Potential sources of used wine bottles, such as hotels and restaurants, will be contacted to determine their willingness to store bottles for collection and re-use. The costs of different recovery methods will be estimated. New York State wineries will be contacted to determine their requirements for purchasing washed bottles. The contractor will examine the factors used to estimate the feasibility of the overall re-use system and will prepare a business plan for the demonstration phase of this effort. The energy impact of the re-use system will be assessed.

BENEFITS
Re-using wine bottles could reduce solid waste generation, management costs, and energy requirements. Less energy would be needed to wash and re-use bottles than to make new bottles. The reduced energy requirements and other cost savings could be passed on to New York State's wine industry, thus making it more competitive.

SCHEDULE AND STATUS
Initial arrangements have been made for bottle collection and for marketing the washed bottles. A proposal has been completed for a demonstration facility in New York State.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$11,410	0	$11,410
Diamond Beverages, LTD.	11,410	0	11,410
TOTALS	$22,820	0	$22,820

Contractor: Diamond Beverages, LTD
Site: Hamilton, Ontario, Canada
Contract Duration: 11/95 - 7/97
Key Words: environmental, solid waste
Project Manager: Tom Fiesinger (518) 862-1090, ext. 3218
Program: Environmental Research
Subprogram: Solid Waste Management
Contract No.: 4249-ERTER-ER-96

-> Demonstrating Uses for Processed Waste Gypsum

Research and demonstrate energy-saving uses for waste gypsum recovered from used drywall.

BACKGROUND

New York State produces about 3.4 million tons of construction and demolition debris each year. Almost three percent, or 92,000 tons, is waste drywall from new construction and renovations; building a 2000-square-foot house produces 1.5 tons of waste drywall. Also, the drywall-manufacturing business must dispose of up to two million tons of off-specification drywall annually. Transporting this material to a landfill for disposal requires more than 75 billion Btu of energy. Decaying drywall in landfills produces hydrogen-sulfide gas, a nuisance and health hazard to those living nearby.

Gypsum from waste drywall may have several energy-saving and environmental applications that would preclude having to transport it to a landfill for disposal. Potential uses include reducing the energy needed for wastewater and paper-mill sludge-drying, sludge-dewatering, fertilizer additive, sewage- and water-treatment plant clarifiers, compost enhancer, and odor control for sludge and liquid waste.

OBJECTIVE

To develop several new uses for recycled gypsum that would otherwise be landfilled, and manufacture salable products from the gypsum.

DESCRIPTION

This project will: (1) assemble a panel of researchers to determine which uses of processed gypsum are most likely to result in a salable product; (2) formulate a research plan that will test the most appropriate applications for processed gypsum; (3) test the selected end-uses in the various research experiments; (4) determine which experiments are successful; and (5) manufacture and market the new products when they are developed.

BENEFITS

Finding uses for waste drywall will reduce the need to landfill it and avoid associated transportation and disposal costs and environmental impacts. Successfully developing new products for sludge-drying, composting, and odor control could save some of the energy these processes use. New products made from a waste material will displace raw materials currently used in manufacturing and add manufacturing capability to the New York State economy. Due to the large amount of waste gypsum available, the contractor should be able to commercialize several useful end-products.

SCHEDULE AND STATUS

The research plan has been approved and is being implemented. Field work will continue through the summer of 1997.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$95,050	0	$95,050
Gyp-Pack Container, Inc. (in-kind)	95,050	0	95,050
TOTALS	$190,100	0	$190,100

Contractor: Gyp-Pack Container, Inc.
Site: Tonawanda, Erie County
Contract Duration: 5/95 - 10/97
Key Words: environmental, product development, solid waste
Project Manager: Jim Reis (518) 862-1090, ext. 3251
Program: Environmental Research
Subprogram: Municipal Wastes
Contract No.: 4127-ERTER-MW-95

-> Collecting, Processing, and Marketing Non-Traditional Recyclables

Develop methods for collecting, processing, and marketing "hard to recycle" materials.

BACKGROUND

New York State's municipalities want to recover more recyclable and reusable materials from the waste stream. Most municipalities recycle glass, paper, and plastic because there are markets for these items. Recycling these materials, however, has reduced the waste stream less than 20 percent; for most municipalities, the reduction has been less than 10 percent. To increase these percentages, source-separation of more materials is required and more end-uses and markets for the materials removed from the waste stream must be found. Monroe County will implement a source-separation project aimed at some of these hard-to-recycle materials.

OBJECTIVE

To increase recycling rates for municipalities by adding several items to the curb-side pick-up program.

DESCRIPTION

The contractor will increase recycling rates by: (1) adding mixed paper, junk mail, telephone books, boxboard, textiles, and other materials to the curb-side recycling program; (2) determining the most energy-efficient, cost-effective ways to collect and process materials; (3) investigating markets and end-uses that will accept and use the recyclable materials; and (4) developing three ways to add hard-to-recycle items to the collection plan. The project tasks include consumer surveys to determine collection preferences, public education, developing markets with Empire State Development and implementing a demonstration project. Monroe County will coordinate this effort with surrounding counties to maximize the program's effectiveness and combine resources for economies of scale and increased material sales.

BENEFITS

Data collected will be applicable to New York State municipalities and other states. Efficient methods for separating, collecting, and processing these materials will save landfill space, save energy in manufacturing processes, and cut the energy required to collect and transport the materials. New markets will improve the cost-effectiveness of recycling and save energy and raw materials that otherwise would be used to manufacture new materials.

SCHEDULE AND STATUS

The data collection phase of the project is complete. The final report will be submitted in May for review and published in the summer of 1997.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$245,125	0	$245,125
Monroe County	264,675	0	264,675
TOTALS	$509,800	0	$509,800

Contractor: Monroe County Department of Environmental Services
Site: Monroe County Recycling Center, Rochester, Monroe County
Contract Duration: 3/94 - 8/97
Key Words: environmental, municipal, solid waste
Project Manager: Jim Reis (518) 862-1090, ext. 3251
Program: Environmental Research
Subprogram: Municipal Solid Wastes
Contract No.: 3134L-ERER-MW-94

-> Brooklyn Union Gas Pavement-Recycling Truck

Test pavement-recycling truck for restoring utility-line-repair openings.

BACKGROUND

While repairing utility gas lines, Brooklyn Union excavates and backfills 30,000 pavement openings each year. Broken pavement and soil from around the gas line must be removed from the site for disposal. New materials are brought to the site to backfill the opening. After the soil has settled, the repair crew returns to the site, removes the top layer of soil, and places the required pavement-base and top-wearing courses to restore the pavement to its pre-excavation level. This process may require three trips to the site, disrupting traffic flow; using excess fuel, soil, and pavement materials; and inconveniencing motorists.

OBJECTIVE

To determine the effectiveness of a pavement-recycling truck that processes excavated soil and pavement into new backfill and pavement to repair openings in one process.

DESCRIPTION

Brooklyn Union will evaluate the use of excavated soil and pavement to make flowable slurry, cement-treated soil, portland-cement concrete, rammer-compacted concrete, and recycled soil for use as backfill. The contractor will: (1) apply these materials to 1,050 restoration openings using a recycling truck that will process the different mixes on board and apply them to the repair immediately; (2) evaluate the restoration techniques both separately and in various combinations to establish the best restoration techniques; (3) compare the results to conventional site-restoration techniques; and (4) analyze the energy, environmental, and economic impacts of using the newly developed techniques.

BENEFITS

Recycling excavated materials at the source has definite environmental and economic benefits. In large urban areas across the United States, as landfill availability decreases, there is an urgent need to extend landfill lives by reducing the amount of waste disposed of in them. Further, the need to conserve scarce natural resources puts a premium on recycling. For soil- and source-reduction, reusing excavated materials offers a significant environmental contribution. Implementing this project will preclude the need to dispose of more than 650,000 cubic yards per year of material in Brooklyn Union's service area alone. An equal volume of new backfill materials will be saved, as will the fuel needed to transport these materials to and from the restoration site. Delays and traffic jams that occur during restoration, which add to vehicle-idling time, will be reduced by 10 to 15 percent, cutting vehicle-fuel use and emissions.

SCHEDULE AND STATUS

This project began in October 1994 with a planning effort that outlined the boundaries of the study area. Pavement-restoration activities were conducted for a six-month period, after which it was determined that redesign was needed to facilitate using such a vehicle in the urban environment. The vehicle will be modified per Brooklyn Union specifications and retested on various types of pavement restorations. Monitoring the quality and performance of the restorations will continue through October 1997.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$338,000	0	$338,000
Brooklyn Union	338,000	0	338,000
TOTALS	$676,000	0	$676,000

Contractor: Brooklyn Union
Site: Brooklyn, Kings County (multiple sites)
Contract Duration: 10/94 - 10/97
Key Words: environmental, utilities, industrial, recycling, product development
Project Managers: Jim Reis and Adele Ferranti (518) 862-1090, exts. 3251 and 3206
Programs: Environmental Research; Industry and Applications
Subprograms: Municipal Wastes; Industrial Waste Minimization
Contract No.: 4092L-ERTER-ER-96

-> Waste Reduction/Food-Waste Composting at Rikers Island.

Design, construct, and demonstrate an institutional-scale food-waste-composting system using products on site and marketing surplus product off site.

BACKGROUND

Waste diversion to an on-site compost system using on-site compost cuts down on the energy that otherwise would be used to transport waste to landfills or other waste treatment/disposal facilities. Composting converts organic waste to a usable product, removing material that otherwise would enter the municipal solid waste (MSW) stream. The process is recognized in Part 360 of the New York State Department of Environmental Conservation's (DEC) solid waste regulations as a waste-management practice with a product having beneficial-use characteristics. To the extent the compost can be used on site, it is analogous to other on-site waste-reduction measures such as backyard composting and mulching mowers. Currently, the New York City Department of Sanitation (DOS) disposes of wastes generated at Rikers Island Correctional Facility at the Fresh Kills landfill.

OBJECTIVES

To demonstrate food-waste composting and compost use on an institutional scale at a minimum of 10 tons per day.

DESCRIPTION

The contractor will (1) assess food-waste-composting technology; (2) assist DOS in developing plans and specifications for a minimum 10-ton-per-day food-waste-composting facility for Rikers Island; (3) construct, operate, and test the facility; (4) determine the effect of composting food waste and site-generated bulking agents on reducing wastes needing disposal; (5) develop material-handling plans to maximize the material to be composted and ensure satisfactory operation; (6) develop a facility-monitoring plan; (7) ascertain the amount of energy used; and (8) assist DOS in marketing the compost products on and off site.

BENEFITS

The project will provide DOS and others with demonstration and operating data for a small-scale enclosed composting system. These data will be used to determine the energy, economic, and environmental benefits of on-site, institutional-scale composting as a solid waste management method. Wastes sent to Fresh Kills will be reduced by 10 to 20 tons per day. This demonstration will provide a basis for making future decisions about composting as a partial means of dealing with NYC solid wastes if Fresh Kills landfill is closed.

SCHEDULE AND STATUS

Items completed to date include compost technology review and selection, conceptual and detailed design, and development of a material-handling plan, with attention to source separation. Construction was completed in August 1996 after significant delays in the design phase. Biofilter media was replaced and work is under way to improve operation. The demonstration phase will continue through October 1997.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$181,404	0	$181,404
NYC Dept. of Sanitation	130,000	$5,234,700*	5,364,700
NYC Dept. of Corrections**	30,000	0	30,000
TOTALS	$341,404	$5,234,700	$5,576,104

* includes $5,000,000 toward construction

** in-kind services

Contractor: Tellus Institute
Site: Rikers Island, Bronx County
Contract Duration: 12/92 - 12/97
Key Words: environmental, municipal, solid waste, composting, waste reduction, land application
Project Manager: Barry Liebowitz (518) 862-1090, ext. 3248
Program: Environmental Research
Subprogram: Solid Waste Management
Contract No.: 2004-ERER-MSW-93

-> Waste Reduction at the Oneida-Herkimer Materials Recovery Facility

Demonstrate and evaluate technologies for waste reduction at a materials-recovery facility.

BACKGROUND

Waste reduction has first priority in the hierarchy of integrated solid-waste-management systems called for by New York State's Solid Waste Management Plan. Better information is needed about how waste-reduction methods can reduce the energy, environmental, and economic costs of solid-waste management. Municipalities operating materials-recovery facilities (MRF) could benefit from a thorough evaluation of equipment that can increase recovery of materials for marketing and reduce process residues that must be disposed of.

OBJECTIVES

To demonstrate and evaluate the energy-conservation potential of improving a MRF's operation to reduce process residue, and to transfer the results to other MRF operators in New York State.

DESCRIPTION

Equipment to be evaluated includes a glass pulverizer and garbage-bag opener. The contractor will: (1) characterize the composition of the residue, (2) install equipment that can reduce the residue in a cost-effective way, (3) monitor the energy use of the MRF, (4) evaluate the energy impacts of using the new equipment, and (5) transfer information to other New York State MRF operators.

BENEFITS

Implementing waste reduction to the degree recommended in the State Solid Waste Management Plan has the potential to conserve several million barrels of oil each year. By documenting the effectiveness of waste-reduction equipment for MRF operations and by evaluating the energy, environmental, and economic costs and benefits of the equipment, this project will provide information to enable municipalities and solid-waste managers to implement cost-effective waste-reduction programs. Information on energy use also will help operators identify opportunities for energy conservation.

SCHEDULE AND STATUS

The contractor has been evaluating different equipment for reducing residue quantities. The glass pulverizer was installed and used to produce glass aggregate for an asphalt paving contract. The pulverizer was removed to make room for recycling additional material and long-term plans for this equipment are being reevaluated.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$103,567	0	$103,567
Oneida-Herkimer Solid Waste Authority	51,783	0	51,783
TOTALS	$155,350	0	$155,350

Contractor: Oneida-Herkimer Solid Waste Authority
Site: Utica, Oneida County
Contract Duration: 12/92 - 12/97
Key Words: environmental, municipal, solid waste, waste reduction, recycling
Project Manager: Tom Fiesinger (518) 862-1090, ext. 3218
Program: Environmental Research
Subprogram: Municipal Solid Wastes
Contract No.: 1950-ERER-MSW-93

-> Eastern Rensselaer County Community Warehouse

Manage used and salvageable materials and construction and demolition debris at a pilot community warehouse.

BACKGROUND

Landfills and transfer stations are depositories for large amounts of salvageable materials and construction and demolition debris, much of which is reusable. Building contractors with leftover and usable materials at construction or demolition sites, and business owners and homeowners discarding furniture, computers, etc., often find it too expensive or inconvenient to salvage these materials, and often simply dispose of them. Adding these materials to landfills, especially in large quantities, is expensive, takes up valuable landfill space, and is detrimental to the environment. One solution would be to develop a program to collect, warehouse, organize, refurbish (if necessary), and donate or sell these materials to needy groups or individuals. The Eastern Rensselaer County Solid Waste Management Authority in conjunction with NYSERDA, Winnett & Associates, Energy Answers Corporation, and Rensselaer County, will investigate managing these materials by piloting a community warehouse.

OBJECTIVE

To develop and operate a community warehouse, financed by materials sales, using volunteer, student, and workfare labor.

DESCRIPTION

This two-year pilot project will: (1) investigate managing used, salvageable items from landfills, transfer stations, building sites, homes, businesses, and drop-off sites; (2) explore the cost-effectiveness of retrieving usable items (doors, windows, moldings) from buildings scheduled to be demolished; (3) investigate and test the most cost-effective, practical ways to find, gather, store, refurbish, and distribute these materials; (4) quantify the energy saved by salvaging reusable materials (based on life-cycle costs); and (5) determine through quantifiable data the most energy-efficient, replicable methods to manage used materials.

BENEFITS

Usable materials will be removed from the waste stream and sold/donated to needy people or used to construct facilities for non-profit organizations and low-income housing developments. The project is expected to be self-sufficient after two years.

SCHEDULE AND STATUS

The community warehouse is open and materials are being collected, refurbished, and distributed. Data-collection activities are complete and the final report is being prepared.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$304,292	0	$304,292
ERCSWMA	127,575	0	127,575
Barn Raisers	15,940	0	15,940
Winnett & Associates	6,810	0	6,810
TOTALS	$454,617	0	$454,617

Contractor: Eastern Rensselaer County Solid Waste Management Authority
Site: Hoosick Falls, Rensselaer County
Contract Duration: 3/94-10/97
Key Words: environmental, solid waste, municipal
Project Manager: Jim Reis (518) 862-1090, ext. 3251
Program: Environmental Research
Subprogram: Municipal Solid Wastes
Contract No.: 3169-ERTER-MW-94

-> Plasma Pyrolysis for Regulated Medical-Waste Disposal

Use plasma pyrolysis to dispose of medical waste.

BACKGROUND

The medical industry in New York State produces more than 61 million pounds of regulated waste each year. The accepted method for disposal is to "red bag" the material and transport it in refrigerated vehicles to an approved autoclave site where it is sterilized and landfilled. This form of disposal is not only costly, but also hazardous during transit, subject to disruption due to weather conditions and labor strife, and environmentally taxing because of the demand on landfill space. Pyrolysis Systems, Inc. has been developing an alternative to this process that uses plasma pyrolysis, is environmentally sound, and has significant economic-development potential for New York State.

OBJECTIVE

To demonstrate the energy, economic, and environmental advantages of using plasma pyrolysis to dispose of medical waste.

DESCRIPTION

The project will be carried out in two phases. The first phase includes: (1) design and installation of a new waste-injection system; (2) installation of a new plasma torch designed by the proposers; (3) design and construction of a new scrubber system that will both clean and recycle the off-gas stream; and (4) evaluation of the effectiveness and energy efficiency of the system using simulated medical waste. The second phase will entail: (1) testing on real medical waste as a full-scale demonstration unit; (2) expanding the system to process other types of wastes, such as chemical, low-level radioactive or contaminated soils, to address a still larger market; (3) measuring the s's effectiveness by sampling and analyzing t -gas and solid residue from operating the s using uncontaminated material similar to n l waste and waste spiked with various sub- s to determine the fate of such substances; determining the energy efficiency of power ption as a function of the weight of material ed. A full-scale system will be implemented enture-capital funding for both the system process.

E ITS

Th tem will be operated with argon gas in the ab of oxygen, which will preclude the formation nany types of gaseous pollutants. The argon will be partially recycled, further reducing costs opportunities for pollutant discharge. In-state pr ssing will substitute for shipping the materials to other states which results in the export of large sums of money. Out-of-State transport is also environmentally unsound on a national basis, uses large amounts of fuel, and is unreliable in the event of labor disputes in the interstate trucking industry. Developing a process for local destruction of such waste would represent a significant decrease in medical costs to New York State residents and environmental improvements, and will create new manufacturing opportunities and opportunities for larger hospitals to create regional medical-waste-processing facilities to serve smaller, local generators.

SCHEDULE AND STATUS

The systems are constructed and will be tested and evaluated through the summer of 1997.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$250,000	0	$250,000
Plasma Pyrolysis, Inc.	407,878	0	407,878
TOTALS	$657,878	0	$657,878

Contractor: Pyrolysis Systems, Inc.
Site: Chittenden Falls Hydropower Plant, Stuyvesant Falls, Columbia County
Contract Duration: 9/95-8/97
Key Words: product development, environmental, solid waste
Project Manager: Jim Reis (518) 862-1090, ext. 3251
Program: Environmental Research
Subprogram: Solid Waste Management
Contract No.: 4296-ERTER-ER-96

-> Using Construction and Demolition Debris as Constituents in Asphalt Pavement

Use plastic, window glass, and concrete from construction and demolition debris in asphalt pavement.

BACKGROUND

Construction and demolition (C&D) debris often must be transported to distant landfills. High disposal costs and fuel use make C&D activities more expensive. The City College of the City University of New York and the New York City Department of Transportation are evaluating the potential for using crushed concrete, glass, and plastic from C&D debris.

OBJECTIVE

To evaluate the technical and economic potential for using crushed plastic, window glass, and concrete from C&D debris in asphalt pavement.

DESCRIPTION

The contractor will collect C&D debris from different sources. Plastic debris will be combined in varying proportions with asphalt to determine the potential for using scrap plastic as a binder constituent in asphalt pavements. Crushed concrete and glass from C&D debris will be mixed with different proportions of the plastic/asphalt and standard asphalt. Energy requirements of using these mixes and standard mixes also will be compared. Laboratory samples of the asphalt mixes will be prepared and subjected to physical and chemical tests. The environmental, economic, and energy impacts of using C&D/asphalt products will be compared to standard asphaltic binders and aggregate.

BENEFITS

Using C&D plastic, glass, and concrete can save energy now used to transport them to landfills, and can save the energy to extract and transport the aggregate and binder replaced by the C&D material. Reducing the costs of C&D disposal also can reduce the costs of housing construction and urban renewal projects.

SCHEDULE AND STATUS

Different mixtures of plastic and asphalt have been tested. Mixtures of processed C&D concrete aggregate have been tested. An interim report has been completed. Tests are being completed for the final report.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$249,949	0	$249,949
CUNY (in-kind)	91,882	0	91,882
NYC DOT (in-kind)	50,000	0	50,000
TOTALS	$391,831	0	$391,831

Contractor: City University of New York
Site: New York County
Contract Duration: 1/93 - 10/97
Key Words: environmental, university, solid waste, municipal, recycling, construction & demolition debris
Project Manager: Tom Fiesinger (518) 862-1090, ext. 3218
Program: Environmental Research
Subprogram: Municipal Solid Wastes
Contract No.: 1986-ERER-MW-93

-> End-Uses for Wood Ash from Construction and Demolition Waste

Research end-uses for ash produced by burning construction and demolition waste wood.

BACKGROUND

The difficulty of disposing of wood-ash from treated wood has limited burning wood to produce energy. This project will research and identify end-uses for wood ash produced from burning the treated-wood portion of the construction and demolition (C&D) waste stream, emphasizing its use as an ingredient in ash-concrete products and as a land-applied product to reduce soil acidity.

OBJECTIVES

To test the physical, chemical, and environmental characteristics of combinations of C&D wood ash and concrete, emphasizing flowable fill. A secondary objective will be to evaluate the potential for controlling soil acidity by land-application of ash.

DESCRIPTION

The contractor will survey potential uses of ash from the combustion of treated and untreated wood. Markets for the new products will be researched and the use of ash-concrete and land-application products will be assessed. Physical and chemical ash characteristics will be evaluated for multiple samples of ash from several types of treated wood. Environmental regulations and issues affecting C&D wood-ash uses also will be investigated. The leaching potential of the ash samples and of ash-concrete mixes will be measured. Costs and environmental impacts to produce ash-products will be estimated. Developing innovative end-uses for wood ash from C&D waste will be the primary objective .

BENEFITS

Burning C&D wood-waste can produce significant quantities of thermal and electric energy. The potential is limited because burning wood that has been treated or painted is restricted due to toxic constituents. If uses can be found for problematic ash that will not have significant environmental effects, then the limitations on burning treated and painted woods can be removed and more energy can be recovered from C&D wood. Reducing the acidity of soils can increase agricultural productivity and may reduce acid-rain impacts. Reducing costs of C&D disposal by developing markets for C&D wood-ash also can reduce the costs of housing construction and urban renewal projects.

SCHEDULE AND STATUS

The ash-sampling event and most material testing have been completed. The final report has been drafted and is under review.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$206,537	0	$206,537
C.T. Donovan Associates, Inc.	181,989	0	181,989
Resource Cons. Service	18,530	0	18,530
TOTALS	$407,056	0	$407,056

Contractor: C.T. Donovan Associates, Inc.
Site: Burlington, VT
Contract Duration: 1/93 - 8/97
Key Words: environmental, assist business, solid waste, construction and demolition, recycling, wood ash, landfill management
Project Manager: Tom Fiesinger (518) 862-1090, ext. 3218
Program: Environmental Research
Subprogram: Municipal Solid Waste
Contract No.: 1987-ERER-MW-93

-> Using Landfill Gas to Evaporate Leachate

Use landfill gas produced at Brookhaven Landfill to evaporate leachate as energy-saving alternative to transportation and treatment off site.

BACKGROUND

6 NYCRR Part 360, which regulates solid waste management, requires landfill operators to minimize the environmental impacts of their landfills. Leachate, the liquid that percolates down through the landfill, must be collected and treated. The off-gases must be vented or collected to avoid accumulation at or near the site.

Operators of the Town of Brookhaven Municipal Landfill transport the landfill's leachate to a nearby wastewater-treatment plant (WWTP). Transporting leachate off site for treatment is an expensive, energy-intensive process. On-site leachate treatment and use of the gas is an alternative that should be investigated in New York State.

OBJECTIVE

To build and test a leachate-evaporation system that is fueled by landfill gas.

DESCRIPTION

The contractor will construct a 40-gallon-per-hour leachate-evaporation system (LES) at the landfill. The LES will use the methane produced by the landfill as the heat source. Exhaust gases from the LES will be routed through an enclosed methane flare for thermal oxidation of air pollutants. The project success will be assessed to determine its applicability and potential energy savings.

The project includes: (1) system design, (2) permitting, (3) preparing feasibility test and health and safety plans, (4) constructing a unit, (5) feasibility test runs and sampling, (6) analysis, and (7) impact assessment. Leachate will be evaporated partially, with the remaining concentrate reinjected into the landfill for disposal. The test plan will determine the optimal concentration of the leachate to provide maximum energy and environmental benefits. If successful, feasibility studies will be done at other landfills.

BENEFITS

New York State landfills produce three billion gallons of leachate per year that must be transported to WWTPs for treatment and disposal, requiring the energy equivalent of 293,000 barrels of oil. These same landfills produce usable methane equivalent to 475,000 barrels of oil, most of which is vented to the atmosphere or flared, adding greenhouse gases to the atmosphere. Using this methane to treat the leachate on site will save the energy required to transport, treat, and dispose of the leachate, and reduce the amount of methane emitted to the atmosphere.

SCHEDULE AND STATUS

Construction of the evaporator was completed on December 27, 1996. Testing and evaluation will continue through August 1997.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$250,000	0	$250,000
Town of Brookhaven	79,632	0	79,632
Wehran Engineers	23,860	0	23,860
TOTALS	$353,492	0	$353,492

Contractor: Town of Brookhaven
Site: Brookhaven Municipal Landfill, Suffolk County
Contract Duration: 4/94 - 8/97
Key Words: environmental, product development, landfill management, municipal, solid waste
Project Manager: Jim Reis (518) 862-1090, ext. 3251
Program: Environmental Research
Subprogram: Municipal Solid Wastes
Contract No.: 3133-ERER-MW-94

-> Leachate Recirculation to Enhance Methane Production at the Monroe County Landfill

Enhance methane production at operating landfill via leachate recirculation.

BACKGROUND

Over time, the anaerobic-decomposition process in landfills releases methane, a greenhouse gas that can be collected to reduce its environmental impact and combusted to produce energy. Leachate, produced as rainwater and snowmelt percolate through the refuse, must be collected and hauled to a wastewater treatment plant (WWTP) for disposal. Recirculating the leachate back through the landfill reduces its strength and reseeds the waste with moisture and nutrients to accelerate methane production.

OBJECTIVE

To design, build, and evaluate two leachate-recirculation systems in a landfill.

DESCRIPTION

This project, which will be subject to a technical peer review for each phase, involves: (1) a literature search on landfill-related issues, (2) designing and constructing two types of recirculation systems in separate landfill cells, (3) monitoring the pollutant parameters contained in the recirculated leachate over time, (4) monitoring landfill-gas quality and quantity, and (5) comparing the leachate quality and quantity, and gas quality and quantity produced from the cells with the leachate and gas from a control cell. Two separate cells will be designed with a different leachate-recirculation system to determine which is more effective at both improving the quality of the leachate that must be disposed of and increasing the volume of methane. The contractor will demonstrate that biogas-production rates can be accelerated by leachate recirculation, that recirculating leachate avoids trucking it to a WWTP, and that the stabilized landfill either can be reclaimed or can accept additional refuse due to the volume reduction achieved by the stabilization.

BENEFITS

Accelerating biogas-production rates at landfills will make it more economical to produce electricity and may enable smaller landfills to use biogas recovery. The energy to truck leachate to a WWTP and treat it aerobically will be avoided. Methane, a more potent greenhouse gas than CO_2, will reduce landfill impacts on global warming if it is used on site to produce energy.

SCHEDULE AND STATUS

The operational phase and monitoring will run through December 1998.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$754,200	0	$754,200
Monroe County	704,027	0	704,027
U.S. Environmental Protection Agency	58,469	0	58,469
Browning Ferris Industries	150,000	$50,000	420,000
TOTALS	$1,666,696	$50,000	$1,936,696

Contractor: Monroe County
Site: Mill Seat Landfill, Town of Riga, Monroe County
Contract Duration: 11/91 - 12/98
Key Words: environmental, solid waste, municipal, landfill
Project Manager: Jim Reis (518) 862-1090, ext. 3251
Program: Environmental Research
Subprogram: Municipal Solid Wastes
Contract No.: 1831M-ERER-MW-92

-> Wetland Treatment of Leachate at the Olean Landfill

Monitoring performance of wetland system to treat landfill leachate.

BACKGROUND

Leachate, which is formed when rain and snowmelt seep into landfills, must be collected and treated to avoid contamination of surface and groundwater. Treatment usually involves transportation off site to a sewage-treatment plant at a high energy and economic cost. While most leachate seeps to the bottom of the landfill and is collected in a leachate-collection system, some moves laterally and seeps out the sides of the landfill, causing surface-water contamination. In addition, lateral movement of leachate increases when groundwater enters the landfill, or when leachate is recirculated back into the waste mass to enhance methane-gas production. An energy-efficient method of collecting and treating leachate from sideslope outbreaks will be researched and tested.

OBJECTIVE

To evaluate the use of constructed wetlands to treat landfill leachate.

DESCRIPTION

A collection and treatment system consisting of diversion berms and three series-connected surface-treatment cells will be built near the landfill. Cell 1 will be designed as a deep-water settling basin and will be provided with an impermeable lining system. Cell 2 will be designed as a lined surface-flow wetland and Cell 3 will be designed as a lined subsurface-flow wetland. Vegetation in the treatment cells will include water hyacinth, duckweed, cattail, bulrush, and giant reed (phragmites). The effluent of Cell 3 will be discharged to an unnamed tributary of the Ischua Creek that currently receives untreated leachate seepage from the landfill. After construction, the contractor will: (1) monitor the wetland system for two years to determine its effectiveness in collecting and treating leachate seepage, (2) compare the cost of constructing and operating the system and its overall treatment efficiency to transportation off site and conventional leachate treatment, and (3) compare the monitoring results to past wetlands-treatment projects to both verify results and determine the fate of some nutrients within the system.

BENEFITS

The long-term use of wetlands to treat leachate can lower energy consumption with a combination of natural aeration and solar/biological processes to remove organics, nutrients, and metals in an on-site wetland environment rather than trucking the leachate to a mechanically operated wastewater-treatment plant. Wetlands treatment also saves energy by avoiding the production of extra sludge at a wastewater treatment plant. Environmental benefits include decreasing the potential for spills off site by eliminating transportation and adding new wetlands to the ecosystem. Economic benefits are provided through reduced construction and operation costs. System optimization will minimize energy use and maximize cost savings for leachate treatment in Olean and other New York State municipalities.

SCHEDULE AND STATUS

The wetland system is currently in the design phase.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$101,312	0	$101,312
City of Olean	396,911	0	396,911
TOTALS	$498,223	0	$498,223

Contractor: City of Olean
Site: Ischua, Cattaraugus County
Contract Duration: 9/95 - 1/99
Key Words: environmental, solid waste, municipal
Project Manager: Jim Reis (518) 862-1090, ext. 3251
Program: Environmental Research
Subprogram: Solid Waste Management
Contract No.: 4278-ERTER-MW-96

-> Methane Gas Production at Broome County Landfill

Distribute leachate in Broome County landfill to enhance gas production.

BACKGROUND

Almost all solid waste landfills produce methane gas as a by-product of degradation. Organic material, in the presence of adequate moisture, is converted to methane and carbon dioxide. While some moisture is naturally present in landfills, adding leachate to the waste enhances its capacity to produce methane gas, while at the same time disposing of and possibly stabilizing the leachate. Fundamental to adding leachate is whether it is possible to uniformly permeate liquids throughout the waste mass in a closed landfill, and whether chemical precipitation and particle-settling in the waste mass over time reduces the permeability of the waste. It is unknown if conditions for maximum gas production are created in the entire landfill, or if the gas that has been generated comes from only part of the waste, or if some organic material is never converted to methane. Due to moisture short-circuiting and chemical precipitation on the surface of organic material, some organic waste probably remains unconverted, reducing gas production potential.

OBJECTIVE

To construct and evaluate a bioreactor trench in a closed landfill cell to determine if landfill-gas production can be appreciably enhanced and if the pollutant levels in the leachate are reduced.

DESCRIPTION

To understand the moisture-uptake and -distribution potential of waste, and how to maximize moisture uptake, field experiments on the moisture content and permeability of waste in and adjacent to the leachate-recirculation system are proposed. The contractor will: (1) construct a bioreactor trench leachate-recharge system in a closed landfill section; (2) periodically fill the trench with leachate; (3) monitor the leachate-quality improvement in the trench; (4) monitor the quality and quantity of landfill gas produced in the trench; (5) evaluate the costs and effectiveness of the system; (6) compare gas-production rates from the trench with rates from a control cell; (7) collect data on moisture movement in the waste, as well as permeability in and around the trenches; and (8) analyze the waste in a proximate control cell to determine properties of solid waste that affect moisture movement and how these properties change over time.

BENEFITS

Data collected from the field experiments will be used to build and operate methane-gas-enhancement projects at closed landfills. As more landfills are closed, there will be more opportunities for these projects. Gas-production rates measured in the field lag behind theoretical rates at a ratio of more than 1:4. If moisture-distribution methods are improved, gas-production efficiencies can be improved. Based on current waste-generation rates, gas production from New York State landfills could exceed the equivalent of 11.4 million barrels of oil each year.

SCHEDULE AND STATUS

Field work began in June 1995 and sampling will continue through April 1997. The final report is due in October 1997.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$182,987	0	$182,987
Broome County	44,680	0	44,680
SUNY/Oswego	24,823	0	24,823
TOTALS	$252,490	0	$252,490

Contractor: Broome County Division of Solid Waste Management
Site: Nanticoke Landfill, Broome County
Contract Duration: 3/94-11/97
Key Words: environmental, municipal, landfill management
Project Manager: Jim Reis (518) 862-1090, ext. 3251
Program: Environmental Research
Subprogram: Municipal Solid Wastes
Contract No.: 3135L-ERER-MW-94

-> Constructed Wetlands Leachate Treatment in Monroe County

Treat landfill leachate biologically in a constructed wetland.

BACKGROUND

NYSERDA developed and tested a constructed wetland that has been operational since July 1990 to treat about 1000 gallons per day (gpd) of landfill leachate in Tompkins County. The pilot project's success persuaded Monroe County to construct full-scale wetlands at the Van Lare Sewage Treatment Facility to treat all the leachate (about 10,000 gpd) from a remote landfill.

OBJECTIVE

To build and test a full-scale constructed wetland to treat landfill leachate.

DESCRIPTION

The contractor will: (1) build a modified wetland treatment system that will incorporate both an overland-flow area to pretreat leachate through aeration, oxidation, and then precipitation of iron, manganese, and other heavy metals, and a constructed wetland, downslope of the overland-flow area and planted with the reed Phragmites australis, that will be the principal treatment area where biological and geochemical processes, in conjunction with plant uptake, will remove contaminants; (2) recycle treated leachate through the process in drought periods to continue treatment and evaporation; (3) demonstrate that the discharge from a constructed wetland will meet State and national pollution discharge-elimination standards (SPDES and NPDES); and (4) identify the nature of water-renovating processes within the system.

BENEFITS

The long-term use of wetlands to treat leachate can lower energy consumption with a combination of natural aeration and solar/biological processes to remove organics, nutrients, and metals in an on-site wetland environment, rather than trucking leachate to a mechanically operated wastewater-treatment plant (WWTP). Wetlands treatment also contributes to energy savings by avoiding the production of extra sludge at the WWTP. Environmental benefits include decreasing the potential for spills off site by eliminating transportation. Economic benefits are provided through reduced construction and operation costs. System optimization will minimize energy use and maximize cost savings for leachate treatment in Monroe County and New York State.

SCHEDULE AND STATUS

The monitoring period is complete and the final report is being prepared.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$167,250	0	$167,250
Monroe County Health Department	55,750	0	55,750
U.S. Geological Survey	223,000	0	223,000
TOTALS	$446,000	0	$446,000

Contractor: Monroe County Health Department
Site: Frank E. Van Lare Sewage Treatment Facility, Rochester, Monroe County
Contract Duration: 11/92 - 12/97
Key Words: environmental, leachate, landfill, municipal, constructed wetland, solid waste
Project Manager: Jim Reis (518) 862-1090, ext. 3251
Program: Environmental Research
Subprogram: Municipal Solid Wastes
Contract No.: 1924-ERER-MW-93

-> Landfill-Reclamation Feasibility Study in the Town of East Hampton

Investigate feasibility of landfill reclamation at Town of East Hampton Landfill.

BACKGROUND

Old landfills contain large amounts of combustible, reusable, and recyclable materials. Landfill capping, which is expensive, essentially entombs these materials forever. Capping closed landfills is problematic due to the air and groundwater impacts. Long-term monitoring costs and the possibility of cover failures have caused municipal officials to reconsider the effectiveness of landfill closure. An earlier project in Edinburg (Saratoga County) concluded that, while reclaiming soil, materials for recycling, refuse for energy, and the land itself was feasible, site-specific studies were needed to assess more widespread applicability.

OBJECTIVE

To determine the feasibility of reclaiming all or part of the landfill to reduce closure costs, reclaim materials, reduce environmental impacts, and save energy.

DESCRIPTION

Components of this work include: (1) preparing work and contingency plan; (2) providing for worker health and safety monitoring; (3) conducting field work involving invasive sampling and testing; (4) evaluating landfill contents; (5) quantifying, characterizing, and determining the energy content of combustible materials; (6) developing operating procedures and equipment standards and criteria; (7) assessing economic feasibility; (8) determining applicability to other landfills; (9) identifying implications for incorporating landfill reclamation into an integrated solid-waste-management strategy; and (10) developing and implementing a technology-transfer plan.

BENEFITS

An estimated 350 landfills in New York State are located on sites potentially suitable for landfill reclamation and reuse. Reclaiming this depleted landfill resource could upgrade the environment and provide the State with the capacity to accommodate the waste of its entire population for 6 1/2 years if no other waste-management alternatives are used. Energy recovery would contribute 170 trillion Btu, the equivalent of 26.8 million barrels of oil, toward the State's energy needs. Usable materials such as ferrous metals, soil, and the land itself could be recovered.

SCHEDULE AND STATUS

The project field work was completed in October 1996. The final report is under review.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$58,943	0	$58,943
Town of East Hampton	39,616	0	39,616
Duffy-Thompson, Inc.	20,000	0	20,000
TOTALS	$118,559	0	$118,559

Contractor: Town of East Hampton
Site: Springs Fireplace Road Landfill, Town of East Hampton, Suffolk County
Contract Duration: 11/94 - 7/97
Key Words: environmental, solid waste, municipal
Project Manager: Jim Reis (518) 862-1090, ext. 3251
Program: Environmental Research
Subprogram: Municipal Solid Wastes
Contract No.: 4085-ERTER-MW-95

-> Landfill Gas Clean-up and Use at the City of Albany Interim Landfill

Research ways to collect, clean up, and use landfill gas at small landfill.

BACKGROUND

There are almost 1,400 small to medium-sized landfills in New York State, all of which produce methane gas as a by-product of decomposition. Using the methane gas produced by smaller landfills for energy production is difficult because the capital expenditures are high and gas-production rates can fluctuate, making energy production unreliable. Also, the gas often contains hydrogen sulfide, which can foul engines and cause odor problems. Due to these limitations, the gas produced is usually flared to the atmosphere, essentially wasting the energy resource and releasing greenhouse gases. Developing ways to collect, clean up, and use the gas under these conditions would enable the operators of smaller landfills to build a reliable source of energy for on-site uses.

OBJECTIVE

To determine the effectiveness of a new landfill gas-extractor and construct a gas-cleaning system and landfill-gas/diesel dual-fuel engine that will produce electricity at a small landfill.

DESCRIPTION

The contractor will: (1) install an inexpensive landfill-gas extractor system inside the waste mass as it is being placed; (2) design and install a gas-cleaning contactor that uses a non-sludging chemical reagent; (3) design and construct a portable power station to produce electricity for on-site use; (4) operate the systems for a prolonged period; (5) evaluate the effectiveness of the landfill gas extractors; (6) determine the effectiveness of the cleanup system; (7) evaluate the power station for continued use and use at other sites; and (8) determine the effect of the landfill gas on the internal components of the engine. The power station will use a dual-fuel engine that has previously been used only to burn biogas from farm operations. This type of engine will be run mostly on landfill gas, although it also will consume a small amount of diesel fuel to lubricate the engine heads. During periods of low landfill-gas production, additional diesel fuel can be added to maintain the needed horsepower. This will ensure dependable energy production for on-site use. Data from this project will be used in future landfill-gas-collection projects to optimize gas-collection efficiencies. Gas impurity levels will be measured before and after cleanup.

BENEFITS

This project will result in a demonstration of an efficient, small-scale methane-recovery and gas-cleaning system that will produce energy for on-site use. Data from this project will be used by operators of other small landfills to evaluate the potential of energy production. The gas-cleaning system also could be applied to gas use at many larger landfills in an effort to increase off-site uses such as steam-production and processing of various gas products. Finally, landfill gas currently being flared and adding to air pollution will be used beneficially .

SCHEDULE AND STATUS

The project is complete and the final report is under review.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$243,892	0	$243,892
City of Albany	96,260	0	96,260
TOTALS	$340,152	0	$340,152

Contractor: City of Albany
Site: Albany Interim Landfill, Albany County
Contract Duration: 8/95 - 6/97
Key Words: environmental, solid waste, municipal
Project Manager: Jim Reis (518) 862-1090, ext. 3251
Program: Environmental Research
Subprogram: Municipal Wastes
Contract No.: 4276-ERTER-MW-96

-> Anaerobic Dechlorination of Polychlorinated Biphenyls (PCBs)

Demonstrate biological treatment of PCB-contaminated soil at hazardous waste landfill.

BACKGROUND

PCBs were used for 50 years in a wide variety of industrial applications and later became regulated as a toxic substance under the federal Toxic Substance Control Act (TSCA) in 1978. About 1.5 billion pounds were produced worldwide and many sites are contaminated. Currently, TSCA prescribes that PCB-contaminated remediation wastes (e.g., soils), with PCB concentrations greater than 500 parts per million (ppm) be incinerated, and, if greater than 50 ppm, treated and disposed of in a hazardous waste landfill. The U.S. Environmental Protection Agency (EPA) proposed revisions to TSCA, if adopted, would allow PCB-contaminated wastes to be "treated down" below 50 ppm and then disposed of at subtitle D municipal waste landfills.

OBJECTIVE

To demonstrate that anaerobic biological treatment of PCBs in contaminated-soils can reduce concentrations to less than 50 ppm by providing sufficient technical information to prove technical feasibility, regulatory compliance, and full-scale economic feasibility.

DESCRIPTION

At its permitted hazardous waste treatment facility in Model City, New York, the contractor will: (1) obtain all necessary permits, monitor the site environment, decontaminate equipment, and properly dispose of all liquid and solid residuals; (2) design, construct, and install three pilot-scale anaerobic treatment reactors sufficient to treat 20-30 tons of contaminated soil, and develop a detailed research and testing plan for the demonstration and parallel bench-scale experiments; (4) collect and analyze samples from pilot- and bench-scale experiments; and (4) evaluate the technical and economic potential of anaerobic dechlorination treatment.

BENEFITS

Anaerobic biological treatment is far less energy-intensive than incineration and thermal desorption, and is more acceptable than either method from the public's perspective. The availability of such treatment will enable more contaminated sites to be reclaimed because of lower costs.

SCHEDULE AND STATUS

Treatment reactors were constructed. Contaminated soil will be procured and testing will begin in June 1997.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	0	$147,600	$147,600
Waste Management, Inc.	0	179,600	179,600
TOTALS	0	$327,200	$327,200

Contractor: Waste Management of Ohio, Inc.
Site: Model City, Niagara County
Contract Duration: 3/97 - 3/98
Key Words: environment, assist business, industrial, solid waste, anaerobic bioremediation
Project Manager: Barry Liebowitz (518) 862-1090, ext. 3248
Program: Environmental
Subprogram: Solid Waste Management
Contract No.: 4450-ERTER-MW-97

Evaluate potential for using incinerator-ash material in road-paving aggregate and other applications.

BACKGROUND
Municipalities facing high costs for managing ash produced by energy-from-waste incinerators need information about using ash, rather than disposing of it in landfills.

OBJECTIVES
To: (1) evaluate ash-management options and test ash from five facilities to measure physical and chemical properties, and (2) evaluate the potential for using ash as a partial aggregate substitute to produce asphalt pavement.

DESCRIPTION
In the first phase, the contractor will characterize incinerator ash from selected energy-from-waste facilities and evaluate several options for ash use. The second phase is designed to include the demonstration and evaluation of several components of an ash-aggregate paving demonstration. In the second phase, the contractor will monitor key activities for process emissions, such as potential fugitive dust and runoff from an ash stockpile and air emissions from the asphalt plant using the ash. The demonstration roadway also would be monitored for leaching for at least two years.

BENEFITS
Energy-from-waste facilities can provide New York State with more than 400 MW of electric-generating capacity, but the problems associated with disposing of incinerator ash residues have been significant barriers to implementation. This project will investigate ash-management options, focusing on ash use in road-paving aggregate. Successful ash use could significantly reduce the quantities of ash that need to go to ashfill sites. In addition, ash use may achieve significant savings in ash-management costs and reduce the overall cost to operate energy-from-waste systems.

SCHEDULE AND STATUS
First-phase testing and evaluation are complete and the report has been distributed. Data from the stockpile demonstration have been collected, analyzed and described in the stockpile report. The paving demonstration is under way and data collection has begun.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$1,280,586	0	$1,280,586
LIRPB*	361,679	0	361,679
Nassau County	65,000	0	65,000
Suffolk County*	96,400	0	96,400
13 LI towns & 2 cities	224,504	0	224,504
Port Authority of NY & NJ	1,146,391	0	1,500,000
New York City*	34,843	0	34,843
NJDOT*	927,000	0	927,000
NJDEP	518,525	0	518,525
TOTALS	$4,654,928	0	$5,008,537

*Portions in-kind

Contractor: Long Island Regional Planning Board (LIRPB)
Site: SUNY/Stony Brook and Commack, Suffolk County; New Jersey
Contract Duration: 1/87 - 10/98
Key Words: environmental, municipal, solid waste, ash, aggregate, asphalt, incinerator
Project Manager: Tom Fiesinger (518) 862-1090, ext. 3218
Program: Environmental Research
Subprogram: Municipal Solid Wastes
Contract No.: 976B-ERER-ER-87

-> Demonstrating and Evaluating Electricity Production from a Modular Solid-Waste Incineration System

Evaluate long-term capabilities of modular solid-waste incineration to produce electricity using seasonal excess steam.

BACKGROUND

In 1985, small municipalities considering waste-to-energy incinerators needed better information about the long-term reliability of such systems, including the feasibility of installing small-scale electric turbines to use seasonal excess steam. Oneida County had established a 200-ton-per-day resource-recovery system with four separate modules each rated at 50 tons per day. The system supplied steam to Griffiss Air Force Base. When the steam load was low, the facility generated more steam than it could sell. In cooperation with NYSERDA, the County installed a 2.2-megawatt power-generation turbine to use the excess steam. The project's objectives were to demonstrate the long-term capabilities of a small-scale resource-recovery system for producing electricity with modular incinerators and a condensing turbine operating under highly variable steam-loading conditions, and to obtain long-term data on the operation and maintenance of this system.

ACCOMPLISHMENTS

The Oneida Herkimer Solid Waste Authority (OHSWA) provided monthly data describing 10 years of operation through March 29, 1995, when the energy-recovery facility had to close due to the closure of the Air Base, which was the only steam customer. Data was provided on material flows, energy use and production, and downtime and maintenance operations. Of the possible hours of operation, the overall energy-recovery system showed annual availabilities ranging from 72% to 91%. The turbine proved to be a reliable addition to the energy-recovery facility. The highly variable steam-loading conditions did not appear to adversely affect the turbine operation. Data on turbine system downtime showed turbine system availabilities of about 98% of potential operating time.

FINDINGS AND CONCLUSIONS

The turbine system could be a reliable component for an energy-recovery system even under variable loading conditions. Site-specific conditions would determine whether a turbine system would be an economic addition. Sufficient excess steam and adequate avoided electricity costs or revenues would be needed to make the addition of such turbine systems cost-effective.

REALIZED OR ANTICIPATED BENEFITS

The turbine system produced 20 million kWh of electricity over its 10-year operation from steam that would otherwise have been wasted. During this time, gross electricity revenues amounted to $1.2 million.

TECHNOLOGY TRANSFER ACTIVITIES

Descriptions of the energy-recovery facility, including the turbine system, were presented at a meeting of the New York State Association for Solid Waste Management and published in a national magazine. After the project was initiated, most small communities elected to use other waste-management methods besides energy-recovery. Data on the efficiency of the modular energy recovery facility and the turbine have been shared with the State's one remaining operator of a modular incinerator.

FUNDING	TOTALS
NYSERDA	$300,000
OHSWA	1,595,193
TOTALS	$1,895,193

Contractor: Oneida Herkimer Solid Waste Authority
Site: Oneida County Energy Recovery Facility, Rome, Oneida County
Contract Duration: 12/84 - 4/96
Key Words: environmental, municipal, solid waste, combustion, incinerator
Project Manager: Tom Fiesinger (518) 862-1090, ext. 3218
Program: Environmental Research
Subprogram: Municipal Waste
Contract No.: 747-RIER-RER-85

-> Collecting and Using Used Oil from Do-it-Yourselfers (DIY) in the Capital District

Implement used-oil collection program for six-county Capital District region.

BACKGROUND

The City of Albany, which leads the ANSWERS regional solid-waste-management consortium, was interested in evaluating the quantity and quality of used oil collected from do-it-yourself (DIY) oil changers. CIBRO Petroleum was interested in the information for expanding its used-oil-reprocessing operations.

ACCOMPLISHMENTS

A public education campaign was conducted to inform area residents about proper used-oil-disposal methods. Two telephone surveys were conducted in the six-county area to determine used-oil generation rates and disposal practices.

FINDINGS AND CONCLUSIONS

Based on survey results, it is estimated that about 700,000 gallons per year of used oil are generated in the six-county area. About 150,000 gallons per year are estimated to be disposed of improperly.

REALIZED OR ANTICIPATED BENEFITS

The second survey found that the number of people reporting improper disposal had dropped from 25 percent to 7 percent. The public education program appears to have contributed to greater awareness of proper disposal methods.

TECHNOLOGY TRANSFER ACTIVITIES

Copies of the public education materials and of the final report have been shared with the participating communities and the State Department of Environmental Conservation.

FUNDING	Total
NYSERDA	$105,464
CIBRO Petroleum (in-kind)	150,000
Creighton Manning (in-kind)	20,247
City of Albany (in-kind)	2,500
TOTALS	$278,211

Contractor: City of Albany
Site: Town of Bethlehem, and City of Albany, Albany County
Contract Duration: 5/91 - 7/96
Key Words: environmental, assist business, oil, municipal, solid waste, recycling, collection
Project Manager: Tom Fiesinger (518) 862-1090, ext. 3218
Program: Environmental Research
Subprogram: Municipal Solid Wastes
Contract No.: 1752-ERER-MW-92

-> Demonstrating Waste-Volume Reduction for Landfill Reclamation

Increase heating value and reduce volume of waste to be disposed of after landfill reclamation.

BACKGROUND

A previous NYSERDA project in Edinburg, NY, demonstrated that landfill reclamation (excavating a landfill and separating the reusable and combustible materials) could be an economically and environmentally beneficial alternative to conventional landfill closure. Separation equipment was used to reclaim part of a landfill, producing reusable soil, recyclable metals, and residual waste with a heating value of 3500 Btu/lb, which is lower than "normal" municipal solid waste (5500 Btu/lb.). The residual was taken to a waste-to-energy (WTE) facility where it was burned for a fee. Project results showed that more than half the cost of reclamation was for transportation and disposal, leading to the conclusion that decreasing disposal costs and increasing the residual's heating value was needed for landfill reclamation to be more cost-effective. Using additional equipment could help, but would increase the project's complexity. Simple composting was another option. This project was aimed at determining the effect of composting waste on reducing project costs and increasing the residual's heating value .

ACCOMPLISHMENTS

Screened waste was composted in windrows during reclamation. Windrow temperature and moisture were monitored periodically. After two months, the waste was rescreened, with separated portions weighed and measured. Half was sent to a WTE facility for combustion testing and the remaining was re-piled in a windrow for additional composting. After another two months, the remaining waste was rescreened again and the residual sent to a WTE facility for combustion testing.

FINDINGS AND CONCLUSIONS

Two months of composting was found to be optimal, increasing the heating value of the waste to 4500 Btu/lb and decreasing weight by 31% and volume by 17%. Net project cost savings were 11%.

REALIZED OR ANTICIPATED BENEFITS

An estimated 350 New York State landfills are potentially suitable for landfill reclamation and reuse, which could upgrade the sites' environmental quality and allow the State to accommodate all of its waste for 6-1/2 years if no other waste-management alternatives were used. Energy recovery could contribute 170 trillion Btu, the equivalent of 26.8 million barrels of oil, toward the State's energy needs. Materials such as ferrous metal, soil, and the land itself can be recovered during landfill reclamation.

TECHNOLOGY TRANSFER ACTIVITIES

One subcontractor is currently writing an article about this project for Biocycle magazine. Project results were presented at the 1996 national meeting of the Solid Waste Association of North America in Portland, Oregon, in September 1996. The results also were presented during a Landfill Mining and Rehabilitation Seminar in New Zealand in September 1995.

FUNDING	TOTALS
NYSERDA	$56,800
Town of Hague	19,000
TOTALS	$75,800

Contractor: Town of Hague
Site: Town of Hague, Warren County
Contract Duration: 2/95 - 6/96
Key Words: environmental, municipal, solid waste
Project Manager: Jim Reis (518) 862-1090, ext. 3251
Program: Environmental Research
Subprogram: Municipal Solid Wastes
Contract No.: 4133-ERTER-MW-95

-> Northeast Regional Community Environmental Center

Establish research center in New York City to facilitate interaction between utilities and their customers, foster energy R&D, and provide technology transfer and technical assistance.

BACKGROUND

The Electric Power Research Institute, utilities, NYSERDA, and other research organizations all have common interests in energy/environmental research in the water, wastewater, and health care industries in New York State and the Northeast. This project will allow NYSERDA to pool its resources with other organizations in New York State to address regional energy and environmental-management problems and other areas of common interest in water systems, wastewater treatment, sludge management, and health care.

OBJECTIVES

To create and participate in activities that develop and market energy-efficient environmental-management technologies in New York State and the Northeast serving the water, wastewater, and health care industries

DESCRIPTION

The contractor will: (1) issue and respond to solicitations for R&D projects in the areas of water, wastewater, and health care; (2) prepare Program Opportunity Notices and Requests for Proposals and respond to outside solicitations; and (3) organize and participate in technology-transfer activities.

BENEFITS

New York State water and wastewater systems use three to four billion kWh of electricity per year. A number of energy-saving technologies have been identified and developed over the past few years that could be implemented easily at these facilities after testing and demonstration. New technologies could be developed with assistance from the Center that could further reduce the amount of energy required for environmental management. Total energy savings for the water and wastewater industries in New York State may reach 1.5 billion kWh per year if these industries maximize the use of the new, energy-efficient technologies.

SCHEDULE AND STATUS

A Healthcare Initiative Program Manager has been hired. Healthcare Initiative projects include a conference and a video planning meeting. Municipal water and wastewater projects include a video planning meeting and a watershed protection demonstration.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$250,000	$125,000	$625,000
Con Edison	500,000	250,000	1,250,000
ESEERCO	250,000	125,000	625,000
Electric Power Research Institute	400,000	200,000	1,000,000
TOTALS	$1,400,000	$700,000	$3,500,000

Contractor: Consolidated Edison Co. of New York, Inc.
Site: Manhattan College, Bronx County
Contract Duration: 8/94 - 12/98
Key Words: environmental, wastewater, water, medical waste, environmental management, utilities
Project Manager: Larry Pakenas (518) 862-1090, ext. 3247
Program: Environmental Research
Subprogram: Municipal Wastewater and Sludge
Contract No.: 3145-ERER-MW-94

-> On-Line Process Audits and Submetering at Municipal Wastewater-Treatment Plants

Monitor wastewater and sludge-processing energy use.

BACKGROUND

Many of the wastewater-treatment plants (WWTPs) in New York State may have unnecessarily high operating costs due to overloading, failing equipment, lack of process-control instrumentation, and operating problems. In addition, landfill closures, new regulations for sludge management, requirements for beneficial use of sludge, volatile organic compound/odor control, storm-water treatment, and nutrient removal from wastewater have driven up the cost of wastewater treatment and sludge management even further and have made the job of operating a WWTP more difficult. These conditions often result in excessive energy and chemical use. To solve these problems, costly plant expansion, new plant construction, or equipment replacement may be proposed and may result in a net increase in energy use and operating cost.

OBJECTIVE

To obtain on-line plant operating and energy-use data to examine opportunities for energy and other operating cost-savings without large capital expenditures.

RESEARCH EFFORT

The contractor will: (1) select at least eight WWTPs with flows greater than 500,000 gallons per day that are representative of typical designs in New York State and that provide secondary treatment or greater; (2) examine performance and energy use on a process-by-process basis at the selected WWTP sites; (3) collect real-time operating data to examine the dynamic performance of WWTPs, including liquid and sludge trains, and determine process energy use; and (4) prepare individual site reports and a summary final report.

BENEFITS

The project should result in energy savings at WWTPs without requiring large capital expenditures. Project information will be disseminated to other WWTPs in New York State and the United States so they may review the costs and benefits of on-line process-audit and electrical-submetering programs, and consider implementing these programs at their own facilities.

SCHEDULE AND STATUS

Approximately 90 WWTPs were contacted to determine their interest in participating in the project. Six WWTPs received on-line monitoring and electricity submetering under Phase 2, which was completed in September 1996. Individual site testing reports are being prepared.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$59,691	$176,057	$250,000
ESEERCO	0	150,000	150,000
Electric Power Research Institute	0	50,000	50,000
Municipalities	0	50,000	50,000
TOTALS	$59,691	$426,057	$500,000

Contractor: CH2M Hill
Site: Statewide
Contract Duration: 4/94 - 7/97
Key Words: environmental, municipal, wastewater treatment, sludge management
Project Manager: Larry Pakenas (518) 862-1090, ext. 3247
Program: Environmental Research
Subprogram: Municipal Wastewater and Sludge
Contract No.: 3172M-ERTER-MW-94

-> Application of an Hourly Energy-Pricing Expert System

Develop and test computer software to control energy costs at wastewater-treatment plant.

BACKGROUND

In 1991, the Town of Amherst's wastewater-treatment plant (WWTP) began participating in a time-of-day electricity-pricing schedule offered by Niagara Mohawk. For Amherst to save energy costs under this program, the WWTP must shift electricity use from high- to low-cost periods. Each day, the WWTP receives an hourly electricity-price schedule from Niagara Mohawk for the following business day starting at midnight. Because the schedule is received at 4 p.m., little time is left for energy-use planning for the next day. The WWTP has on-site storage capacity and process flexibility that would allow for storing wastewater or sludge during times of high electricity cost and treating them when the electricity rates are lower. The plant needs an expert system that can assist the operators with process-control and operating decisions, resulting in greater energy savings. Niagara Mohawk has an expert system that was developed to improve an industrial customer's ability to respond to hourly electricity pricing.

OBJECTIVES

To develop algorithms and engineering models that define the operating and performance characteristics of the equipment and processes at the Amherst WWTP, and design an energy-management expert system.

DESCRIPTION

The contractor will: (1) survey the Amherst WWTP operations to identify processes, equipment, operating strategies, and energy use to help in designing the expert system; (2) prepare the algorithms and engineering models; (3) develop and test user and software interfaces; (4) validate the engineering models and operating rules; and (5) train WWTP personnel on the completed system.

BENEFITS

This project will provide the Amherst WWTP with a tool to help the plant operator identify electricity load-shifting opportunities that result in an increase in energy savings from hourly electricity pricing. This tool, if applied at other WWTPs in New York State, could help reduce the $125 million spent annually for electricity.

SCHEDULE AND STATUS

Software design is under way. The consultant has begun to develop the user interface and the engineering models. Parts of the software have been tested by the WWTP operators.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$121,625	0	$121,625
Town of Amherst	40,542	0	40,542
TOTALS	$162,167	0	$162,167

Contractor: Town of Amherst
Site: Amherst, Erie County
Contract Duration: 4/95 - 8/97
Key Words: environmental, municipal, energy management, wastewater treatment
Project Manager: Larry Pakenas (518) 862-1090, ext. 3247
Program: Environmental Research
Subprogram: Municipal Wastewater and Sludge
Contract No.: 4118-ERTER-MW-95

-> Demonstrating the Selector-Contact Stabilization Process

Install and test selector-contact stabilization at Fredonia wastewater-treatment plant.

BACKGROUND

The Village of Fredonia owns and operates a 3.3-million-gallon-per-day (mgd) advanced wastewater-treatment plant (WWTP) designed in the late 1970s to achieve tertiary-level removal of biochemical oxygen demand (BOD) and total suspended solids (TSS), and remove phosphorus to an effluent concentration of one milligram per liter (mg/l) by chemical precipitation. The WWTP was expected to reach its design capacity by 2000, but instead began to approach it by the early 1990s, when plant-influent BOD loadings were about 30-percent higher than design values, and average plant-influent flows were about 2.2 mgd.

"Selector" means growing and maintaining specific bacteria by controlling their environment. The selector process modifies the activated-sludge processes' conventional contact-stabilization mode. The contact tank is divided into zones or compartments where anoxic and oxic conditions, and related "selector" bacteria, are maintained. A high food-to-(bio)mass (F/M) ratio is maintained in the anoxic zone to degrade organics from the primary settler by rapid growth of bacteria recirculated from the stabilization tank. Mixed-liquor suspended solids (MLSS), a mixture of biomass and organics from the contact tank, also are recirculated from the non-selector zone of the contact tank to the selector zone to provide process stability and a working biomass population.

OBJECTIVE

To install and evaluate an energy-saving wastewater-treatment process at the Fredonia WWTP that has the potential to increase the plant's treatment capacity without increasing its size.

RESEARCH EFFORT

The contractor will: (1) install the selector-contact stabilization process at the WWTP to increase the plant's BOD-removal capacity; (2) monitor and test the selector for 14 months, including process stress-testing and oxygen-transfer efficiency testing; and (3) use a mathematical model to predict the benefits of the selector process for different WWTP sizes.

BENEFITS

The selector process is expected to benefit the WWTP by: (1) increasing plant capacity without increasing its size; (2) removing phosphorus from the wastewater to levels that meet or exceed regulatory requirements; (3) improving settling characteristics of the WWTP sludge; and (4) saving energy due to lower sludge age, faster BOD removal, and an increase in oxygen-transfer efficiency.

SCHEDULE AND STATUS

The selector process has been installed and the start-up period has begun. Oxygen-transfer testing is complete. Process monitoring began in January 1996. Loss of sludge handling equipment delayed completion of the testing and monitoring task. Testing will be completed in May 1997.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$250,000	0	$250,000
Village of Fredonia	273,956	0	273,956
TOTALS	$523,956	0	$523,956

Contractor: Village of Fredonia
Site: Fredonia, Chautauqua County
Contract Duration: 2/95 - 8/97
Key Words: environmental, municipal, wastewater treatment, contact stabilization, process development
Project Manager: Larry Pakenas (518) 862-1090, ext. 3247
Program: Environmental Research
Subprogram: Municipal Wastewater and Sludge
Contract No.: 4068-ERTER-MW-95

Test chlorination/dechlorination and ultraviolet disinfection equipment side-by-side.

BACKGROUND

Nearly all wastewater-treatment plants (WWTPs) in New York State disinfect their treated effluent prior to discharge, most using gaseous or liquid chlorine. Chlorine has been investigated for residual levels and formation of toxic halogenated compounds in the wastewater effluent or receiving water. There seems to be a trend toward lower allowable residual levels with the same pathogen-kill requirement, possibly forcing dechlorination and a subsequent cost increase. Imposing standards for whole-effluent toxicity raises additional uncertainties about using chlorine.

OBJECTIVES

To determine the effectiveness of alternative disinfection technologies under varying water-quality and hydraulic conditions, and compare their costs and benefits.

DESCRIPTION

The contractor will: (1) test several configurations of ultraviolet (UV) disinfection as an alternative to chlorination, (2) test the effect of UV followed by chlorination and dechlorination, (3) test liquid hypochlorite to replace gaseous chlorine, (4) test more energy-efficient injection methods, (5) determine the efficacy of dechlorination as a regulatory compliance tool, and (6) analyze data and economics.

BENEFITS

UV can be more cost-effective than chlorination, particularly if dechlorination is needed; however, UV will use more energy overall. UV disinfection is effective, leaves no residual, and has no known adverse by-products. It has been demonstrated to have a faster reaction time than chlorine, but is impeded by turbidity. Electricity consumption for a liquid hypochlorite system is about 50 percent less than that for a gaseous system. There would be substantial cost savings for safety, training, and equipment.

SCHEDULE AND STATUS

Bids have been received for the new liquid hypochlorite system. Design of the UV system is complete. Installation of both systems is under way. Testing began in June 1996 and was completed in January 1997. Interim task reports are being prepared.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$237,486	0	$237,486
Orange and Rockland Utilities, Inc.	50,000	0	50,000
Rockland County Sewer Dist.	190,315	0	190,315
HydroQual	12,494	0	12,494
TOTALS	$490,295	0	$490,295

Contractor: Rockland County Sewer District
Site: Orangeburg, Rockland County
Contract Duration: 10/94 - 8/97
Key Words: environmental, municipal, wastewater treatment, disinfection
Project Manager: Larry Pakenas (518) 862-1090, ext. 3247
Program: Environmental Research
Subprogram: Municipal Wastewater and Sludge
Contract No.: 4071-ERTER-MW-95

-> Evaluating Alternative Technologies for Disinfecting Low-Grade Wastewaters

Evaluate on pilot-scale potential for using ultraviolet light to disinfect untreated or partially treated wastewaters.

BACKGROUND

Water-quality standard compliance for many receiving water bodies will require that combined-sewer and sanitary-sewer overflows and stormwaters be disinfected before discharge. Chlorination has been by far the dominant disinfectant; however, the issues of residual chlorine and chlorine by-products, and their associated toxic effects in the local aquatic environment, has led to the need to develop alternative disinfection technologies. Ultraviolet light (UV) neither leaves a residual nor produces toxic by-products, but its widespread use as a disinfectant has been hampered by its sensitivity to wastewater quality, the occluding effects of solids, and the ability of damaged microorganisms to repair.

OBJECTIVE

To demonstrate the technical feasibility of disinfecting combined-sewer overflow- (CSO) type, low-quality wastewaters with UV alternative lamp systems.

DESCRIPTION

The contractor will: (1) review and select equipment for removing particulate from primary and secondary wastewater streams and disinfecting the streams using state-of-the-art UV equipment; (2) design and install a disinfection pilot plant using three UV systems; (3) design and install one or more particulate-removing units to provide screened wastewater to the UV pilot plant; (4) test the pilot UV systems using various types of partially treated wastewaters, including CSO wastewaters from 10 CSO sites; and (5) characterize the particle-size distribution of the influent wastewaters and the UV dose-response.

BENEFITS

Cost and energy-use benefits will be calculated as part of the project scope. UV offers the benefit of no toxic residual or by-products. UV disinfection will provide advantages over chlorination in safety, training, equipment handling, and building requirements.

SCHEDULE AND STATUS

The project began in January 1997.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$199,535	0	$199,535
Rockland County	56,203	0	56,203
HydroQual	14,000	0	14,000
Equipment manufacturers	30,000	0	30,000
TOTALS	$299,738	0	$299,738

Contractor: Rockland County Sewer District
Site: Orangeburg, Rockland County
Contract Duration: 1/97 - 12/97
Key Words: environmental, municipal, wastewater treatment, disinfection
Project Manager: Larry Pakenas (518) 862-1090, ext. 3247
Program: Environmental Research
Subprogram: Municipal Wastewater and Sludge
Contract No.: 4442-ERTER-MW-96

-> Excess Dredge-Water Treatment System

Develop and document capabilities of system for treating excess dredge water.

BACKGROUND

New York and New Jersey recently agreed to commit $130 million for deepening New York City's harbor to stem losses of economic activity due to sediment deposition. More than 150,000 jobs and $20 billion in annual sales are generated by port commerce. Before recent restrictions on off-shore dumping, about six million cubic yards of sediment were dredged annually. More than one-third of the sediment in the harbor is now classified by the Army Corps of Engineers as Category III material, not suitable for ocean disposal. Disposal is expensive; recently, it cost $118 per cubic yard to dispose of dredge materials containing 50-percent water. An economical way to make dredge water clean enough to return to the ocean could result in significant savings, both in energy used to transport it to landfills or wastewater-treatment plants, and in the overall costs of sediment disposal in New York City.

OBJECTIVE

Melrose Marine Service, Inc. has invested in a system designed to capture sufficient contaminants from dredge water for it to be returned directly to the ocean. An initial project objective is to develop a plan for bringing the system to market. Research objectives include developing, testing, and documenting system design parameters for efficient particulate removal. If successful, the resulting data will be used to advance the commercialization plan.

DESCRIPTION

Testing will be used to establish process design, equipment arrangements, feed rates of any flocculant chemicals, and dredge-material flow rates that will optimize the energy efficiency and overall economics of the process. A commercialization plan will be developed and four dredge sites selected for sampling. After the samples are characterized, bench-scale tests will evaluate the benefits of adding flocculants. Larger samples will be taken from two sites for a pilot-scale testing program to examine the system effectiveness for different flocculants, sediments, hydraulic loadings, and particle size. One large sample will be taken for a full-scale operations test. Test results will be used to update the commercialization plan and begin implementing it.

BENEFITS

If successfully commercialized, the system will reduce costs for disposing of the millions of cubic yards of dredge material that need to be removed from State waterways. In New York harbor alone, dredging costs could be reduced by up to $20 million per year. If successful, the system could contribute to more rapid dredging of New York's harbor and help prevent diversion of shipping to other deep-water ports such as Norfolk, Virginia. This would save the State's consumers from having to pay higher prices to cover the fuel and other costs of trucking goods to New York.

SCHEDULE AND STATUS

Development of the preliminary commercialization plan, site selection, and regulatory approvals are expected to be completed by June 1997. Bench-scale testing of flocculants is planned for mid-1997, with pilot-testing to follow in the late summer. Field-testing is planned for early 1998, and final documentation of system capabilities is to be completed by August 1998.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	0	$250,000	$250,000
Melrose Marine Service, Inc.	0	199,127	199,127
Chesner Engineering, PC	0	54,141	54,141
TOTALS	0	$503,268	$503,268

Contractor: Melrose Marine Service, Inc.
Site: Town of Southold, Suffolk County
Contract Duration: 8/96 - 9/98
Key Words: product development, wastewater treatment
Project Manager: Tom Fiesinger, (518) 862-1090, ext. 3218
Program: Environmental Research
Subprogram: Solid Waste Management
Contract No.: 4452-ERTER-ER-97

Monitor and evaluate wastewater-treatment system's performance.

BACKGROUND

Seasonally and during rain storms, the Village of Minoa's wastewater-treatment plant is overloaded and cannot meet its discharge permit. To correct this, the Village is improving its existing facility and plans to increase capacity to treat large and seasonally variable flows. This additional capacity, however, has to be oversized because it is based on peak hourly flow and not the average flow. The Village has proposed using a subsurface-flow wetland (SFW) to attenuate and treat the variable wastewater flow. The SFW, recognized as an innovative technology, is eligible for zero-percent financing from the State Revolving Fund. Construction will be phased. In the first phase, an SFW will be designed, constructed, and tested to treat part of the seasonal flow and to determine the need for additional capacity.

OBJECTIVE

Demonstrate the capability of an SFW to treat primary or secondary effluent.

DESCRIPTION

The contractor will: (1) design, construct, plant, and operate an SFW with three cells that can be operated in parallel and in series, with each cell divided by an impermeable barrier and planted with one of two plant species, leaving one-half unplanted to evaluate the effects of hydraulic residence time, plant species, and mode of operation on performance; (2) improve the existing facility by installing new screening equipment and a wetlands effluent-recycle system, and replacing rock filter media with synthetic cross-flow media in its trickling filter; (3) conduct tracer tests to test hydraulic characteristics of the SFW; (4) install sampling wells and monitor flow, temperature, and conventional wastewater parameters over a two-year period to determine performance; and (5) evaluate the energy and operating costs of the system and compare these to conventional treatment systems.

BENEFITS

If the SFW is successful, conventional capacity can be reduced, lowering capital, operating, and maintenance costs, and saving energy. The SFW approach may offer an economical alternative to other communities in New York State for treating combined sewer-overflow problems.

SCHEDULE AND STATUS

The wetland was planted in April 1995. Hydraulic testing was completed in August 1995. The SFW was started up on secondary effluent cells and switched to primary effluent before the fall of 1995. SFW biochemical oxygen demand removal by August 1996 was lower than expected. An external review committee was formed to troubleshoot the project. The wetland will be operated in series operation during the summer of 1997.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$250,000	0	$250,000
U.S. Environmental Protection Agency	200,000	0	200,000
Village of Minoa***	786,000	0	786,000
Clarkson University**	112,633	0	112,633
TOTALS	$1,348,633	0	$1,348,633

*** including an estimated $742,000 for SFW construction.
** in-kind contributions.

Contractor: Village of Minoa; subcontractor: Clough, Harbour & Associates
Site: Village of Minoa, Onondaga County, and Potsdam, St. Lawrence County
Contract Duration: 11/94 - 9/97
Key Words: environmental, municipal, wastewater treatment, constructed wetland
Project Manager: Barry Liebowitz (518) 862-1090, ext. 3248
Program: Environmental Research
Subprogram: Municipal Wastewater and Sludge
Contract No.: 4066L-ERTER-MW-95

Reduce nitrogen in wastewater effluent to prevent eutrophication of Long Island Sound.

BACKGROUND

Since 1992, the New York City Department of Environmental Protection (NYCDEP) has dewatered its digested sludge. The centrate produced from dewatering about 4.5 million gallons per day from all of NYC's pollution-control plants contains high concentrations of ammonia (about 800 milligrams per liter) and biochemical oxygen demand (BOD). The centrate returned to the head of the treatment plant has increased the amount of nitrogen discharged. About 3.2 million gallons of centrate per day are processed by four plants (Wards Island, Hunts Point, Bowery Bay, and Tallman Island) that discharge to Long Island Sound, where the "no net increase" policy for nitrogen, due to concern about eutrophication, is expected to become a State Pollution Discharge Effluent Standard (SPDES) permit requirement.

OBJECTIVES

To evaluate the performance of a pilot-plant designed to treat digester centrate at operating conditions that simulate full-scale conditions to minimize the need for further scale-up.

DESCRIPTION

The contractor will: (1) design, construct, operate, and monitor a 25,000-gallon-per-day facility to test a new biological nutrient removal (BNR) process at Wards Island; (2) test and evaluate a variety of cross-flow filter membranes, both at bench-scale and pilot-scale; (3) test and evaluate the performance of a variety of oxygen-transfer devices; (4) develop reliable design parameters for full-scale plant design; (5) evaluate the advantages and benefits of this BNR process in terms of energy, capital, and operating and maintenance cost savings and sludge reductions compared to conventional BNR; and (6) communicate the results of this demonstration to NYCDEP, regulators, and others in the technical and environmental community. (Note: The new BNR process includes pH adjustment and direct nitrification by biological treatment in a completely mixed reactor, followed by cross-flow filtration to retain active biomass. The nitrified cross-flow filtration effluent then will be added to an anoxic zone of the activated-sludge process at the Wards Island plant for denitrification.)

BENEFITS

Direct biological treatment of the centrate after dewatering uses the higher-source temperature (about 36°C) of the centrate to promote high rates of biological nitrification. Based on the effect of temperature, reduction in tankage volume of 70-80 percent is possible compared to the volume required at 15°C, due to increases in rate. Cross-flow filtration substituted for secondary clarifiers and return-sludge-pumping leads to further savings in capital and operating cost and reduces the area required for the system. Mixing cross-flow effluent with return-sludge in the anoxic zone of the modified activated-sludge process eliminates the need for methanol to achieve denitrification and leads to savings in storage, dosing, and feedstocks. Using return-sludge will reduce energy needs for both aeration and sludge production.

SCHEDULE AND STATUS

Five cross-flows filters were tested on a bench-scale. The pilot-plant is under construction. Testing will begin in August 1997.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$250,000	0	$250,000
NYCDEP	1,504,000	0	1,504,000
TOTALS	$1,754,000	0	$1,754,000

Contractor: New York City Department of Environmental Protection
Site: Wards Island, New York County
Contract Duration: 4/95 - 9/98
Key Words: environmental, municipal, wastewater, nitrification, denitrification, centrate, eutrophication
Project Manager: Barry Liebowitz (518) 862-1090, ext. 3248
Program: Environmental Research
Subprogram: Municipal Wastewater & Sludge
Contract No.: 4065-ERTER-MW-95

Combustion-test multiple-hearth sludge incinerator.

BACKGROUND

All the sludge incinerators at the City of Oswego East Side Wastewater Treatment Plant, designed and constructed more than 20 years ago, are inefficient, and some are obsolete, with poor combustion, odors, and particulate emissions. Many of the incinerators are manually controlled, with changes to operating procedure based on visual inspections of feed sludge, sludge combustion in the furnace, ash, temperature gauges, and stack emissions. Energy costs for the incinerators are about $180,000 per year. The exhaust heat is not recovered and used.

OBJECTIVE

To record and analyze sludge-management operations data and sludge-incinerator combustion data for incinerator improvements and waste-heat-recovery options.

DESCRIPTION

The contractor will: (1) prepare a comprehensive combustion-testing plan, (2) determine incinerator instrumentation and control needs, (3) compute heat balances and evaluate combustion quality and air-pollution control effectiveness for pending and future New York State stack-emissions regulations, and (4) prepare a waste-heat recovery and use feasibility study.

BENEFITS

The City expects to save at least $150,000 each year in energy costs after installing instrumentation, controls, and heat-recovery equipment at the plant.

SCHEDULE AND STATUS

The project, scheduled to begin in November 1991, was delayed due to emergency construction requirements at the treatment plant. Combustion testing was performed in February 1995. Data analysis has been completed. The draft final report will be completed shortly.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$54,532	0	$54,532
City of Oswego	78,472	0	78,472
TOTALS	$133,004	0	$133,004

Contractor: City of Oswego
Site: Oswego, Oswego County
Contract Duration: 11/91 - 6/97
Key Words: environmental, municipal, combustion, incineration, sludge management, heat recovery, combustion testing
Project Manager: Larry Pakenas (518) 862-1090, ext. 3247
Program: Environmental Research
Subprogram: Municipal Wastewater and Sludge
Contract No.: 1729-ERER-MW-92

-> Using Ash from Sludge Incinerators

Investigate feasibility of using ash from sludge incinerators in pavement mixtures.

BACKGROUND

This project will determine if incinerator ash can be used as a substitute for fine aggregate or as an additive in asphalt and portland-cement concrete mixtures. The Suffolk County Department of Public Works pays more than $75,000 annually for ash disposal. The Department would like to use the ash as a construction material for public works projects in the County.

OBJECTIVE

To determine whether sludge incinerator ash is suitable to use in portland cement and asphalt concrete mixtures for pavements and structures..

DESCRIPTION

The contractor will: (1) determine physical and chemical characteristics of sludge incinerator ash from the Bergen Point Wastewater Treatment Plant; (2) prepare and test laboratory mixtures of asphalt and portland-cement concrete containing ash; (3) determine if ash is suitable as an additive or as a substitute for fine aggregate; (4) prepare and test field-scale pavements and erosion-control structures for durability, wear, runoff, and environmental impact; and (5) develop standard specifications for ash/asphalt and ash/portland-cement mixtures for the building and highway-construction industries.

BENEFITS

If environmentally acceptable, incinerator ash may be used as a construction material by the building and highway industries for erosion control and pavements. Removing this material from landfills will save valuable space and eliminate a possible source of heavy metals and toxics that could contribute to environmental pollution.

SCHEDULE AND STATUS

The ash-characterization plan and the characterization report are complete. Mixtures of portland-cement and asphalt concrete were prepared and laboratory-tested for physical and chemical properties. Pavement slabs of selected mixtures were tested further in the laboratory for runoff and freeze-thaw. One asphalt and one portland-cement concrete pavement section were field-tested in April 1993. The work plan for the Phase II effort is complete. Laboratory work on erosion-control structures was performed in the last quarter of 1994. Field work began in June 1996. A concrete block wall has been constructed in a bay subject to wave action. Blocks are removed and tested monthly.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$575,000	0	$575,000
Suffolk Co./CCNY	643,560	0	643,560
TOTALS	$1,218,560	0	$1,218,560

Contractor: Suffolk County Department of Public Works
Site: Babylon, Suffolk County
Contract Duration: 8/90 - 12/97
Key Words: environmental, municipal, combustion, incineration, ash utilization, sludge management
Project Manager: Larry Pakenas (518) 862-1090, ext. 3247
Program: Environmental Research
Subprogram: Municipal Wastewater and Sludge
Contract No.: 1572-ERER-MW-90

-> Oxygen-Enriched Multiple-Hearth Sewage-Sludge Incinerator Demonstration

Demonstrate oxygen-enriched combustion technology for reducing volatile organic compound and odor emissions, and natural gas consumption of multiple-hearth incinerator at wastewater-treatment plant.

BACKGROUND

Poor combustion efficiency of multiple-hearth sewage-sludge incinerators results in undesirable volatile organic compound (VOC) and odor emissions. Many incinerators are retrofit with natural-gas afterburners to complete the combustion process and minimize emissions. New VOC- and odor-emission regulations will require significant equipment and operational changes at multiple-hearth facilities; this may lower incinerator-sludge throughput.

OBJECTIVES

To demonstrate oxygen-enriched combustion technology for reducing VOC and odor emissions and natural-gas consumption, without reducing sludge throughput, at a municipal wastewater-treatment plant (WWTP) multiple-hearth sewage-sludge incinerator.

DESCRIPTION

Oxygen-injection equipment will be designed, fabricated, installed, and tested to improve combustion performance of a multiple-hearth sewage-sludge incinerator. An oxygen-delivery, storage, and control system will be designed, installed, and evaluated on site. VOC and odor emissions and natural-gas consumption will be measured and compared with and without oxygen injection. Tradeoffs between incinerator emissions and sludge-feed rate will be determined.

BENEFITS

A successful demonstration of this technology may provide sewage-sludge incinerator operators an economical alternative for complying with new VOC-and odor-emission regulations without reducing sewage-sludge-processing feed rates. New York State vendors could benefit from manufacturing and marketing oxygen-enrichment equipment and combustion-injection equipment. Industrial Incineration Incorporated of Rochester (Monroe County) may receive orders to refurbish multiple-hearth incinerators with enriched oxygen-injection systems.

SCHEDULE AND STATUS

Project work is complete and the contractor is reviewing test data and preparing the final project report.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$199,960	0	$199,960
Praxair, Inc.	199,960	0	199,960
TOTALS	$399,920	0	$399,920

Contractor: Praxair, Inc.
Site: Tarrytown, Westchester County; Tonawanda, Erie County; and Rochester, Monroe County
Contract Duration: 11/94 - 7/97
Key Words: environmental, air quality, product development, sludge management, municipal, industrial
Project Manager: Joe Sayer (518) 862-1090, ext. 3298
Program: Environmental Research
Subprogram: Air Quality/Environmental Impacts
Contract No.: 4051-ERTER-ER-95

-> Winery Wastewater Treatment using Anaerobic Mobilized-Film Technology

Reduce winery energy use, operating costs, and sludge production with anaerobic wastewater treatment.

BACKGROUND

AnAerobics Inc. (AAI) operated a 10,000-gallon-per-day (gpd) pilot plant using mobilized film technology at Canandaigua Wine Company (CWC) in 1994-95, demonstrating its potential to reduce energy use, and chemical, polymer, and sludge-disposal costs. In January 1996, AAI entered into an agreement with CWC to build and initially operate a full-scale anaerobic MFT treatment system in exchange for a share in CWC's savings from not operating its existing aerobic wastewater-treatment plant. MFT is an expanded-bed-type reactor in which sand particles or other media are kept in motion by up-flowing wastewater and bacterial biomass that attaches to the media to treat the wastewater.

OBJECTIVES

To demonstrate the capability of the anaerobic MFT treatment system to meet the City of Canandaigua's sewer permit requirements and document the costs and benefits of the anaerobic system.

DESCRIPTION

The contractor will: (1) design, fabricate, install, and operate two 26,000-gallon anaerobic MFT modules and other necessary subsystems to treat an average of 50,000 gpd of winery wastewater; (2) develop system check-out, start-up and operating plans; (3) monitor wastewater flow rates, MFTs and total power demand, and energy consumption for the treatment system, biogas production and usage (including, flared gas and supplemental gas usage), total chemical usage (including phosphoric acid, aqueous ammonia, polymer and ferric chloride), and sludge production; (4) sample treatment-plant influent and effluent for total and soluble chemical oxygen demand, biochemical oxygen demand, and suspended and volatile suspended solids, total phosphorus, ortho phosphate, pH, temperature, alkalinity, and total volatile acids; and (5) analyze system and process data collected and evaluate performance.

BENEFITS

The anaerobic MFT system potentially could reduce CWC's operating costs for wastewater treatment by 95 percent and could be used by other wineries and industries with similar waste streams in New York State.

SCHEDULE AND STATUS

Construction began in September 1996 and was completed by February 1997. The facility is treating 2/3 of CWC's daily flow. Operators hope to shut down one of two aeration tanks in June 1997.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$250,000	0	$250,000
AnAerobics Inc.	425,764	0	425,764
Canandaigua Wine Company	223,700	0	223,700
C&S Engineers Inc.	102,400	0	102,400
General Contractor	128,000	0	128,000
City of Canandaigua	2,940	0	2,940
TOTALS	$1,132,804	0	$1,132,804

Contractor: AnAerobics Inc.
Site: Canandaigua, Ontario County
Contract Duration: 3/96 - 3/98
Key Words: environment, assist business, industrial, wastewater treatment, anaerobic digestion
Project Manager: Barry Liebowitz (518) 862-1090, ext. 3248
Program: Environmental Research
Subprogram: Wastewater Treatment and Sludge Management
Contract No.: 4280-ERTER-MW-96

-> Anaerobic Pretreatment of Sewage: Optimization Studies and Assessment of Post-Treatment Impacts on Conventional Aeration Processes

Determine optimal level of anaerobic pre-treatment based on costs and savings associated with reduced aeration and sludge-management requirements.

BACKGROUND

Anaerobic processes are typically used in wastewater-treatment plants to digest biological solids (sludge), not to treat wastewater. Anaerobic attached-film reactors, however, have shown promise in pretreating wastewater, saving energy and reducing sludge volume.

OBJECTIVES

To determine the performance of an anaerobic expanded-bed reactor as a function of temperature and loading rate, using attached-film media from another NYSERDA project at Cornell University; determine the effect of anaerobic pretreatment on downstream processes using aerobic bench-scale sequencing batch reactors as a function of loading rate and temperature; to develop an analytical model to estimate the optimal process configuration based on performance and cost of a variety of processes, including anaerobic expanded-bed reactors, activated-sludge and trickling filters, secondary clarification, vacuum dewatering, and sludge disposal, and to determine the fate of recalcitrant organics (picric acid) of anaerobic pretreatment followed by aerobic treatment.

DESCRIPTION

The contactor will: (1) conduct bench-scale experiments to evaluate anaerobic pretreatment (APT) of sewage followed by conventional aerobic treatment through bench-scale experiments, (2) use bench-scale processes to investigate APT effects on downstream aerobic processes to determine if these processes still perform as designed, (3) develop a process-optimization model to determine the conditions that make APT favorable, (4) verify the model against local municipal treatment plants near Clarkson University, (5) hold seminars for design engineers and treatment-plant operators, and (6) develop commercial-quality APT model software and a user's manual for test-marketing. The improved APT model will include more processes and features such as nitrification, filter-press dewatering, and user-defined options.

BENEFITS

When cost-effective, APT will reduce the energy required for aeration and the amount of sludge for treatment and disposal.

SCHEDULE AND STATUS

The APT software package was distributed to a test market group of design engineers. Interest by design engineers was weak. A final report is expected in June 1997. Clarkson has decided not to market the software. NYSERDA staff will try to develop a technology transfer strategy that will put the APT software to use.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$282,736	0	$282,736
Clarkson University	194,986	0	194,986
Village of Potsdam*	9,300	0	9,300
Walker Process*	6,000	0	6,000
Dupont Chemical**	15,000	0	15,000
TOTALS	$508,022	0	$508,022

*in-kind contribution; **cash contribution

Contractor: Clarkson University
Site: Potsdam, St. Lawrence County
Contract Duration: 6/91 - 12/96
Key Words: environmental, university, anaerobic processes, biological pretreatment, wastewater treatment, biogas, wastewater chemistry
Project Manager: Barry Liebowitz (518) 862-1090, ext. 3248
Program: Environmental Research
Subprogram: Municipal Wastewater and Sludge
Contract No.: 1772-ERER-ER-91

-> Phosphoric Acid Fuel-Cell Testing using Anaerobic-Digester Gas

Test 200kW phosphoric acid fuel cell and gas pre-treatment unit on anaerobic-digester gas at Yonkers Sewage Treatment Plant.

BACKGROUND

Anaerobic digesters at sewage-treatment plants produce gas that consists mainly of methane, carbon dioxide and hydrogen sulfide (H_2S). Some of this gas is used to operate the plant, but most is flared, adding to the amount of air pollutants and waste heat in the atmosphere. The contractor will install a 200kW fuel-cell power plant and a gas cleanup system at the sewage-treatment plant to produce electricity with a portion of the gas. The PC25 200kW fuel cell and gas-cleaning system has not been used with anaerobic-digester gas before. The ONSI PC25 phosphoric acid fuel cell is the first commercially available fuel cell. Approximately 55 of these 200kW units have been sold throughout the world to various gas and electric utilities.

OBJECTIVE

To construct an anaerobic-digester gas-cleaning system to remove H_2S and use the gas to produce electricity from a fuel cell.

DESCRIPTION

The contractor will: (1) fabricate and install a digester gas-cleaning unit and a PC25 fuel-cell power plant at the Yonkers Sewage Treatment Plant; (2) rigorously test the units and determine if they are successful; (3) evaluate whether other units should be installed in parallel to use as much gas as possible and maximize electricity production; (4) operate the system for three years; (5) conduct a comprehensive gas analysis to characterize oxygen, nitrogen, carbon monoxide, methane, carbon dioxide, ammonia, volatile organics, and sulfur gases; and (6) monitor fuel-cell efficiency, power output, reliability, emissions, and long-term operating costs using an independent contractor to preserve the integrity of the data.

BENEFITS

There are 34 sewage-treatment plants in the New York City area with anaerobic digesters that produce enough gas to generate 5-10 MW of electricity using fuel-cell power plants. A successful application along with an independent monitoring effort would pave the way for other similar anaerobic-digester gas or landfill applications. In addition, this project would provide additional economic development benefits to the New York State manufacturers that provide 29% of the fuel cell's value.

SCHEDULE AND STATUS

The fuel cell construction will be completed in the summer of 1997. The cell will be operated, monitored, and evaluated for a three-year period.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	0	$400,000	$400,000
New York Power Authority	0	850,000	850,000
Electric Power Research Institute	0	170,000	170,000
U.S. Department of Energy/NREL	0	100,000	100,000
TOTALS	0	$1,520,000	$1,520,000

Contractor: New York Power Authority
Site: Yonkers Sewage Treatment Plant, Westchester County
Contract Duration: 3/96-3/00
Key Words: product development, environmental, electricity, wastewater treatment
Project Manager: Jim Reis (518) 862-1090, ext. 3251
Program: Environmental Research
Subprogram: Solid Waste Management
Contract No.: 4314-ERTER-ER-96

-> Solar Detoxification of Contaminated Waters with Porous Photocatalyst

Synthesize titanium dioxide porous photocatalyst to evaluate catalyst morphology and efficiency, and develop theory relating synthesis conditions and catalyst performance.

BACKGROUND

Transporting oil and manufacturing and using energy and chemical products contaminate the environment through spills and disposing of the residues in unlined landfills. Spills of oil products such as gasoline are not readily removed from surface waters except through evaporation. Photocatalytic destruction, if perfected, could economically mitigate oil spills and treat waters by converting the contaminants to carbon dioxide and water vapor using solar energy. This technology is in the very early stages of development.

OBJECTIVES

To produce titanium dioxide (TiO_2) aerogels with preferred material and chemical properties light enough to float in oil spill/aqueous environments, and develop an analytical theory to model the chemical and mass-transfer properties of the materials produced.

DESCRIPTION

The contractor will: (1) synthesize photocatalyst materials, (2) determine the photocatalytic activity on candidate compounds, (3) analyze the form of porous TiO_2 materials, (4) determine the kinetics of porous catalysts, and (5) develop a computer simulation and theory upon which to base improving photocatalyst system performance.

BENEFITS

One of NYSERDA's goals is to reduce or mitigate adverse environmental effects of energy facilities. This project specifically addresses the cleanup problems of oil spills; however, the technology also may be applied to leachate treatment and groundwater remediation (the latter, for example, at the site of old town-gas facilities). This research may lead to developing a waste-treatment technology that uses solar energy to clean up oil spills more rapidly.

SCHEDULE AND STATUS

Two TiO_2 aerogels, annealed and non-annealed, were synthesized using sol-gel techniques. The aerogel's pore volume, surface area, and size were determined. The absorption isotherms and kinetics of salicylic-acid disappearance were determined. Similar experiments using phenol are ongoing. Three scientific papers have been published. A model relating catalyst dimensionality and performance has been formulated. Based on this progress and continued U.S. Department of Energy support, the project was funded incrementally. Oil-tank residues and landfill leachate were used as experimental substrates. Future tests using the aerogels will be done on tannic acid, fulvic acid, a simple chlorinated hydrocarbon, or ammonia. The draft final report material is under review.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$104,542	0	$104,542
U.S. Department of Energy	376,598	0	376,598
TOTALS	$481,140	0	$481,140

Contractor: Brooklyn College/City University of New York
Site: Brooklyn, Kings County
Contract Duration: 11/92 - 6/97
Key Words: environmental, university, wastewater treatment, catalyst, oil spill, solar energy, titanium dioxide, aerogels
Project Manager: Barry Liebowitz (518) 862-1090, ext. 3248
Program: Environmental Research
Subprogram: Municipal Wastewater and Sludge
Contract No.: 1983M-ERER-MSW-93

-> Long-Term Fate of Land-Applied Wastewater Sludge Products -- Clarkson University

Compare mobility of metals in variety of sludge products applied to soil.

BACKGROUND

Municipalities can use a variety of processes to manage the sludge produced by wastewater treatment, including composting, digestion, chemical conditioning/stabilization, incineration, and dewatering/drying. All consume energy, and all yield a beneficial sludge residue or by-product that may be used on land as a soil amendment. In addition, ash may be used as a construction material and dried sludge as a boiler fuel. NYS Department of Environmental Conservation (DEC) regulations specify only compost as a beneficial use of sludge, and require other sludge products to apply for a beneficial-use determination on a case-by-case basis. With the end of ocean-dumping and landfill closings, sludge-management practices will depend more on land-application. To ensure that supply does not exceed demand for specific sludge products, municipalities need to have a variety of options for sludge management.

OBJECTIVES

To determine and compare long-term environmental and economic costs and benefits of land-applied sludge products, including compost, anaerobically digested/dewatered sludge, dried sludge, chemically stabilized sludge, and incinerator ash; to evaluate the effect of freeze/thaw and plant-growth cycles on the fate of sludge constituents; and, by cost/benefit and energy-use analysis, to compare the advantages and disadvantages of sludge-management options. The project will be reviewed periodically by a Technical Advisory Committee comprising State and U.S. Environmental Protection Agency regulators, municipal officials, and members of the scientific community.

DESCRIPTION

The research design consists of applying a minimum of eight sludge products to two types of NYS soils, and subjecting the soil/sludge test cells to both freeze/thaw and plant-growth cycles. The contractor will determine the fate of the metal constituents in the sludge product/soil-test cell with respect to soil, leachate, and plant matter. The bioavailability of copper and mercury will be investigated using a genetically altered microorganism that becomes luminescent when these metals are taken in. Gross wastewater-pollutant parameters and PCBs also will be monitored.

BENEFITS

More knowledge about the relationships among sludge-management practice, product composition, and the fate of metals and other constituents of concern will be useful to DEC and the NYS Dept. of Agriculture and Markets when refining regulations concerning the beneficial use of sludge products, and to sludge managers concerned with costs and benefits.

SCHEDULE AND STATUS

A new set of soil test-cell experiments began in February 1995 using five products derived from Onondaga County sludge. A meeting of the TAC will be scheduled in August 1997.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$381,140	0	$381,140
Clarkson University	197,860	0	197,860
General Electric Company *	27,000	0	27,000
TOTALS	$606,000	0	$606,000

* in-kind contribution

Contractor: Clarkson University
Site: Potsdam, St. Lawrence County
Contract Duration: 9/92 - 8/97
Key Words: environmental, university, assist business, sludge management, land application, municipalities
Project Manager: Barry Liebowitz (518) 862-1090, ext. 3248
Program: Environmental Research
Subprogram: Municipal Wastewater and Sludge
Contract No.: 1990-ERER-MW-93

-> Long-Term Fate of Land-Applied Wastewater Sludge Products -- Cornell University.

Compare mobility of metals in variety of sludge products applied to soil.

BACKGROUND

Municipalities can use a variety of processes to manage sludge produced by wastewater treatment, including composting, digestion, chemical conditioning/stabilization, incineration, and dewatering/drying. All consume energy, and all yield a sludge residue or by-product that may be used beneficially on land as a soil amendment. Ash also may be used as a construction material, and dried sludge as a boiler fuel. NYS Department of Environmental Conservation (DEC) regulations specify compost only as a beneficial use of sludge, and require other sludge products to apply for a beneficial-use determination on a case-by-case basis. With ocean-dumping ending and landfills closing, sludge-management practices will depend more on land-application. To ensure that supply does not exceed demand for specific sludge products, municipalities need to have a variety of options for sludge management.

OBJECTIVES

To determine and compare long-term environmental and economic costs and benefits of land-applying sludge products, including compost, anaerobically digested/dewatered sludge, dried sludge, chemically stabilized sludge, and incinerator ash. The project will be reviewed periodically by a Technical Advisory Committee (TAC) comprising State and U.S. Environmental Protection Agency regulators, municipal officials, and members of the scientific community.

DESCRIPTION

The contractor will: (1) field-sample five "old" sludge-application sites for soil, leachate, plant material, earthworms, and surface runoff, (2) conduct laboratory experiments to study the effects of soil type, sludge-product type, and pH on metals and nutrients movement, including three NYS soil types and five sludge products; (3) procure these five sludge products from a single source; (4) determine the environmental fate of the metal constituents in the sludge product with respect to soil, leachate, and plant materials; (5) develop a model to predict the long-term impact of nutrient movement on groundwater; (6) evaluate the cost/benefit and energy use of the various sludge-processing land-application methods; and (7) compare the advantages and disadvantages of sludge-management options.

BENEFITS

Knowledge about sludge-management practice, product composition, and the fate of metals and other constituents will be useful to DEC and the NYS Dept. of Agriculture and Markets when refining regulations concerning the beneficial use of sludge products, and to sludge managers concerned with costs and benefits.

SCHEDULE AND STATUS

Sampling of runoff, soil, flora, and fauna continue. Five cycles, two at agricultural-application rates and two at 100-ton-per-hectare and two post-application, are complete. A TAC meeting will be scheduled for August 1997.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$273,585	0	$273,585
Cornell University	101,328	0	101,328
Onondaga County*	2,000	0	2,000
TOTALS	$376,913	0	$376,913

* in-kind contribution through Memorandum of Understanding No. 1991A-ERER-MW-93.

Contractor: Cornell University
Site: Ithaca, Tompkins County
Contract Duration: 9/92 - 6/97
Key Words: environmental, university, sludge management, land application, municipalities
Project Manager: Barry Liebowitz (518) 862-1090, ext. 3248
Program: Environmental Research
Subprogram: Municipal Wastewater and Sludge
Contract No.: 1991O-ERER-MW-93

-> Low-Cost Small-Community Wastewater-Treatment Systems

Evaluate and compare feasibility of small-community wastewater-treatment alternatives.

BACKGROUND

Many small communities have inadequate or failed on-site wastewater-treatment systems, which can lead to adverse environmental and health effects. Conventional central treatment systems (including sewers) cost about $10,000 per household, with operating and maintenance costs of about $150 per household each year, making them prohibitive for many small communities.

Combining individual and clustered septic tanks/sand filters to discharge to one or several absorption-field/wetland (AF-wetland) areas may offer a low-cost, energy-efficient alternative, while meeting secondary treatment standards and ammonia/nitrogen effluent limits. This approach uses a distributed secondary treatment system (DST) rather than a central treatment approach. The AF-wetland can be used as park landscaping, a community greenspace, a jogging trail or bike path, or a tree farm.

This system is being evaluated in seven New York State communities, including a hamlet in the Town of Lafayette, Onondaga County; a hamlet in the Town of Cairo, Greene County; the communities of Ransomville and Romberg Beach in the Town of Porter, Niagara County; the communities of Duane Lake, Mariaville Lake, Duanesburg, and Quaker Street/Delanson in the Town of Duanesburg, Schenectady County; the Village of Morrisville, Madison County; the Village of Lyons Falls, Lewis County; and the hamlet of West Valley in the Town of Ashford, Cattaraugus County.

OBJECTIVES

Evaluate the feasibility of the DST/AF-wetland and conventional wastewater-treatment alternatives.

DESCRIPTION

Each contractor will prepare an engineering report including a preliminary design and life-cycle cost comparison of the DST/AF-wetland with conventional low-cost alternatives. Information will be assembled to allow each community to pursue regulatory approval.

BENEFITS

The project will provide the information each community needs to make loan applications if the approach is found to be technically and economically feasible. The DST system also offers a low-cost wasterwater-treatment alternative for new subdivisions.

SCHEDULE AND STATUS.

Preliminary reports were received. A summary report will be prepared by NYSERDA staff when all final reports are received.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$291,092	$1,500	$292,592
Town of Cairo	25,000	0	25,000
Town of Porter	11,690	0	11,690
Town of Duanesburg	7,469	3,500	10,969
Village of Morrisville	12,465	0	12,465
Town of Lafayette	22,190	0	22,190
Village of Lyons Falls	20,956	0	20,956
Town of Ashford	1,750	0	1,750
TOTALS	$392,612	$5,000	$397,612

Contractor: Municipalities listed above
Site: Greene, Niagara, Cattaraugus, Schenectady, Madison, Onondaga, and Lewis counties
Contract Duration: 12/94 - 9/97
Key Words: environmental, municipal, wastewater treatment, small flow, constructed wetlands
Project Manager: Barry Liebowitz (518) 862-1090, ext. 3248
Program: Environmental Research
Subprogram: Municipal Wastewater and Sludge
Contract Nos.: 3176, 3177, 3178, 3179, 4021, 4022, and 4089-ERTER-MW-94/95

-> Distributed Secondary Wastewater Treatment Monitoring

Monitor performance of distributed secondary wastewater-treatment system at new housing subdivision.

BACKGROUND

The distributed secondary wastewater-treatment system (DSWT) consists of septic tanks and buried sand filters (with plastic liners if necessary) appropriately sized for each household, building, or cluster of homes. The secondary effluent from each sand filter flows to a small (50-gallon) wet well.

From each wet well, the effluent is pumped into the small-diameter, pressurized collection system and conveyed to one or several absorption fields/wetlands (AF/wetland) for subsurface discharge. If gravity sewers are used, the wet well will be needed for observation purposes only.

OBJECTIVES

Document construction, operation, maintenance, and monitoring costs, and assess the performance of a DST AF/wetland system, as described above.

DESCRIPTION

The system would be built by Totem Lodge Estates, a residential development in the Town of Nassau, Rensselaer County. When fully developed, Totem Lodge Estates will consist of 17 homes with an estimated wastewater flow of 7,650 gallons per day. Rensselaer County Water and Sewer Authority (RCWSA) the contractor will: (1) during a two-year monitoring period, collect water samples from the DSWT and community wet wells and three AF/wetland groundwater monitoring wells used to assess system-monitoring requirements and groundwater impacts, (2) analyze samples for chemical and biological oxygen demand, Chloride, total suspended solids, ammonia, nitrate and nitrite, turbidity, and fecal coliform, (3) monitor flow, temperature, hydraulic head, and snow and precipitation data will be collected, (4) conduct on-site "look and sniff" inspections on a periodic basis of the on-site wet wells and septic tanks, (5) document construction and operating and maintenance costs, and (6) develop a homeowner education program.

BENEFITS

The DSWT system has a number of design advantages for new subdivisions, including: reducing initial system capital cost by phasing construction rather than building for future capacity all at once; reducing the size of collection systems and the need for pumping stations through use of multiple absorption areas rather than conveying flows to a central facility; allowing for cluster development design, which minimizes lot sizes, street length, and other utility lines/piping; and reducing energy needs for treatment by using passive treatment systems (septic tanks and buried sand filters) for primary and secondary treatment rather than central systems requiring active aeration and other mechanical devices.

SCHEDULE AND STATUS

Scoping sessions for the environmental impact statement are under way.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$63,106	0	$63,106
RCWSA	19,992	0	19,992
TOTALS	$83,098	0	$83,098

Contractor: Rensselaer County Water and Sewer Authority
Site: Town of Nassau, Rensselaer County
Contract Duration: 3/96 - 3/99
Key Words: environment, municipal, residential, wastewater treatment
Project Manager: Barry Liebowitz (518) 862-1090, ext. 3248
Program: Environmental Research
Subprogram: Wastewater Treatment and Sludge Management
Contract No.: 4328-ERTER-MW-96

-> Identifying Methane-Producing Bacteria Using Immunological Techniques

Develop monitoring tools to control anaerobic digesters.

BACKGROUND

The performance of anaerobic digesters used for wastewater and sludge treatment or to extract energy from waste biomass depends on reactor design, substrate, reactor conditions, process control, and the microorganisms present in the system. The objectives were: to develop and use immunological probes to track changes in microbial populations for potential use as a process control or diagnostic tool; to find ways to alter formation of microbial granules, flocs, and films to optimize reactor conditions; and to pursue discoveries of heat-shock response in methane-producing organisms to genetically improve these organisms in wastewater treatment and energy from biomass systems.

ACCOMPLISHMENTS

(1) Developed and standardized about 63 polyclonal probes and 50 hybridoma cell cultures to produce monoclonal antibodies; (2) collaborated about 10 independent research laboratories to study the microbial ecology of anaerobic bacteria in a variety of bioreactor applications; (3) documented cell-surface composition changes related to the formation of single-cells, packets, and laminar-sheets with the acetate-using methanogen Methanosarcina mazei S-6; and (4) isolated several heat-shock proteins by immunological techniques, determined their amino acid sequence, identified their genetic locus, and studied the genetic expression of heat-shock genes in response to environmental change.

FINDINGS AND CONCLUSIONS

The immunologic probes showed that the presence and quantity of anaerobic bacteria varied with substrate, reactor conditions, and type. The probes also were used to identify known and unknown methanogens in a variety of ecosystems. The value of monitoring specific bacteria was demonstrated as a diagnostic tool in both man-made and engineered systems, but not for purposes of process control.

The Methanosarcina species studied seem to change form as if part of a life-cycle. One enzyme discovered seem to play a role transforming multicellular forms packets and sheets to dispersed single-cell form. This disaggregation factor and other genetic factors affecting cell-surface proteins may be used eventually in controlling biofilm formation, which may be exploited to improve rates of bioconversion.

The heat-shock proteins and their genetic sequences discovered during the project were designated as DnaK/dnaK, GrpE/grpE, and DnaJ/dnaJ. Expected differences in the expression of these genes to temperature shock were not adequately explained by multicellular vs. single-cell form. There is still much to know before these genes can be used to improve bacteria functioning, which might be used to improve bioconversion.

REALIZED OR ANTICIPATED BENEFITS

These were as mentioned above.

TECHNOLOGY TRANSFER ACTIVITIES

The results of this research are presented in 34 scientific papers in peer-reviewed journals. A final report is on file that summarizes the work and explains its relationship to developments in biology and engineering.

FUNDING	TOTALS
NYSERDA	$362,290
Gas Research Institute	159,315
NREL	66,200
New York Gas Group	13,995
TOTALS	$601,800

Contractor: Health Research, Inc.
Site: Albany, Albany County
Contract Duration: 5/87 - 6/96
Key Words: environmental, wastewater treatment, anaerobic digestion, biomass, sludge management
Project Manager: Barry Liebowitz (518) 862-1090, ext. 3248
Program: Environmental Research
Subprogram: Municipal Wastewater and Sludge
Contract No.: 706-RIER-BEA-85

Developed process-control technology for wastewater treatment.

BACKGROUND

NYSERDA developed a process-control method for anaerobic sludge digestion where hydrogen (H_2) and carbon monoxide (CO) were monitored in addition to total gas production, and methane and carbon dioxide concentration. H_2 and CO were found in trace concentrations in the parts per million (ppm) and parts per billion (ppb) range, and were found to be sensitive to changes in organic and hydraulic loading, as well as heavy metal and toxic organic contaminations. The purpose of this project was to develop this method further and apply it to control of high-rate anaerobic wastewater treatment.

ACCOMPLISHMENTS

Experiments were conducted using upflow anaerobic sludge blanket (UASB) reactors treating a synthetic brewery's waste water. The dynamic behavior of the UASB system based on hydraulics, biological kinetics, and mass transfer characteristics was analytically and physically modeled. Steady- and unsteady-state (cyclic) experiments were conducted to provide data to base a control model. Nine organic loading rates (4-25 kg Chemical Oxygen Demand COD/m^3-d) and system hydraulic retention times (HRT) (0.5 to 1.5 days) were used to develop steady-state data. Harmonic and random step-wise perturbation experiments were conducted to determine system response. Data were analyzed using time-series analysis and other statistical techniques. Step-wise cyclic loading and random perturbation experiments to bring the system to failure (up to 60 kg COD/m^3-d) were used to test the trace gas control model. Tests were also conducted with and without pH control.

FINDINGS AND CONCLUSIONS

CO and H_2 were found to be good indicators of the state of the system. Under steady-state conditions these parameters plotted in a bivariate plot of the ratio of CO and H_2 concentration to gas production (GP), in units of ppb/mL/hr and ppm/mL/hr, were within an envelope of {2,1}. This was not the case for perturbations leading to failure when these parameters leave this envelope. Early warning, however, was not obtained by monitoring these parameters. Experiments using phenol as a toxic contaminant, however, did show that CO and H_2 provided early indications of failure prior to a reduction in gas production.

REALIZED OR ANTICIPATED BENEFITS

High-rate anaerobic wastewater treatment proved to be more robust and difficult to bring to failure than expected. The experience at higher loading rates demonstrated the capability of UASBs to handle a wide range of organic loadings without compromising treatment. The UASB reactor was able to handle 25 kg COD/m^3-d without a problem. In all cases, the UASB reactor was able to recover after "failure." MBI and NYSERDA agree markets are limited for early warning of toxic effects based on trace gas monitoring.

TECHNOLOGY TRANSFER ACTIVITIES

A final report will be listed with the National Technical Information Service.

FUNDING	TOTALS
NYSERDA	$198,286
MBI	198,287
TOTALS	$396,573

Contractor: Michigan Biotechnology Institute International (MBI International) and EFX Systems Inc.,
Site: Lansing, Michigan
Contract Duration: 3/92 - 12/96
Key Words: environmental, product development, process control, trace gases, anaerobic treatment, industrial, wastewater treatment
Project Manager: Barry Liebowitz (518) 862-1090 ext. 3248
Program: Environmental Research
Subprogram: Municipal Wastewater and Sludge
Contract No.: 1738-ERER-MSW-92

-> Septage Dewatering and Composting Technology Transfer

Transfer successful treatment technology for septage.

BACKGROUND

NYSERDA sponsored the development, testing, and demonstration of a cost-effective, energy-efficient means to treat domestic septage in the Town of Thompson. First, septage was dewatered, then solids were composted, and the filtrate was aerated and returned to the main treatment plant. The contractor conducted a follow-on technology-transfer program to introduce this technology to other small wastewater-treatment plants (WWTPs) and private septage haulers in New York State.

ACCOMPLISHMENTS

Two seminars were conducted: at the Town of Thompson facility in September 1992 and the New York Water Environment Federation meeting in Corning in June 1994. In addition, a telephone survey was conducted of 49 county planners, eight Department of Environmental Conservation (DEC) regional representatives, 56 WWTP operators, and 27 septage haulers. A final report was prepared that provides a model for implementing the septage-dewatering and composting technology.

FINDINGS AND CONCLUSIONS

Based on survey and demographic data, an estimated 903,000 gallons per day of septage are generated on a 260-day-per-year basis. Of this, 82 percent is hauled to WWTPs for treatment. Dewatering and composting septage can reduce treatment energy use by about 0.07 kWh/lb biological oxygen demand. The septage-dewatering and compost process has a breakeven cost for treatment of about six cents per gallon when aerated effluent is discharged to the WWTP. Tipping fees charged by WWTPs for septage range from between two cents to 13 cents per gallon. In areas of the State where septage treatment is limited, about 50 percent of the wastewater operators surveyed were taking in little or no, or had limited capacity to treat, septage. Based on information gathered in the telephone and mail survey, Ulster, Dutchess, Putnam, Delaware, Schoharie, Otsego, Broome, and Cattaraugus counties need additional septage-treatment capacity.

REALIZED OR ANTICIPATED BENEFITS

Of the WWTP operators contacted, 32 percent expressed interest in composting septage solids. If this percentage were to dewater and compost a proportionate amount of the State's septage, an estimated 280,000 kWh of electricity could be saved yearly. Additional savings would be realized in reduced trucking costs.

TECHNOLOGY TRANSFER ACTIVITIES

The project itself was a technology-transfer effort. The final report, which is an assessment and model for implementation, will be distributed to planners, DEC regional offices, WWTP operators, and private haulers.

FUNDING	TOTALS
NYSERDA	$28,070
E&A Environmental	10,000
Town of Thompson	6,000
TOTALS	$44,070

Contractor: E&A Environmental Consultants Inc.
Site: Town of Thompson, Sullivan County; Southern Tier and Hudson Valley (multiple sites)
Contract Duration: 9/92 - 3/96
Key Words: environmental, municipal, sludge management, septage, wastewater treatment
Project Manager: Barry Liebowitz (518) 862-1090 ext. 3248
Program: Environmental Research
Subprogram: Municipal Wastewater and Sludge
Contract No.: 1958-ERER-MW-93

-> Energy Consulting Services at Municipal Wastewater Treatment Plants

Review 25 wastewater treatment projects for energy-saving opportunities and present results at workshops.

BACKGROUND

A major barrier to implementing energy-saving technologies at New York State municipal wastewater treatment plants (WWTPs) has been the fact that engineers with wastewater-treatment and sludge-management design expertise most often do not have energy-management training. These same engineers then may make recommendations for WWTP construction to regulatory agencies and municipal clients that may not be the most efficient in terms of energy savings.

ACCOMPLISHMENTS

The contractor visited 25 New York State WWTPs; prepared and submitted an energy-evaluation report to each participating municipality; hosted seven workshops for WWTP operators and administrators, engineers, and the New York State Department of Environmental Conservation (DEC) and New York State Environmental Facilities Corporation (EFC) staffs; prepared an energy handbook/reference guide; calculated the increase in treatment capacity at WWTPs where high-efficiency aeration could replace standard-efficiency aeration technology; and contacted WWTPs that received an energy-evaluation report or attended a workshop to determine their plans to use energy-efficient technologies.

FINDINGS AND CONCLUSIONS

None of the WWTP projects reviewed by the contractor included all possible energy-efficient technologies. The contractor found at least one area in all projects where energy efficiency had been overlooked. Approximately 25% of the WWTPs that sent personnel to the workshops stated they subsequently implemented energy-efficient technologies at their WWTPs and the workshop helped make their decisions.

REALIZED OR ANTICIPATED BENEFITS

For the WWTPs studied, the potential energy savings is nine million kWh per year and the estimated annual energy cost savings is $600,000 if the recommended energy-efficient technologies are implemented and wastewater flows remain the same. Energy-efficient aeration also provides for additional treatment capacity at a WWTP. Projected capacity increases ranged from 40-200%, with estimated life-cycle cost savings of up to $25 million.

TECHNOLOGY TRANSFER ACTIVITIES

NYSERDA hosted seven technology transfer workshops across New York State attended by WWTP operators and administrators, consulting engineers, and environmental regulators. Three additional workshops are planned for Fall 1997 in cooperation with the New York Rural Water Association as a special outreach activity to small, rural communities.

FUNDING	TOTALS
NYSERDA	$359,274
TOTALS	$359,274

Contractor: Malcolm Pirnie, Inc.
Site: Buffalo, Erie County
Contract Duration: 4/93 - 2/97
Key Words: environmental, demand-side management, wastewater treatment, sludge management, municipal
Project Manager: Larry Pakenas (518) 862-1090, ext. 3247
Program: Environmental Research
Subprogram: Municipal Wastewater and Sludge
Contract No.: 2034-ERER-MW-93

-> Energy-Efficient Wet-Limestone Flue-Gas Desulfurization and Nitrogen Oxide Emission-Control Process Demonstration

Test two technologies supplied by New York State manufacturers in energy-efficient flue-gas desulfurization process demonstration.

BACKGROUND

The U.S. Department of Energy (U.S. DOE) selected the New York State Electric & Gas Corp. (NYSEG) to demonstrate the Saarberg-Holter-Umwelttechnik (SHU) flue-gas desulfurization process and a nitrogen oxide (NO_x) emission-control process at NYSEG's Milliken Station under U.S. DOE's Clean Coal Technology IV program. The SHU process is energy-efficient and capable of high sulfur dioxide removal.

OBJECTIVES

To: (1) design, construct, and operate a test facility lined with ceramic tile manufactured by Stebbins Engineering and Manufacturing Company of Watertown (Jefferson County) at NYSEG's Kintigh Station, for demonstrating tile endurance when exposed to limestone-slurry spray used in the existing flue-gas desulfurization absorbers; and (2) design, construct, and operate a second test facility at NYSEG's Milliken Station for evaluating a process to remove unreacted ammonia in flue gas. Ammonia can combine with sulfur compounds in flue gas and lead to plugging of a heat-pipe air-heater manufactured by ABB Air Preheater of Wellsville (Allegany County).

DESCRIPTION

Effects of limestone slurry on tile and grouting erosion and corrosion are being evaluated at Kintigh, with on-line repair of the tile-lining system demonstrated. At Milliken, catalyst systems to remove unreacted ammonia in flue gas that may combine with sulfur compounds to plug the surfaces of the heat-pipe air heater will be tested to determine the lowest possible operating temperature that would avoid acid-gas condensation.

BENEFITS

A successful demonstration of the energy-efficient SHU flue-gas desulfurization process using Stebbins' ceramic tile-lining system may provide new market opportunities for the New York company, domestically and abroad. Demonstrating the ABB Air Preheater heat-pipe air heater may expand the market for this energy-saving technology, which does not have the gas-leakage problems of commonly used regenerative air heaters.

SCHEDULE AND STATUS

Both Milliken Units #1 and 2 scrubber modules are operational and undergoing testing. The design coal testing is postponed to the third quarter of 1997 due to the unavailability of test coal with the required sulfur content and additional constraints such as site coal pile liner construction and micronized coal test burns. All formal testing at the Stebbins tile test facility is completed, but the facility will continue to operate to obtain extended erosion data. Heat pipe air heater testing, performed on a cleaned and inspected air heater, indicated that performance was marginal relative to design exit temperatures. Testing of the hybrid SNCR/SCR system will be carried out at GPU's Seward Station.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$1,000,000	0	$1,000,000
New York State Electric & Gas Corp.	92,000,000	$2,000,000	97,000,000
ESEERCO	7,000,000	0	7,000,000
Electric Power Research Institute	4,000,000	2,000,000	7,000,000
U.S. Department of Energy	45,000,000	0	45,000,000
Consol	2,000,000	0	2,000,000
TOTALS	$151,000,000	$4,000,000	$159,000,000

Contractor: New York State Electric & Gas Corporation
Site: Milliken Station, Tompkins County
Contract Duration: 2/94 - 12/99
Key Words: environmental, air quality, electricity, coal, utilities, emissions, heat recovery
Project Manager: Joe Sayer (518) 862-1090, ext. 3298
Program: Environmental Research
Subprogram: Emissions Control/Environmental Impacts
Contract No.: 3167-ERER-ER-94

-> Micronized-Coal Reburn Demonstration at Kodak

Demonstrate performance of micronized-coal reburn system for reducing nitrogen oxide emissions from coal-fired cyclone industrial boiler at Kodak Park.

BACKGROUND

Utility and industrial boiler operators are looking at a number of economic alternatives for controlling nitrogen oxide (NO_x) emissions to comply with current and future emission regulations. Although it is generally believed that selective catalytic reduction technology can meet proposed stringent NO_x emission limits in the Northeast States Coordinated Air Use Management region, lower-cost technologies are being investigated. Combining technologies such as low-NO_x burners, overfire air combustion, and fuel reburn can effectively reduce emissions. Although natural gas is an excellent reburn fuel, availability and price volatility are of concern. Micronized coal may be an economical substitute reburn fuel for natural gas at coal-fired boilers.

OBJECTIVES

To design, retrofit, and operate a micronized-coal reburn system for NO_x control at Eastman Kodak's #15 coal-fired cyclone boiler at Kodak Park in Rochester. The project will evaluate the performance of the micronized-coal reburn system and any performance and operational effects on the boiler.

DESCRIPTION

The contractor will design, fabricate, install, operate, and test a micronized-coal reburn system using two Fuller MicroMills that originally were to have been installed and demonstrated at the Tennessee Valley Authority's Shawnee Plant. NO_x reductions of 50% are targeted, to be in compliance with a recent New York State Department of Environmental Conservation consent decree. The effects of micronized-coal reburn on boiler performance and ash characteristics will be monitored and documented.

BENEFITS

Micronized-coal reburn technology may be able to reduce NO_x emissions effectively and economically without using natural gas. If successfully demonstrated, the technology will make the Kodak Rochester site more competitive in supplying steam to operating divisions, thereby maintaining existing employment levels, and making the site more favorable for product-line expansion and additional job growth.

SCHEDULE AND STATUS

Micronized coal equipment was installed at the Kodak site and shakedown testing was completed. Performance testing is under way.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	0	$250,000	$250,000
U.S. Department of Energy	0	2,000,000	2,500,000
New York State Electric & Gas Corp.	0	0	725,000
Kodak	0	4,938,500	4,938,500
ESEERCO	0	0	250,000
Energy and Environmental Research Company	0	20,000	20,000
TOTALS	0	$7,208,500	$8,683,500

Contractor: New York State Electric & Gas Corporation
Site: Town of Lansing, Tompkins County, and Rochester, Monroe County
Contract Duration: 3/97 - 3/00
Key Words: environmental, emissions control, utilities, product development
Project Manager: Joe Sayer, (518) 862-1090, ext. 3298
Program: Environmental Research
Subprogram: Emissions Control/Environmental Impacts
Contract No.: 4417-ERTER-ER-97

-> Advanced Gas-Reburn Demonstration

Demonstrate performance of advanced gas-reburn system in controlling NO_x emissions from coal-fired utility boiler.

BACKGROUND

Utility and industrial boiler operators are looking at economical alternatives for controlling NO_x emissions to comply with current and future emission regulations. Although selective catalytic reduction technology can probably meet proposed stringent NO_x emission limits in the Northeast States Coordinated Air Use Management (NESCAUM) region, lower-cost technologies are under investigation. Combining technologies such as low-NO_x burners, overfire air combustion, and gas reburn can effectively reduce emissions, but not to future compliance levels. Advanced natural gas reburn (AGR) combines gas reburning, a staged fuel-combustion process where a region of the furnace operates at fuel-rich conditions, and selective non-catalytic reduction (SNCR) using ammonia or urea as a reagent. AGR appears to be a low-cost technology that can approach the performance of selective catalytic reduction in controlling NO_x emissions, but has only been proven to date on a 10-million Btu/hr test facility.

OBJECTIVE

To design, retrofit, and operate an AGR system at a New York State Electric & Gas Corp. (NYSEG) coal-fired power-plant boiler to determine system performance and NO_x emission-control costs.

DESCRIPTION

The project involves design, fabrication, and installation of AGR equipment on top of existing gas-reburning equipment at NYSEG's Greenidge No. 6 tangentially coal-fired boiler, and includes design, costing, and test-planning, followed by equipment installation, start-up, and long-term operation. The project will provide verifiable scale-up data necessary to refine AGR performance projections for application at other industrial and utility boilers.

BENEFITS

AGR technology can reduce NO_x, SO_x, CO_2, particulate, and air toxics emissions; increase operating flexibility; improve the ability to comply with proposed NESCAUM emission limits; allow for an additional 0.6 BCF/yr natural gas demand at Greenidge; and reduce ash disposal. Gas-reburn equipment can be manufactured in New York State, contributing to economic development.

SCHEDULE AND STATUS

Testing during last year's ozone season indicated reagent flow maldistribution, and flue-gas CO non-uniformity contributed to lower-than-expected NO_x reductions. The lowest NO_x emission was 0.19 lbs./MMBtu compared to the target 0.15 lbs./MMBtu. In preparation for testing during this year's ozone season, the reagent injection system was redesigned and the boiler burners were balanced.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	0	$100,000	$200,000
ESEERCO	0	150,000	300,000
Electric Power Research Institute	0	625,000	625,000
Gas DeFrance	0	50,000	100,000
New York State Electric & Gas Corp.	0	765,000	1,765,000
Gas Research Institute	0	500,000	1,500,000
Orange and Rockland Utilities, Inc.	0	10,000	10,000
TOTALS	0	$2,200,000	$4,500,000

Contractor: New York State Electric & Gas Corporation
Site: Town of Dresden, Yates County
Contract Duration: 11/96 - 11/99
Key Words: environmental, emissions control, utilities, product development
Project Manager: Joe Sayer (518) 862-1090, ext. 3298
Program: Environmental Research
Subprogram: Emissions Control/Environmental Impacts
Contract No.: 4441-ERTER-ER-97

-> In-Situ Oxygenator for Volatile Organic Compound Emission Control

Determine volatile organic compound emissions from new aerator in biological wastewater-treatment plant.

BACKGROUND

Under the Clean Air Act Amendments of 1990, the U.S. Environmental Protection Agency (EPA) is promulgating rules to control air emissions from industries and municipal wastewater-treatment plants (WWTP). To meet the new regulations, many treatment-plant operators either will have to enclose some unit processes, or collect and treat off-gases using energy-intensive steam-stripping and incineration that will double energy consumption. Most emissions from these facilities come from the aeration units. In addition to emissions, aeration consumes from 45 to 75 percent of the energy used to treat wastewater. Praxair, Inc. has developed an in-situ oxygenator (I-SO) that can be installed at existing WWTPs, eliminating the need to collect and treat off-gases. This unit has a high oxygen-transfer rate that may reduce energy needed for aeration.

OBJECTIVE

To determine the effectiveness of the aerator in reducing emissions from WWTPs and in transferring oxygen to the wastewater.

DESCRIPTION

The energy cost, efficiency, and level of volatile organic compound (VOC) emissions of the I-SO system compared to conventional aeration systems will be determined. The contractor will: (1) study solid-suspension characteristics and the effects of inert-gas concentration on transfer-rate and use efficiency; (2) simulate and study stripping of VOCs by oxygen bubbles; (3) develop a process-design and -control strategy to minimize off-gassing; (4) determine scale-up parameters to manufacture full-scale units of the I-SO; (5) build and field-test a pilot-scale unit; (6) compare the performance of the I-SO to conventional aeration units; (7) perform a laboratory simulation of the system; (8) demonstrate the field-scale unit at an operating WWTP; and (9) measure energy use, VOC emissions, and treatment efficiencies.

BENEFITS

Compliance with the Clean Air Act can be achieved by using the I-SO, without the expense of the cover and vent-control option. Due to the high transfer efficiency of the I-SO, energy and operating costs of the oxygen-based system can be lower than with the conventional air system. Commercializing I-SO technology will enable potential industrial and municipal customers to save millions of dollars in capital costs and up to 250 million kWh of electricity Statewide.

SCHEDULE AND STATUS

The Buffalo Sewer Authority has been chosen as the host site. The test unit was constructed in the winter of 1996, and will be installed in a side stream of the WWTP and tested through October 1997.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$248,622	0	$248,622
Praxair, Inc.	291,860	0	291,860
TOTALS	$540,482	0	$540,482

Contractor: Praxair, Inc.
Site: Tarrytown, Westchester County
Contract Duration: 5/95 - 10/97
Key Words: product development, environmental, wastewater treatment, industrial waste
Project Manager: Jim Reis (518) 862-1090, ext. 3251
Program: Environmental Research
Subprogram: Municipal Wastes
Contract No. 4125-ERTER-MW-95

-> Rotorfilter Emission-Control Technology Demonstration

Demonstrate Rotorfilter™ performance in controlling fly-ash particulate, sulfur oxide and nitrogen oxide emissions from flue-gas slip-stream at coal-fired utility boiler.

BACKGROUND

Controlling particulate, sulfur oxide (SO_x), and nitrogen oxide (NO_x) emissions at fossil-fuel combustion plants is costly in terms of capital expenditures and energy consumption. Electrostatic precipitators, sulfur dioxide scrubbers, and selective catalytic reactors are volumetrically larger than the typical boiler house. Large, energy-consuming induced-draft and booster fans are required to pull flue-gas through these vessels and into the stack. The Rotorfilter™ is a new technology that has been used commercially for particulate, volatile organic compound and odor, and acid gas removal. The technology may be developed to capture particulate, SO_x, and NO_x effectively in a single vessel, thereby reducing capital and operating costs and energy consumption.

OBJECTIVES

To demonstrate the performance of a Rotorfilter™ for controlling fly-ash particulate, SO_x, and NO_x emissions from a coal-fired power plant flue-gas slip-stream at the Electric Power Research Institute's Environmental Control Technology Center (ECTC) at New York State Electric and Gas' Kintigh Generating Station in Barker.

RESEARCH EFFORT

The contractor will prepare a detailed test plan and coordinate project activities at the test site; design and prepare equipment specifications and layout, and test instrumentation installation; provide, deliver, install, and operate a model R-3000 Rotorfilter™ that is rated at 1400 actual cubic feet per minute at four inches of water-pressure drop; collect and analyze Rotorfilter™ operating data, and prepare a project report; and disassemble and remove the Rotorfilter™ and other test equipment at the conclusion of the project.

BENEFITS

The Rotorfilter™ technology could reduce capital and operating costs and energy consumption for complying with emission regulations compared to existing technologies. A successful demonstration could open up new markets for the Rotorfilter™, which is fabricated and assembled by the contractor in Scotia, and lead to manufacturing expansion and employment opportunities.

SCHEDULE AND STATUS

Testing at ECTC indicated that the Rotorfilter™ demonstration system concurrently removed 99% particulate, 96% SO_2, and 65% NO_x emissions. Higher NO_x removal was achieved, but at reduced SO_2 emission control. The cost of reagent chemicals and processing of system effluent for disposal are concerns that will be addressed in a Phase II follow-on project now under way.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	0	$122,635	$122,635
Air Purification, Inc.	0	236,242	236,242
Electric Power Research Institute	0	50,000	50,000
Elf Atochem	0	5,000	5,000
TOTALS	0	$413,877	$413,877

Contractor: Air Purification, Inc.
Site: Barker, Niagara County, and Scotia, Schenectady County
Contract Duration: 7/96 - 12/97
Key Words: environmental, product development, emissions control
Project Manager: Joe Sayer (518) 862-1090, ext. 3298
Program: Environmental Research
Subprogram: Air Quality/Environmental Impacts
Contract No.: 4446-ERTER-ER-97

-> Continuous Vent-Gas Fractionator

Design, construct, and operate laboratory-scale continuous vent-gas fractionator to recover and reuse volatile organic compounds that otherwise would be emitted with vent gas.

BACKGROUND

The 1990 Clean Air Act Amendments require chemical and petrochemical industries to substantially reduce volatile organic compound (VOC) emissions. Conventional commercial VOC emission-control technologies either do not recover these emissions for reuse, or do not collect and recover enough VOCs in the vent gas to comply with new regulations. Technologies that catalytically or non-catalytically destroy VOCs thermally require auxiliary fuel to sustain the VOC-destruction temperatures. Cryogenic and activated-carbon VOC-absorption systems are batch operations and are not able to separate VOC components for reuse.

OBJECTIVE

To demonstrate a continuous vent-gas fractionator to recover and reuse VOCs in a vent-gas stream while complying with environmental regulations.

DESCRIPTION

The project will survey opportunities to collect, separate, and reuse VOCs in vent-gas streams from commercial operating plants in and outside New York State. The project will include the design, fabrication, and operation of a laboratory-scale cryogenic continuous vent-gas fractionator. Advantages and limitations of the proposed technology will be evaluated.

BENEFITS

Commercial development of this technology will allow New York State firms an energy-efficient option for complying with emission regulations while recovering and reusing VOCs. Energy benefits could include collecting VOC emissions and reusing VOCs that otherwise would be vented or destroyed. New York State equipment vendors could benefit directly by fabricating and selling continuous vent-gas fractionation equipment. Praxair could benefit by expanding its market for liquid nitrogen.

SCHEDULE AND STATUS

Fractionator testing began and thermal characteristics of the fractionator were measured. Preliminary operation indicated the need for some minor modifications. Initial testing will be with water/methanol mixtures.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$199,083	0	$199,083
Praxair, Inc.	199,083	0	199,083
TOTALS	$398,166	0	$398,166

Contractor: Praxair, Inc.
Site: Tarrytown, Westchester County
Contract Duration: 11/94 - 12/97
Key Words: environmental, air quality, product development, industrial
Project Manager: Joe Sayer (518) 862-1090, ext. 3298
Program: Environmental Research
Subprogram: Emissions Control/Environmental Impacts
Contract No.: 4052-ERTER-ER-95

-> Novel Nitrogen Oxide Emission-Control Catalysts

Formulate, characterize, and evaluate new catalysts for destruction of nitrogen oxide in flue gas from fossil-fuel combustion sources.

BACKGROUND

The 1990 Clean Air Act Amendments mandate reduced nitrogen oxide (NO_x) emissions from fossil-fuel combustion and process sources. Existing technology to remove in excess of 80 percent NO_x is expensive and requires the use of toxic ammonia and catalyst materials. New NO_x emission-control catalysts to be investigated in this project have the potential to be more reactive and less expensive, may not require ammonia as a reagent, and are non-toxic and easier to dispose.

OBJECTIVE

To formulate, prepare, and evaluate two types of new catalysts: heteropoly and pillared-clay. Heteropoly catalysts do not require ammonia as a NO_x-reducing gas and operate at flue-gas stack temperatures. The pillared-clay catalysts appear to be more than twice as reactive as existing catalysts and have longer catalytic life.

DESCRIPTION

Catalysts will be prepared and characterized by laboratory techniques such as x-ray diffraction, surface-area measurements, infrared spectroscopy, differential thermal and gravimetric analyses, and chemical analysis. The catalysts then will be tested in bench-scale, laboratory reaction systems where efficiency of NO_x destruction, catalyst performance degradation over time, and temperature-cycling effects will be evaluated. Project results will be used for the process design of a pilot facility to evaluate and develop further catalysts for commercial use.

BENEFITS

These new catalysts may reduce the cost of complying with NO_x-emission regulations. Two New York State companies, a catalyst supplier and a pollution-control equipment manufacturer, have expressed an interest in the technology. Depending on project results, they would consider participating in further catalyst evaluation at the pilot-scale level.

SCHEDULE AND STATUS

Work continues on characterizing catalyst structure and in understanding the nitric oxide absorption/nitrogen desorption process using Fourier Transform Infrared, Temperature Programmed Desorption, Thermogravimetric Analysis, and other analytical techniques.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$100,000	0	$100,000
U.S. Department of Energy (PETC)	140,000	0	140,000
SUNY/Buffalo	36,442	0	36,442
TOTALS	$276,442	0	$276,442

Contractor: Research Foundation of the State University of New York/Buffalo
Site: Amherst, Erie County
Contract Duration: 12/94 - 6/97
Key Words: environmental, product development, university, air quality, emissions control
Project Manager: Joe Sayer (518) 862-1090, ext. 3298
Program: Environmental Research
Subprogram: Emissions Control/Environmental Impacts
Contract No.: 4054-ERTER-ER-95

-> Flue-Gas Treatment Demonstration

Install and operate integrated flue-gas treatment process system to determine pollutant emission-control and energy-recovery performance at oil-fired boiler.

BACKGROUND

The efficiency of boilers can be increased by reducing flue-gas exit temperature. One way to lower the exit temperature is to use a condensing heat-exchanger to recover both sensible and latent heat from the hot flue gas. A Teflon covering on all heat-exchanger surfaces exposed to the flue gas from which condensation of water and acid gases occurs ensures adequate equipment life. A recent improvement in condensing heat-exchanger technology, the integrated flue-gas treatment (IFGT) concept, removes flue-gas pollutants and recovers waste heat. The IFGT appears to be particularly attractive for increasing boiler output with reduced fuel-firing, cost-effectively meeting environmental regulations. The IFGT consists of two condensing heat-exchangers connected by a duct where gaseous pollutants are removed by contact with adsorbent sprays. Particulates and toxics are removed in the condensing heat-exchanger sections.

OBJECTIVE

To install and test the performance of an IFGT unit at Con Edison's Ravenswood A-House oil-fired boiler and to measure IFGT heat recovery and removal of particulates, sulfur oxide, mercury, nickel, and chromium.

DESCRIPTION

The IFGT will be installed to heat boiler feed water and remove pollutants from the 275,000-pounds-per-hour flue gas. Effluent from the IFGT will be analyzed to determine optimum long-term processing to comply with disposal regulations.

BENEFITS

By recovering heat that otherwise would be rejected to the atmosphere, the IFGT technology will increase boiler efficiency and reduce both fuel consumption and production and emission of carbon dioxide. While recovering waste heat, the IFGT will remove particulate, gaseous, and heavy-metal pollutants that otherwise would be emitted to the environment. The ability to control sulfur-oxide emissions may permit the combustion of higher-sulfur-content, lower-cost fuels without exceeding emission regulations. IFGT equipment is manufactured by CHX Corporation in Warnerville, Schoharie County. A successful demonstration at Ravenswood would help market the technology, which could lead to additional manufacturing opportunities.

SCHEDULE AND STATUS

Contractual negotiations for start-up and testing are still ongoing between Babcock and Wilcox Company and Con Edison. The contractor recently experienced a staff reduction, and a new project manager was assigned. Con Edison has issued a request for proposals to perform some of the testing in an effort to contain project costs. A one-year, no-cost contract extension was recently requested.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$250,000	0	$250,000
Babcock & Wilcox	100,000	0	100,000
Con Edison	2,400,000	0	2,400,000
TOTALS	$2,750,000	0	$2,750,000

Contractor: Babcock & Wilcox
Site: Ravenswood Station, Long Island City, Queens County; and Warnerville, Schoharie County
Contract Duration: 4/95 - 3/98
Key Words: environmental, product development, air quality, emissions control, heat recovery, utilities
Project Manager: Joe Sayer (518) 862-1090, ext. 3298
Program: Environmental Research
Subprogram: Air Quality/Environmental Impacts
Contract No.: 4124-ERTER-ER-95

-> Automated Software Development for Emissions Monitor

Develop and test computer software for compact, industrial-grade mass-spectrometer emissions monitor.

BACKGROUND

New environmental initiatives have created a need for reliable, affordable, continuous, on-line exhaust-stack emissions monitors for combustion sources and processing plants. The monitors must be able to detect and quantify emissions for up to 189 chemicals on the U.S. Environmental Protection Agency's (U.S. EPA) toxics list, created in response to the 1990 Clean Air Act Amendments. Compound-specific monitors for many chemicals on this list are unavailable and would have to be developed. A monitor based on mass-spectrometry principles offers the possibility of analyzing a number of compounds with the same instrument. The monitor, designed for industrial applications, is a miniaturized version of a high-resolution, high-sensitivity, research-laboratory-grade instrument that requires no vacuum pumps, but relies on absorption of gases to maintain a vacuum for operation. The monitor detects all compounds on U.S. EPA's toxics list.

OBJECTIVE

To develop software to control operation of a compact, Fourier Transform Ion Cyclotron mass-spectrometer chemical-compound monitor prototype. Software functions will include instrument calibration, normal operation, and data analysis with minimal operator interfacing.

DESCRIPTION

The software will be tested in a laboratory before a prototype monitor is installed in several plants and evaluated under commercial operating conditions. The research and development effort is designed to produce a marketable monitor/software system.

BENEFITS

The monitor/software, which will be produced in New York State, would allow combustion sources and process plants to use emission-control equipment more efficiently for environmental compliance.

SCHEDULE AND STATUS

The contractor prepared production drawings of the analyzer and developed manufacturing costs. Negotiations are under way to obtain funding for a manufacturing facility. Computer code development continues, but at a reduced pace pending negotiations. The contractor's present site is not adequate to accommodate additional employees.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$250,000	0	$250,000
Jencourt, Inc.	370,125	0	370,125
TOTALS	$620,125	0	$620,125

Contractor: Jencourt, Inc. at Syracuse University
Site: Syracuse, Onondaga County
Contract Duration: 4/95 - 9/97
Key Words: environmental, product development, air quality, emissions control
Project Manager: Joe Sayer (518) 862-1090, ext. 3298
Program: Environmental Research
Subprogram: Air Quality/Environmental Impacts
Contract No.: 4126-ERTER-ER-95

-> Dual-Fuel Rapid-Mix Burner Demonstration

Demonstrate performance of and emissions from a natural-gas and oil-fired multiburner package boiler retrofit with dual-fuel rapid-mix burners.

BACKGROUND

The dual-fuel rapid-mix burners (D-RMB) produces less than 10 parts per million (ppm) nitrogen oxide (NO_x) emissions when firing natural gas in single-burner boilers. The burner is a low-cost, front-end alternative for complying with NO_x emission regulations. However, performance and emissions in multiple-burner, load-following boilers remain to be demonstrated. A proposed procedure for achieving low emissions in multiburner boilers is to use biased firing, where some burners operate fuel-rich and others air-rich to minimize overall boiler emissions. Biased firing, coupled with flue-gas recirculation, is expected to result in acceptable combustion and emissions performance.

OBJECTIVES

To demonstrate: (1) performance of two D-RMBs retrofit on an existing steam-raising package boiler in keeping NO_x emissions below 10 ppm with 500°F air-preheat and less than 20 percent flue-gas recirculation with natural gas, and (2) lowest achievable NO_x emissions consistent with minimal impact on particulate, smoke number, and carbon monoxide when firing heavy fuel oil with or without flue-gas recirculation.

DESCRIPTION

The project will retrofit D-RMBs for the two existing oil- and natural-gas-fired burners on a package boiler at Con Edison's 59th Street Station. Less than 10 ppm NO_x emissions testing will be demonstrated on natural gas with bias-firing and flue-gas recirculation. The burners will operate on heavy fuel oil to achieve the lowest NO_x emissions consistent with acceptable boiler performance.

BENEFITS

D-RMB technology can reduce NO_x emissions with natural-gas firing to levels achievable with selective catalytic reduction (SCR), but at lower capital and operating costs, and without using hazardous reagents and catalysts. Estimated capital costs for D-RMB are $15/kW compared to $80/kW for SCR.

SCHEDULE AND STATUS

Burner installation and other ancillary boiler modifications were completed at Con Ed's facility. Burner testing is scheduled to begin in May.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	0	$100,000	$100,000
ESEERCO	0	150,000	150,000
Electric Power Research Institute	0	320,000	320,000
San Diego G&E	0	150,000	150,000
Con Edison	0	375,000	375,000
Gas Research Institute	0	150,000	150,000
Radian	0	95,000	95,000
TOTALS	0	$1,340,000	$1,340,000

Contractor: Empire State Electric Energy Research Corporation
Site: New York, New York County
Contract Duration: 12/96 - 12/97
Key Words: environmental, oil, emissions control, utilities
Project Manager: Joe Sayer (518) 862-1090, ext. 3298
Program: Environmental Research
Subprogram: Emissions Control/Environmental Impacts
Contract No.: 4440-ERTER-ER-97

-> Development of a Field-Effect Cyclone Collector/Separator

Design, fabricate, install, and test innovative, efficient field-effect cyclone particulate collector that can be used to separate different components from dust-laden gas streams.

BACKGROUND

Current cyclone dust-collector designs are efficient in capturing large particles entrained in process-gas flows. Fine particles (less than 10 microns) are not effectively removed, and are emitted with the gas. By installing an electrical grid in the cyclone and energizing it below corona-discharge levels, electric-charge transfer directly to the entrained solid particles may increase collection efficiency. If this process can be demonstrated to work as expected in industrial applications, the expense of installing baghouses for recovering valuable product or for reducing particulate emissions could be reduced. By suitably designing and manipulating the electrical field, different components of multi-component fine-dust streams can be concentrated and separated.

OBJECTIVE

To design, fabricate, install, and test a field-effect cyclone (FEC) collector for removing and collecting entrained particulates from process gas at an industrial site. Performance of the FEC collector will be measured and compared with the performance of current commercial cyclone designs. The FEC collector also will be tested as a concentrator and separator of different components from a multicomponent fine-entrained dust-gas stream.

DESCRIPTION

The contractor will select specific sites for demonstrating the operation and performance of the FEC collector and separator. After designing equipment to meet the specifications for the selected sites, equipment will be fabricated, installed, and tested at those sites. FEC collector and separator performance will be measured and compared with current commercial technology.

BENEFITS

The FEC collector may be an economically attractive technology for recovering valuable material normally inadvertently discarded with process gas, and for complying with more severe particulate-emission requirements. It also may be an economical alternative for collecting specific components from multicomponent dusts entrained in process gas. Clark Specialty Company in Hammondsport will fabricate the new cyclone designs and expand employment opportunities in the region. AET and R&J Laboratories in Penn Yan will design and market the new cyclones and analyze cyclone performance, respectively, thereby providing additional employment opportunities.

SCHEDULE AND STATUS

The contractor is assembling the cyclone collectors for testing at his facility prior to shipment, installation, and testing at industrial test sites. It is anticipated that shop testing will begin in June, and site testing later this summer.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	0	$209,720	$209,720
AET, Inc.	0	216,518	216,518
TOTALS	0	$426,238	$426,238

Contractor: Advanced Electrostatic Technologies, Inc.
Site: Penn Yan, Yates County, and Hammondsport, Steuben County
Contract Duration: 9/96 - 11/98
Key Words: product development, environmental, emissions control
Project Manager: Joe Sayer (518) 862-1090, ext. 3298
Program: Environmental Research
Subprogram: Air Quality/Environmental Impacts
Contract No.: 4448-ERTER-ER-97

-> Least-Cost Options for Ozone Improvements in the Eastern United States

Use computer models to develop least-cost options for improving ozone air quality.

BACKGROUND

The 1990 Clean Air Act Amendments (CAAA) require states with ozone non-attainment areas designated as serious or higher to develop emission-control strategies to achieve compliance with federal air quality standards. However, even with emission controls, northeastern states cannot meet federal standards, due to ozone and NO_x from midwestern power plants. Because of this, U.S. EPA and 37 eastern states formed the Ozone Transport Assessment Group (OTAG) to coordinate modeling activities. Four groups will be responsible for modeling ozone episodes in 1988, 1991, 1993, and 1995. All will use the UAM-V model with the latest U.S. EPA emissions database modified by year as needed for individual ozone episodes. Quantitative model-validation and results-acceptance criteria have been developed and the baseline project is moving ahead with U.S. EPA funding. The modeling will assume that all provisions of the 1990 CAAA were implemented. Some additional modeling is planned to consider additional across-the-board emission controls to meet air-quality standards.

OBJECTIVES

To: (1) establish the baseline model for 1995 and verify its validity and performance with the OTAG, evaluating air-quality effects from combinations of up to eight emission-control options; and (2) develop alternative, spatially focused control strategies and evaluate the emission-control costs associated with them, after which optimal and practical least-cost solutions will be determined.

DESCRIPTION

The project is designed to: (1) use the UAM-V model to determine how various levels of emission control for VOCs and NO_x in the 37 states affects maximum concentrations of ozone air quality in NYS and other northeastern states, (2) develop emission weights for specified sub-regions of the OTAG states that relate emissions from one subregion to ozone concentrations in other sub-regions, (3) link the emission weights with control-cost curves to determine the most cost-effective strategies to reduce ozone concentrations, and (4) based on least-cost results, define a practical-to-implement strategy and verify results using the UAM-V model.

BENEFITS

Provide information to: (1) aid NY and other states' policy-makers in developing cost-effective strategies to meet 1990 CAAA requirements, (2) help U.S. EPA and Congress change the CAAA to account for controlling long-range transport pollution, (3) assist the Federal Energy Regulatory Commission in implementing interregional wheeling on a cost-effective and environmentally sound basis, (4) show disparity in control costs among utilities in the 37 states, and (5) show the benefits of natural-gas-powered vehicles in urban areas.

SCHEDULE AND STATUS

At the first Project Advisory Group meeting, key decisions were made on the sub-regional breakdown of the OTAG states and additional hypotheses to be tested. Emission weights for the sub-regional impacts on NYC and Boston have been made. The cost analysis is beginning.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	0	$281,340	$281,340
NYSDEC	0	50,000*	50,000
SUNY Research Foundation	0	50,000*	50,000
Cornell University	0	50,000*	50,000
TOTALS	0	$431,340	$431,340

* in-kind services and overhead reductions

Contractor: SUNY Research Foundation
Site: Statewide
Contract Duration: 8/96 - 11/97
Key Words: environmental, university, policy
Project Manager: Joe Visalli (518) 862-1090, ext. 3205
Program: Environmental Research
Subprogram: Air Quality
Contract No.: 4422-ERTER-ER-97

-> Externally Fired Combined-Cycle Ceramic Heat Exchanger

Design, construct, and operate a 500-kW coal-based externally fired integrated combined-cycle pilot plant.

BACKGROUND

Gas turbines are the lowest-capital-cost prime movers for generating electricity. Coal is abundant, domestically available, and low in cost. Integrated gasification combined-cycle (IGCC) plants use gas turbines fueled by coal gas, but generating efficiencies are affected by the coal -gasification and gas-cleanup processes. An alternative is firing coal to heat pressurized air in a ceramic heat-exchanger and then expand the clean air in a gas turbine to generate electricity. This externally fired combined-cycle (EFCC) ceramic heat-exchanger technology promises higher generating efficiencies than IGCC.

ACCOMPLISHMENTS

The project tested components and materials to design, construct, and operate a 500-kW gas-turbine EFCC pilot plant. Combustion flue gas from a coal-fired combustor supplied the energy to heat air at 250 psia in a ceramic heat-exchanger designed to operate at 1850°F. The pilot plant operated initially at low temperatures on natural gas with metal heat-exchanger tubes. After debugging, ceramic tubes replaced metal tubes in the heat-exchanger and coal-firing commenced with relatively short runs achieved. Based on project results, the contractor prepared and submitted a proposal in response to the U.S. Department of Energy's (U.S. DOE) Clean Coal Technology V (CCT-V) solicitation, and was selected to conduct a demonstration of EFCC ceramic heat-exchanger technology in repowering an existing coal-fired utility power plant.

FINDINGS AND CONCLUSIONS

The components tested indicated that ceramic heat-exchangers with acceptable air-leakage rates at design temperature and pressure were technically feasible. The pilot plant achieved short-term operation with coal-firing, but at less than design operating temperatures. Brittle ceramic tubes, which could result in catastrophic heat-exchanger tube failure, could be made more ductile with a proprietary process.

REALIZED OR ANTICIPATED BENEFITS

Long-term, continuous operation of the pilot plant was curtailed by a lack of funding. As a result, the U.S. DOE demonstration did not go forward. Much of the technology developed is applicable for other processes requiring high temperatures and low pressurized-gas leakage rates.

TECHNOLOGY TRANSFER ACTIVITIES

The contractor is pursuing private funding.

FUNDING	TOTALS		
NYSERDA	$350,000		
ESEERCO	400,000	Black & Veatch	100,000
Con Edison	50,000	Ed Boulos, Jr.	150,000
U.S. Department of Energy	10,383,800	Cockerill Mechanical Industries	150,000
Allison Engine	150,000	Du Pont Lanxide Composites	150,000
Electric Power Research Institute	150,000	Florida Power Corp.	155,000
Hague International	702,200	Hexcel	150,000
Stone & Webster	69,000	Pennsylvania Electric Energy Council	250,000
Foster-Wheeler	202,000	Southern Company Services	25,000
Ansaldo	150,000	Vattenfall	150,000
American Public Power Association	75,000		
TOTALS			$13,962,000

Contractor: Hague International
Site: South Portland and Kennebunk, Maine
Contract Duration: 4/90 - 6/96
Key Words: environmental, product development, utilities, air quality, combustion efficiency, ceramic heat exchanger, combined cycle, coal, gas turbine
Project Manager: Joe Sayer (518) 862-1090, ext. 3298
Program: Environmental Research
Subprogram: Emissions Control/Environmental Impacts
Contract No.: 1546-ERER-ER-91

-> Flue-Gas Recirculation Fan Magnetic-Bearing Demonstration

Install magnetic bearings on flue-gas recirculation fan and drive motor to evaluate energy savings and maintenance costs.

BACKGROUND

Rotating equipment such as fans, pumps, and turbine-generators at electric generating plants consume large quantities of power. Bearing failures on this equipment also lead to plant outages. Magnetic bearings reduce friction losses and power consumption, and may improve equipment reliability.

ACCOMPLISHMENTS

The project demonstrated short-term operation of magnetic bearings on both a flue-gas recirculation fan shaft, and on the shaft of the electric-drive motor. Mechanical backup bearings, installed to support equipment shafts in the event of magnetic bearing failure, performed as expected during testing to support the shafts during equipment coastdown. The damping capabilities of the magnetic bearings permitted the fan shaft to be reduced in diameter, thereby improving fan performance, without exceeding allowable fan deflections at the critical shaft speed.

FINDINGS AND CONCLUSIONS

The magnetic bearings initially installed on the fan shaft proved to be undersized and were replaced with higher load-capacity bearings. The larger magnetic bearings performed as expected, but problems were experienced with mechanical backup bearings installed to protect the fan shaft in case of magnetic bearing failure. The mechanical bearings tended to overheat, which, in one incident, bowed the fan shaft. The cause of mechanical backup bearing overheating was not conclusively determined, and would require additional project work beyond the available funding.

REALIZED OR ANTICIPATED BENEFITS

Magnetic bearings can be designed to reduce friction and operating costs, and improve the efficiency of large utility low-speed flue-gas recirculation fans.

TECHNOLOGY TRANSFER ACTIVITIES

The final project report will be distributed to Empire State Electric Research Corporation and Electric Power Research Institute member utilities.

FUNDING	TOTALS
NYSERDA	$481,159
Orange and Rockland Utilities, Inc.	775,000
Electric Power Research Institute	628,927
ESEERCO	1,622,680
Howden Sirocco	386,700
Magnetic Bearing Inc.	59,200
TOTALS	$3,953,666

Contractor: Empire State Electric Energy Research Corporation
Site: Haverstraw, Rockland County
Contract Duration: 2/92 - 6/96
Key Words: environmental, product development, utilities, air quality, magnetic bearings, gas recirculation fan
Project Manager: Joe Sayer (518) 862-1090, ext. 3298
Program: Environmental Research
Subprogram: Emissions Control/Environmental Impacts
Contract No.: 1721-ERER-ER-92

-> Spray-Dryer Waste Characterization

Store solid waste from spray-dryer sulfur dioxide emission-control pilot plant in test cells, and periodically sample and analyze precipitation runoff.

BACKGROUND

Spray-drying, an alternative technology for controlling sulfur dioxide emissions from coal-fired boiler flue gas, produces a solid-waste product that is easier to manage than wet scrubber sludge. However, leaching properties of the spray-dryer waste when disposed in landfills are unclear.

ACCOMPLISHMENTS

Six storage cells were constructed and filled with waste from a spray-dryer pilot plant operating at different processing conditions. The contractor sampled and analyzed the waste in the disposal cells for two years to determine physical and chemical properties, and any changes that occurred due to weathering. Precipitation runoff also was collected, sampled, and analyzed to characterize solid-waste leaching properties.

FINDINGS AND CONCLUSIONS

Solid-waste characteristics did not change significantly with weathering and storage time. Some leaching of elements was observed in runoff sampled after wastes were initially stored in the cells, but concentrations were below allowable limits. Leachate concentrations were lowest for sloped-top waste cells, and decreased with storage time.

REALIZED OR ANTICIPATED BENEFITS

Waste characterization and runoff leachate analyses indicate that landfilling spray-dryer wastes is an environmentally acceptable disposal method.

TECHNOLOGY TRANSFER ACTIVITIES

A final report was prepared and distributed to New York State electric utilities.

FUNDING	TOTALS
NYSERDA	$200,000
Electric Power Research Institute	445,652
TOTALS	$645,652

Contractor: Electric Power Research Institute
Site: Somerset, Niagara County
Contract Duration: 12/91 - 6/95
Key Words: environmental, utilities, air quality, coal, solid waste, spray-dryer, flue gas desulfurization
Project Manager: Joe Sayer, (518) 862-1090, ext. 3298
Program: Environmental Research
Subprogram: Emissions Control/Environmental Impacts
Contract No.: 1723-ERER-ER-92

-> Constructing and Testing an Amended Slow Sand Filter

Improve water quality with activated carbon lens in sand filter.

BACKGROUND

The Deansboro Water District serves about 450 rural customers with an average total daily water use of some 20,000 gallons. The District is under orders to develop a second water source. A nearby stream that flows through agricultural land could be used; however, the water would need treatment for turbidity and organic contaminants, including disinfection by-products.

OBJECTIVE

Construct a slow sand filter with a layer of granulated activated carbon in the sand bed to remove the turbidity and organic contaminants, including those that may be precursors to disinfection by-products.

DESCRIPTION

The contractor will: (1) collect data on designing and operating slow sand filters, design the filters and lay out the associated system; (2) construct and start up the filters; (3) test and monitor filter operation for six months; and (4) prepare cost estimates for constructing, operating, and monitoring the filter.

BENEFITS

The filter uses no energy, unlike a conventional water-treatment plant filter that requires pumping. Slow sand filters require no chemical coagulants or sophisticated controls, and produce no filtration residuals that require special treatment. Slow-sand technology is ideal for small rural communities that may be forced to filter their water supplies because of new regulatory requirements.

SCHEDULE AND STATUS

The project design is complete and has received final State and county health department approval. Filter construction has been completed. Sand will be added to the filters in April 1997. Testing will begin in May 1997.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$64,575	0	$64,575
Deansboro Water District	21,525	0	21,525
TOTALS	$86,100	0	$86,100

Contractor: Town of Marshall, Deansboro Water District
Site: Deansboro, Oneida County
Contract Duration: 5/95 - 3/98
Key Words: environmental, municipal, drinking water, filtration
Project Manager: Larry Pakenas (518) 862-1090, ext. 3247
Program: Environmental Research
Subprogram: Drinking Water Treatment
Contract No.: 4136-ERTER-MW-95

Measure energy cost of biological growth in treatment plants and distribution systems.

BACKGROUND

Maintaining a chlorine residual is unreliable in preventing bacteria regrowth in water-distribution systems. Pipe surfaces in distribution systems are particularly prone to heavy colonization by microorganisms. Excessive bacteria can contribute to pipe corrosion, reduced flow, and water-quality problems such as bad taste, odor, and appearance. Increasing the dose of chlorine may not be possible if future water-quality regulations strictly control using chlorine to reduce chlorinated organic compounds.

OBJECTIVES

To: (1) assess biological stability and disinfection by-product levels in New York City drinking water, (2) develop correlations between biological stability of drinking water and routinely measured water-quality parameters, (3) evaluate and optimize chlorination practices with respect to biological stability, (4) evaluate various water-treatment unit processes for producing biologically stable water, and (5) determine the energy and other costs of water treatment and disinfection when producing a biologically stable finished water.

DESCRIPTION

The contractor will: (1) sample and analyze water from 10 locations within the New York City water-distribution system, (2) assess the biological stability of the drinking water and the level of disinfection by-products at these locations, (3) use a pilot-scale system TO evaluate the optimum level of disinfection and treatment for biological stability, and (4) estimate the amount of energy used for full-scale treatment systems.

BENEFITS

Bacteria regrowth in water-distribution systems and precursor characteristics of the raw water will be better understood. The cost to control bacteria regrowth using the two most common forms of disinfection, chlorine and ozone, will be quantified. The optimum use of chlorine will minimize the potential for creating undesirable disinfection by-products. Controlling biological growth in distribution systems will lower water-pumping costs.

SCHEDULE AND STATUS

Sampling units for bacteria regrowth have been installed and sampling and analyses are under way. Pilot-scale water-treatment testing began in January 1996 and is complete. The draft final report will be submitted in May 1997.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$248,488	0	$248,488
New York City	339,114	0	339,114
CUNY Research Foundation	25,100	0	25,100
TOTALS	$612,702	0	$612,702

Contractor: CUNY Research Foundation
Site: New York City, New York County
Contract Duration: 4/95 - 7/97
Key Words: environmental, municipal, public water systems, disinfection
Project Manager: Larry Pakenas (518) 862-1090, ext. 3247
Program: Environmental Research
Subprogram: Public Water Systems
Contract No.: 4137-ERTER-MW-95

-> Evaluating the City of Amsterdam's Water System for Energy Savings

Study water system improvements, including transmission main and hydropower.

BACKGROUND

In the City of Amsterdam's water system, water flows by gravity from Glen Wild reservoir to a concrete chamber called the Crossover via approximately seven miles of 24-inch-diameter transmission main. The difference in elevation between Glen Wild and the Crossover is approximately 210 feet. The water returns to atmospheric pressure at the Crossover and then proceeds by gravity through another seven miles of 24-inch transmission main to a pressure-reducing station adjacent to the Water Filtration and Treatment Plant (Filter Plant). The water arrives at the pressure-reducing station at a pressure of approximately 125 psi, after which it is subsequently reduced to approximately 30 psi through two pressure-reducing valves. The portion of the City of Amsterdam that is below the Filter Plant receives water by gravity. The higher elevations of the City are served by a pump station at the Filter Plant, electricity for which costs approximately $170,000 per year.

OBJECTIVES

To: (1) perform a preliminary engineering analysis to determine whether it would be feasible to construct a new filter plant in the higher elevations, (2) conduct a feasibility study to assess the use of hydroelectric power at the Filter Plant/pump station, and (3) prepare a hydraulic model of the water system.

DESCRIPTION

The contractor will: (1) gather data about water flows and water-system operations to develop a hydraulic model of the system, (2) screen alternatives for reducing or eliminating pumping, (3) evaluate several hydropower options, (4) use an economic analysis to screen the energy-saving and hydropower alternatives, and (5) select an option for preliminary design and life-cycle cost analysis.

BENEFITS

The costs and benefits of transmission-main hydropower will be available to the City of Amsterdam and other municipal water systems in New York State. If successful, one or two hydropower stations in the Amsterdam water-transmission main could provide energy to offset 60 percent of the pumping costs.

SCHEDULE AND STATUS

Field surveys are complete and the hydraulic model has been prepared. Treatment and hydropower scenarios have been evaluated. The draft final report will be submitted in May 1997.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$55,000	0	$55,000
City of Amsterdam	50,197	0	50,197
TOTALS	$105,197	0	$105,197

Contractor: City of Amsterdam
Site: Amsterdam, Montgomery County
Contract Duration: 3/95 - 7/97
Key Words: environmental, municipal, energy management, hydropower, drinking water
Project Manager: Larry Pakenas (518) 862-1090, ext. 3247
Program: Environmental Research
Subprogram: Public Water
Contract No.: 4138-ERTER-MW-95

-> Influent Hydropower Feasibility Study - City of Lockport Wastewater Treatment Plant

Determine feasibility of influent hydropower station at Lockport wastewater treatment plant.

BACKGROUND

The City of Lockport wastewater treatment plant (WWTP) is at the bottom of an escarpment with a vertical drop of approximately 100 feet. Raw wastewater is conveyed from the top of this escarpment to the WWTP by two interceptor sewers. The City has a combined sewerage system that increases WWTP flow during wet weather. The WWTP typically has an electricity demand of between 400 and 500 kW. Based on a gross available head of 100 feet, the potential generating capacity of an influent-flow hydroelectric facility at the Lockport WWTP is 70-180kW.

OBJECTIVE

To determine the technical and economic feasibility of constructing and operating an influent hydropower-generating facility at the Lockport WWTP. The analysis will evaluate using existing upstream storage to optimize hydropower generation and wastewater treatment as opposed to building more clarifiers or overflow-retention tanks at the WWTP.

DESCRIPTION

The project will: (1) gather and evaluate wastewater-flow and energy-use data, (2) develop and screen hydropower alternatives, (3) gather and evaluate data and prepare cost estimates for wastewater-interceptor storage, (4) determine interceptor storage's impact on WWTP operations, (5) evaluate hydropower alternatives, and (6) determine the feasibility of the recommended alternative.

BENEFITS

If feasible, using the influent hydropower station would offset 20-25% of the electricity purchases at the WWTP, saving $75,000 to $85,000 per year in energy costs.

SCHEDULE AND STATUS

The project is under way.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	0	$24,870	$24,870
City of Lockport	0	27,886	27,886
TOTALS	0	$52,756	$52,756

Contractor: City of Lockport
Site: Lockport, Niagara County
Contract Duration: 4/97 - 12/97
Key Words: environmental, municipal, wastewater, hydropower
Project Manager: Larry Pakenas (518) 862-1090 ext. 3247
Program: Environmental Research
Subprogram: Municipal Wastewater and Sludge
Contract No.: 4311-ERTER-MW-97

Use computer model to predict outcome of natural water-treatment systems.

BACKGROUND

The federal Safe Drinking Water Act requires that all surface-water supplies be filtered. New York City was granted conditional filtration avoidance by the U.S. Environmental Protection Agency for its two largest supply systems. To comply with the conditions of this decision, New York City must begin extensive watershed-protection and enhancement research that will ensure certain water-quality parameters are maintained within specified ranges. Wetlands in the watersheds may remove up to 90 percent of the suspended solids in the water, but using wetlands as a definitive means for water filtration needs further research.

OBJECTIVES

To develop and test mathematical models to identify and prioritize areas within the New York City watershed that either significantly enhance or degrade water quality.

DESCRIPTION

The contractor will: (1) use a digital-elevation model and a geographic-information system to derive kinetic and potential energy levels in the streams; (2) define and code stream and wetland segments by their predicted energy levels; (3) use soils, vegetative cover, hydrology, and surface geology to analyze the classified stream and wetland segments; (4) estimate pollutant-loading rates from these parameters through the use of models; (5) monitor the water quality before and after selected watershed modifications, and (6) offer recommendations on implementing the best management practices.

BENEFITS

If New York City can manage its watershed so that non-point-source pollution is controlled and the natural features of the watershed, such as wetlands, are used to remove turbidity, then the City may be able to avoid spending $6 billion for construction of a new water-treatment plant that could use up to one billion kWh of electricity annually. Avoided operating and maintenance costs are estimated at $600 million per year.

SCHEDULE AND STATUS

The literature search has been completed. Sampling and analyses of water from Malcolm Brook are under way. Work has begun on GIS mapping and mathematical modeling of the watershed.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$250,455	0	250,455
NYC Dept. of Environ. Protection	221,010	0	221,010
City University of New York	147,552	0	147,552
TOTALS	$619,017	0	$619,017

Contractor: CUNY Research Foundation
Site: Valhalla, Westchester County
Contract Duration: 2/96 - 2/98
Key Words: environmental, municipal, public water, watershed management, modeling
Project Manager: Larry Pakenas (518) 862-1090, ext. 3247
Program: Environmental Research
Subprogram: Drinking Water Treatment
Contract No.: 4283-ERTER-MW-96

-> Novel Electrotechnology Water-Treatment Process Demonstration

Demonstrate chlorine-free water-treatment/disinfection electrotechnology at several cooling towers.

BACKGROUND

Conventional technologies for treating potable water, municipal and industrial wastewaters, and process water use chemical additives as filtering aids and chlorine for disinfection. Filtering-aid chemical additives increase residual sludge production, requiring additional energy for acceptable disposal, and can lead to scaling deposits that impair the performance of heat-transfer equipment. Chlorine disinfectants can lead to formation of toxic chlorinated hydrocarbons with adverse environmental impacts.

OBJECTIVE

To demonstrate a new water-purification technology that does not use chemical filtering aids and chlorine-based disinfectants. Originally, the new technology, based on electro-coagulation/magnetic separation, was to be demonstrated on a cooling tower, a chiller, and a high-rise building potable water system. After very positive performance results on a cooling tower at the University of Rochester's Memorial Arts Gallery Museum, the contractor suggested modifying the original agreement and demonstrating the technology at other cooling towers. Cooling tower water treatment represents a huge market for the new technology.

DESCRIPTION

Equipment will be designed, fabricated, installed, and tested at a 550-ton/hr cooling tower in Albuquerque, NM, at an 800-ton/hr cooling tower in IL, and at a 1,200-ton/hr cooling tower in Denver, CO.

BENEFITS

A flocculation chemical additive- and chlorine-free water-treatment process would provide significant energy and environmental benefits by not producing additional sludge for treatment and disposal and by eliminating the discharge of chlorine compounds into the environment. Performance of heat-transfer equipment should not deteriorate with time, as no chemicals that could lead to scale deposits are present in the water. New employment opportunities will be created at the contractor's plant in western New York, where the processing equipment will be manufactured and the control systems assembled and tested.

SCHEDULE AND STATUS

Cooling tower water treatment testing is now under way in Rochester, NY; Denver, CO; and Moline, IL, will soon be under way in Albuquerque, NM. These four towers have different water chemistries, climatic conditions, and thermal loads. Positive results were experienced at the Taber Center in Denver compared to past chemical treatment. The Albuquerque site should be the most challenging, as the water has a high silica content.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	$40,000	$210,000	$250,000
Alpha/Omega Environmental	40,000	210,000	250,000
TOTALS	$80,000	$420,000	$500,000

Contractor: Alpha/Omega Environmental, Inc.
Site: Marion, Wayne County; Rochester, Monroe County; NM; IL; and CO
Contract Duration: 3/96 - 9/97
Key Words: Environmental, product development, industrial, water treatment
Project Manager: J.H. Sayer, (518) 862-1090, ext. 3298
Program: Environmental Research
Subprogram: Air Quality/Environmental Impacts
Contract No.: 4346M-ERTER-ER-96

-> Advanced Ceramic-Membrane Filter

Test surface-treated ceramic-membrane elements in water filters.

BACKGROUND

Ceramic membranes hold promise for providing features not found in polymer-based membranes, such as oxidant tolerance, rugged design, and longer prospective life. A superior water-filtering system has been postulated based on new surface-effect ceramic membranes developed by Refractron Technologies, plus high-kinetic-force backwashing, improved vessel design housing the filter and an oxidant contactor, and simplified automated controls. The system features high mass-transfer efficiency, high flux rates, and low head loss. While several elements of the system have been tested individually at bench scale, the entire system has not been evaluated under realistic operating conditions at a larger scale.

OBJECTIVE

To develop and demonstrate a ceramic-membrane-based water-filtering system that will provide drinking water that meets regulatory standards when treating groundwater from wells under the influence of surface water while minimizing energy use, waste streams, and life-cycle costs.

DESCRIPTION

The contractor will: (1) construct and test a bench-scale ceramic-membrane water-filtering system; (2) design, construct, and test a pilot-scale filter plant based on the results of the bench-scale work; (3) analyze water-quality testing results and system-performance data; (4) identify strengths and weaknesses of the ceramic-membrane water-filtering system; and (5) prepare a life-cycle cost analysis of the preferred design and compare to costs for conventional water-filtering systems. Refractron Technologies will manufacture the ceramic-membrane filters in Newark. Rhodes Instruments will provide the instrumentation package and will assemble the water-filtering system at its subsidiary company, Prinz Optics, in Stuyvesant. United Water of New York will test the filtering system at a well site in Spring Valley. O'Brien & Gere Engineers will provide the engineering analyses at their offices in New York City. McSweeney & Company will coordinate the overall effort.

BENEFITS

The ceramic-membrane filter is a compact, in-line device that operates under normal wellhead pressure, requires less water for backwashing, is compatible with strong oxidants, and uses 50-80% less energy for water treatment than flexible membranes or cartridge filters.

SCHEDULE AND STATUS

Bench-scale testing of ceramic filters is under way.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	0	$49,914	$49,914
Refractron Technologies	0	5,941	5,941
McSweeney & Company	0	32,880	32,880
United Water of New York	0	43,250	43,250
Rhodes Instruments	0	10,930	10,930
Prinz Optics (Rhodes subsidiary)	0	0	0
O'Brien & Gere Engineers	0	5,995	5,995
TOTALS	0	$148,910	$148,910

Contractor: Refractron Technologies Corp.
Site: Newark, Lewis County; White Plains, Westchester County; Stuyvesant, Columbia County; West Nyack and Spring Valley, Rockland County; and New York, New York County
Contract Duration: 12/96 - 12/97
Key Words: environmental, product development, public water
Project Manager: Larry Pakenas (518) 862-1090, ext. 3247
Program: Environmental Research
Subprogram: Public Water
Contract No.: 4492-ERTER-MW-97

Compare ozone treatment to using chemicals for taste and odor control.

BACKGROUND

The Village of Waterloo Water Treatment Plant (WTP) takes water from Seneca Lake to supply an average daily demand of one million gallons. The Village must address several issues to maintain high-quality water for its customers. Carcinogenic trihalomethanes (THM) are formed as a result of chlorinating water that contains organic matter. The THM concentration in Waterloo's treated water often exceeds forthcoming regulations of 80 parts per billion (ppb). Zebra mussels attached themselves to the water intake, reducing the size of the opening and adding to the organic load in the raw water. Controlling the mussels with chemicals often leads to complaints from customers about poor taste and odor.

OBJECTIVE

To determine whether the THM concentration in water provided to the Village of Waterloo's customers can meet the proposed 80 ppb limit in a financially feasible and practical manner without creating or contributing to taste and odor problems by (1) adding activated carbon, potassium permanganate (KMnO4), and a polymer to the prefiltration/disinfection process, and (2) treating the raw or finished water with ozone.

DESCRIPTION

The contractor will: (1) construct chemical feed lines between the WTP and the water intake; (2) add potassium permanganate, chlorine, and a cationic polymer/molluscicide to the raw water at the intake; (3) add an activated carbon slurry in the raw-water well at the WTP; (4) install ozonation equipment and treat the water by injecting ozone at the raw-water intake and within the WTP for six months; (5) obtain water samples to be analyzed for one year; (6) record energy use and cost data for the chemical feed and ozonation equipment; (7) complete a life-cycle cost economic analysis and a total energy analysis of each treatment option tested; and (8) prepare life-cycle cost and total energy matrices for ozone and chemical treatments for five size ranges of WTPs.

BENEFITS

Waterloo and other WTPs in New York State will receive complete cost, benefit, and energy information on using various combinations of chemicals and ozone for water treatment, and their impact on finished water quality in relation to raw-water parameters. High-quality water will be available for a planned industrial park at the former Seneca Army Depot.

SCHEDULE AND STATUS

Preliminary design of the ozonation equipment is under way.

FUNDING	Past Years	FY 1996-97	Total Anticipated
NYSERDA	0	$95,000	$95,000
Village of Waterloo	0	49,107	49,107
New York State Electric & Gas Corp.	0	45,000	45,000
Electric Power Research Institute	0	25,000	25,000
O'Brien & Gere Engineers	0	9,600	9,600
TOTALS	0	$223,707	$223,707

Contractor: Village of Waterloo
Site: Waterloo, Seneca County
Contract Duration: 1/97 - 9/98
Key Words: environmental, municipal, water treatment
Project Manager: Larry Pakenas (518) 862-1090, ext. 3247
Program: Environmental Research
Subprogram: Public Water Systems
Contract No.: 4491-ERTER-MW-97