MASTER

NATIONAL PLAN
FOR THE
ACCELERATED COMMERCIALIZATION
OF
SOLAR ENERGY

EXECUTIVE SUMMARY

MID-AMERICAN SOLAR ENERGY CENTER
1256 TRAPP ROAD
EAGAN, MINNESOTA 55121

DISCLAIMER

This report was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency Thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

DISCLAIMER

Portions of this document may be illegible in electronic image products. Images are produced from the best available original document.

MASEC-R--79-029 Vol. 1

DE82 013368

NATIONAL PLAN
FOR THE
ACCELERATED COMMERCIALIZATION
OF
SOLAR ENERGY. ³⁴

Volume 1. 44
EXECUTIVE SUMMARY

MID-AMERICAN SOLAR ENERGY CENTER

1256 TRAPP ROAD

950 9610 EAGAN, MINNESOTA 55121

DISCLAIMER

This book was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

DISTRIBUTION OF THIS DOCUMENT IS UNLIMITED

MGW

MASEC-R-79-029 (vol. 1)

EXECUTIVE SUMMARY

FOREWARD

The subject of this report is the Mid-American Solar Energy Center's Implementation Planning response to the Congressional mandate to the Department of Energy to develop a National Plan for the Accelerated Commercialization of Solar Energy. Congress has mandated the development of a National Plan for Accelerated Commercialization of Solar Energy (NPAC). The development of NPAC is to be accomplished in two phases which are 1) Options Analysis, and 2) Implementation Planning.

The Options Analysis is a calculation of the differential benefits and costs of alternative solar commercialization options which differ mainly in the level and delivery methods of federal solar incentives. Implementation Planning is a detailed set of activities needed to execute the policy option selected by the Secretary of the Department of Energy. The Regional Solar Energy Centers and SERI are responsible for the development of the Implementation Plan prepared by the Mid-American Solar Energy Center.

The body of this report details programs that can help resolve Mid-America's regional needs through the accelerated commercialization process. These proposed programs assume certain funding restraints and do not represent pushing the technological limits of all possible solar applications. A more ambitious proposed federal program could naturally bring us closer to solutions to regional and national energy needs. However, we feel these programs can have a significant impact on reducing our dependence upon the nation's dwindling access to non-renewable resources.

MASEC

The Mid-American Solar Energy Complex is one of four Regional Solar Energy Centers funded by the Department of Energy to commercialize solar energy and conservation integral to solar applications. MASEC is a Minnesota not-for-profit corporation governed by a region-wide Board of Directors under contract to the Department of Energy. The Board of Directors of MASEC is comprised of members nominated by the Governors of 12 states in the Mid-American Region. A council of states comprising individuals from each MASEC state is appointed by their Governors to serve on a Program Review and Planning Board, which is comprised of council members and a group of experts in each state called the Solar Resource Advisory Panel. State Solar Offices serve as the primary in-state interface between the state and MASEC and are manned by coordinators.

The Mid-American Solar Energy Center (MASEC) Corporation is responsible, within its Region, as DOE's lead institution related to the regional commercialization of solar technologies and conservation integral to solar applications. Assignments to carry out these missions are under the cognizance of the Assistant Secretary for Conservation and Solar Applications.

In carrying out its program responsibilities, MASEC established and maintained contact with a wide range of organizations and institutions, public and private. The MASEC program management approach is a continuing cycle of program development, implementation, evaluation, and regional education. The basic steps in program planning are to survey the Region for needs, resources and appropriate actions.

The MASEC/NPAC Methodology

The base data for the Mid-American Region's NPAC report comes from regional planning meetings and topical conferences--with a variety of participants from each state representing every facet of interest and technology.

A regional planning meeting called the "Boiler Room" was held on April 16-18, 1979, at the MASEC Center, for the purpose of preparing input for the Mid-American section of NPAC Implementation plans. Programmatic working groups were organized by market sector.

Major outputs from the "Boiler Room" session were: (1) implementation programs in each of four market sectors, (2) energy use questionnaire, (3) determination of energy costs and percentage contribution, and (4) position papers.

Programs were developed for the buildings sector in seven generic areas:

1. Public Education/Awareness
2. Education and Training
3. Financial Incentives
4. Legislative and Regulatory
5. Performance/Analysis
6. Design and Planning
7. Demonstrations

The overall tenor of the program set was an emphasis on what could be termed a "sociological solution" rather than a "technological solution" to the problem of accelerated solar commercialization.

Introduction

The Mid-American Region consists of the states of Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin. They constitute 21.5% of the nation's land area and contain approximately 27% of the United States' population. The regional distribution of energy demand by primary consumers is similar to the national distribution except that 42% of all natural gas used in the entire national residential sector is utilized by consumers in the MASEC Region. The sector demand in the Region is 31% industrial, 21% transportation, 20% residential, 7% electric utilities, the 8% commercial, and 3% agriculture. The Regional fractions for fuels are: 34.6% for petroleum, 33.5% for natural gas, and 27.7% for coal; compared with the national distribution of: 42.6% for petroleum, 33.7% for natural gas and 17% for coal.

In 1975 the Mid-American Region consumed over 28 percent of the total energy consumed nationally but produced only 9 percent of the nation's energy. Such statistics underscore the Mid-American Region's backing of those solar commercialization programs which point to the near-term savings of conventional fuels by tapping renewable energy resources readily found in the Region. The Mid-American Region views the emerging national solar commercialization goals as a major step to begin to offset the huge energy deficit found in Mid-America.

The MASEC Region will play a crucial role in the future commercialization of solar energy systems. In 1978, there were at least 222 solar equipment manufacturers operating within the MASEC Region. A recent Congressional study noted that nearly three million jobs would be created and the nation's bill for conventional fuels would be slashed by almost \$120 billion by 1990 if the United States underwent a massive shift toward the use of solar and away from fossil energy.

Buildings

Buildings in the residential and commercial sectors afford a large opportunity for the increased utilization of solar energy. Addressing this market sector requires a dual approach. First, the approach is appropriate design, construction and management of buildings less energy, and second the approach is utilization of solar technologies. An estimated 5 quads of conventional fuels can be saved by 1983 through energy conservation and solar applications in the Region. The most applicable solar technologies for this sector in the near-term are passive, hot water heating, and space heating applications, and to a lesser extent, wood combustion and small-scale rural applications of wind. Energy conservation is an integral part of, and must precede solar, if the system employed is to be effective in satisfying a large portion of the building's energy needs. Passive heating compared favorably on a life-cycle basis with electrical space heating for nearly all of the United States. A large potential market for passive design exists for residential, commercial, and institutional buildings.

Residential Market Characterization

In the MASEC region, space heating accounts for 73.5% of the residential energy demand; this amount is significantly higher than the national residential space heating demand of 63.7%. About 40% of this heating demand was accounted for by consumers. Solar heating technologies allow a viable alternative to natural gas which supplies nearly 70% of the residential heating and 78% for hot water heating. The solar market is largest for new and retrofit installations in single-family detached homes. Custom homes are also a significant market because of easier financing. The apartment buildings market requires addressing the problems of building managers, rent control authorities, builders, and construction financiers.

Commercial Market Characterization

In the near-term the commercial component of the buildings sector affords a large opportunity for the utilization of proven solar technologies, especially passive and hot water systems. The majority of energy consumption in the commercial sector is for space conditioning and solar is an entirely appropriate energy source for meeting the energy demand. Retail trade buildings comprise 59% of the total commercial buildings and solar can make an important impact. There is a large potential for the utilization of solar in public and government buildings and this submarket consumes over 18% of the commercial energy in the Region. The visibility factor of solar demonstrations in public buildings is important to public awareness. Schools and educational buildings have load profiles with an excellent match between energy demand and insolation availability. Estimates from the American Institute of Architects show that with aggressive solar and energy conservation programs, the amount of energy saved in this sector alone could range from 30 to 50%.

BUILDINGS SECTOR PROGRAMS

<u>Program Number</u>	<u>Program Title</u>	<u>Description</u>
---------------------------	----------------------	--------------------

1.	<u>Solar Information Dissemination</u>	- Prepare technical information packages. Provide regional solar performance and economic packages.
2.	<u>Solar Case Studies</u>	- Identify, document and dissemination information about successful solar installations.
3.	<u>Audio/Visual Library</u>	- Prepare and maintain audio visual materials for use by regional solar interest groups.
4.	<u>Solar Index program</u>	- Assist expansion of the DOE solar index program.
5.	<u>Solar Conferences/Product Shows</u>	- Organize and conduct solar conferences and shows on the local level.
6.	<u>Solar Information Resource Centers</u>	- Fund staff to organize, supply and operate a solar information center within local libraries.
7.	<u>Energy Education Program</u>	- Provide energy curriculum materials for grades K-12 for regional educators.
8.	<u>Vocational-Technical Training</u>	- Institute solar and conservation training programs in vocational schools throughout the region. Provide architectural and financial support for vocational-technical schools.
9.	<u>Organized Labor - Skills Upgrade</u>	- Work with organized labor to develop apprentice and supplemental journeyman training programs for solar installation and maintenance.
10.	<u>Financial Community Education</u>	- Prepare and disseminate relevant solar information for workshops with financial and insurance personnel. Prepare information for builders and installers to present to lenders for loans.
11.	<u>Builder and Realtor Education</u>	- Gather information on existing solar projects on construction techniques, equipment performance, maintenance, economics, and marketing factors. Disseminate gathered information to builders and real estate professionals.
12.	<u>Architects and Engineers Education</u>	- Develop and disseminate solar courses for engineering and architecture curricula.
13.	<u>Solar Access Legislation</u>	- Develop model solar access legislation for dissemination to state legislators.
14.	<u>Codes and Regulations</u>	- Provide the solar industry with information on existing solar codes and regulations. Develop model codes and regulations.
15.	<u>Performance Monitoring</u>	- Identify, measure, and analyze solar water heating systems and instrumentation. Disseminate resulting information throughout the region.

16. Performance/Payback Analysis - Perform thermal and economic analysis on combinations of solar system and building types based on existing analytical models.
17. Tract Home Designs - Research, provide solar designs for, and disseminate information to the tract home industry.
18. Government Building Demonstrations - Fund solar demonstrations for local government buildings. Disseminate information on solar energy to state officials.
19. Urban Retrofit Expositions - Fund designer/contractor teams to build and document urban retrofit solar systems. Disseminate information on the systems.
20. State Energy/Planning Agency Interface - Compile information effectiveness on solar tax incentives and provide such to state agencies and legislators. Form an interagency study team to investigate a utility loan program. Provide communities with information on the effect of policies on energy use.
21. Analysis of Climate Variables and System Performance - Analyze current data gathered and provide new programs as needed. Develop analytical models for prediction of solar thermal/wind systems.
22. Solar Thermal - Establish solar hot water heating system demonstrations. Survey and monitor existing installations. Assess the regional need for make-up warm air for space conditioning and process heat. Evaluate the impact of combining current heat pumps and solar technologies.
23. Passive - Analyze regional potential for passive solar. Develop regional passive models. Monitor and assess selected structures. Develop and provide design methods for passive to architects and home owners. Make cost-effectiveness analysis and disseminate information to the region.
24. Wind - Gather and assess regional wind data. Prepare and disseminate data from analysis. Develop wind measuring equipment loan program for solar buyers.
25. System and Component Evaluation and Certifications - Survey and assess existing test equipment in region. Define regional test criteria and test procedures. Establish a test laboratory. Perform tests and publish procedures, standards and results.
26. Handbooks - Survey and gather available information on solar. Develop information storage and retrieval mechanisms. Provide and maintain regional handbook. Identify specific user audiences. Repackage and disseminate solar material to specific and general audiences.

27. Solar Energy and Conservation Workshops - Prepare and conduct regional workshops on solar to the general public. Prepare and conduct regional specific audience workshops for architects, builders, designers, and solar technologists.
28. Information and Education Services - Develop and maintain capabilities for handling specialized information requests. Compile and organize a specialized collection of materials. Develop a solar energy information data bank. Maintain data processing capabilities. Provide capabilities for preparing and packaging solar documents, audio visual materials, and other information dissemination methods.
29. Public Affairs - Hold public meetings, lectures, discussions, seminars, workshops, etc., on solar subjects. Organize and maintain a speaker's bureau. Prepare, coordinate, and conduct solar energy shows. Prepare and conduct mass media shows. Prepare materials for public affairs.
30. Displays and Exhibits - Design, construct, and operate a solar energy conservation van. Build and lend out solar display booths. Develop collateral materials for display booths.
31. Warranties - Study the warrantee issue. Develop model warrantee program. Maintain contact with state consumer protection agencies.
32. Certification Studies - Make a study of the problems in solar system certification. Develop mechanisms for certification.
33. Production Distribution Study - Evaluate economic and technical impacts of solar technology on the distribution of solar products. Plan and promote distribution networks for solar products.
34. Regional Needs and Resources - Assess regional solar opportunities from regional supply/demand profiles.
35. Market Analysis - Develop a regional energy market model to forecast the future solar market.
36. Materials Development - Assess the present and the future material needs for solar. Maintain an interface between the solar industry and government agency to disseminate information on solar materials.
37. Small Business Financing Study - Survey the financing needs of lenders and small businesses in the region. Disseminate the results of the survey and provide expertise to lenders. Prepare a regional business development plan.
38. Regional Planning and Coordination - Provide communication links between industry, government and solar consumers. Maintain contact with solar advisory boards from the region.

Industrial Process Heat

In the Industrial Process Heat market, 0.6 quads of energy could be saved by the year 1985 and 7.0 quads saved by the year 2000. The industrial process heat market is favorable characterized by large energy usage with many large installations which can be easily identified. These sites are characterized by relatively low costs in dollars per BTU because the solar energy equipment has a constant load demand and the large installations afford economies of scale. Other favorable market characteristics include low cost, fast, and effective communication is available through trade and professional associations, shows and literature.

The Mid-American Region accounted for 29% of all industrial energy consumption in the U.S. including 40% of the primary metals, 34% of the stone clay and glass, and 42.5% of the food processing. The industrial sector uses about 40% of the actual energy production of which process steam and heat together account for 67%. The industrial fuel for the region is comprised of mostly natural gas and coal.

The top energy usage markets are primary metals, petroleum refining, chemicals, paper, and allied products, stone, clay, and glass and food processing. Of those markets only chemical, paper, and food have a large required direct energy demand under 350°F and only one market, food processing, has a large demand under 212°F.

The applicability of solar energy to industrial process heat varies widely with industry, process, and even plant site. The market program in IPH must be very specific in its direction and in its site selection criteria. Initial market selected for investigation in the food industry includes hog slaughtering, pork processing, wet corn milling, soy bean oil manufacturing, whey and milk

INDUSTRIAL PROCESS HEAT PROGRAMS

<u>PROGRAM NUMBER</u>	<u>PROGRAM TITLE/DESCRIPTION</u>
1.	<u>IPH Solar Industry Coordination and Sales Assistance</u> - Coordinate programs directed towards the solar industry and assist in sales.
2.	<u>IPH Solar Industry Marketing</u> - Survey the solar industry and disseminate information on products and services.
3.	<u>Industrial Financial Assistance</u> - Study financial data on individual companies and disseminate a financial report. Organize a venture capital corporation.
4.	<u>IPH Architect and Engineering Training and Assistance</u> - Acquire installation data, develop design tools, develop A and E data bank and provide education aids and course curricula for A and E schools.
5.	<u>IPH Contractor and Installer Training</u> - Collect cost and operational data on installations, publish information, provide workshops and assistance.
6.	<u>IPH Operation and Maintenance Training</u> - Acquire and analyze data on solar equipment operation and maintenance. Develop training programs and workshops.
7.	<u>IPH Consumer Coordination</u> - Coordinate consumer orientated programs.
8.	<u>Executive Awareness Programs</u> - Organize industry speakers bureau and develop presentation packages individualized by industry and application. Organize an industry advisory council for advice on government policies and programs.
9.	<u>Consumer and Economic Research</u> - Analyze economic, technological, and environmental, and consumer factors which affect industrial solar energy potential.
10.	<u>IPH Target Market</u> - Identify promising markets, present solar feasibility workshops, develop energy audit procedures and preliminary design methods and disseminate the information.
11.	<u>IPH Consumer Financial Assistance</u> - Determine the financial needs and qualifications of potential IPH purchasers and lenders. Develop financial packages and assist lenders in making evaluations.
12.	<u>IPH Industry Solar Promotion and Consumer Assistance Program</u> - Develop solar system data book and provide industrial consumer assistance.

13. IPH Government Coordination - Coordinate and transmit information among governments and programs.
14. IPH Tax - Survey and analyze existing solar IPH related taxes, develop model legislatures, and promote results. Form a solar tax council to recommend studies, legislation, and regulatory changes.
15. IPH Legislative Study - Monitor then model legislation affecting IPH. Study legislation for IPH fuel prioritization.
16. IPH Legal and Regulatory - Survey existing regulations and codes on solar systems and components and disseminate a report.
17. State and Local Government Interface - Promote tax, regulatory and legislative program results, and transmit information between the state and local governments and industry.
18. Federal Government Interface - Recommend results of legislative, tax, and regulatory programs and promote grants and demonstration projects.
19. Technology Development Coordination - Assist candidates for demonstration programs. Coordinate technical and demonstration programs with industry.
20. Target Industry Design - Develop design criteria then models of generic system designs for target industries. Hold design competitions.
21. IPH Demonstration - Provide demonstration program promotions and management. Provide for installation analyses and problem solving.
22. IPH Demonstration and Data Support - Provide for installation data and performance analysis and disseminate information to the solar industry. Provide component testing and recommendations.
23. Industrial Process/Product Redesign - Develop methods, and requirements for process and product redesign and provide models and analysis in combination with appropriate workshops and conferences.
24. IPH Woody Biomass - Survey the forest products industry for opportunities. Organize analysis team.

drying, rendering and sugar. Other initial processing markets include automotive, glass, lumber, paper and asphalt and various preheating applications.

Industrial decisions are based on return on investment, reliability, operating and maintenance costs and equipment life. The decision makers can be contacted through the commercialization media, associations, show conferences, seminars and even directly approached. Commercialization requires an understanding of the needs of the buyer and the several levels of corporate management which are often involved.

Before a major government action on energy is made, the effects in the entire socio-economic systems must be considered. The study methodology involves first identifying and assessing the problems and then developing and promoting alternative recommendations. The final step is to promote the results throughout the region. The programs are organized into three constituencies: the consumer, the government, and the solar industry. By directing programs towards types of individuals, client contracts are easier and advocacy on issues is simplified. A fourth category, product definitions, covers programs directed toward improving solar technology.

Agriculture

Nationally about 2% of the total energy consumed in the U.S. is used directly on the farm. Production agriculture uses about 20% total energy required by the food system while food processing, transportation, trade and final preparation make up the balance. Safeguards against fuel shortages put agriculture high on the priority list; however, recent disruptions of the distribution system indicate the frailty of the system.

The MASEC Region accounts for approximately 47% of the nation's total agricultural energy consumption. Its farms produced 82% of the nation's corn and 53% of the wheat.

Studies indicate manures will be increasingly valuable resource for crop production rather than a waste product. Livestock and poultry manure can supplement fertilizer or feed. The quality of these manures varies significantly with climatic conditions and waste management practice.

An estimated 52 million tons of manure is economically recoverable, and about 49% of the available animal manure could be economically converted to methane given the current state of the art. Studies indicate a clear need to focus of the development of conversion technologies applicable to the small and intermediate size operation.

The nine leading crops in the U.S. produced nearly 400 million tons of crop residue a year, but if removed replacement of large amounts of nutrients would be required. Sound energy conservation and management techniques will become increasingly important as energy costs rise and supplies become uncertain.

The use of wind energy will provide mechanical and electrical power for irrigation, and other uses. Flat plate solar thermal systems are capable of providing hot water for devices, space heating, crop drying, and other uses. Passive solar will increasingly become attractive for space heating needs of rural residences, livestock buildings, farrowing houses, etc. Photovoltaic systems hold vast potential for on-site applications requiring electricity.

Fermentation of grains, crops, and other organic residues can produce alcohol for use in gasohol which may be cost effective depending on among other factors, the price of feed stock and gasoline. In order for many of these techniques to become cost-effective, integrated systems and processes must be demonstrated. The cost-effectiveness of each application will depend on cost and availability of conventional fuels, financing, government regulations, taxes, and other practices.

Greenhouse agriculture utilizing solar reliant design features and waste heat could serve as an economic means of producing high yield crops on a year around basis and has a potential savings of 1 quad of energy.

Farmers are self-determined, self-sufficient and innovative and are willing to use new technology to increase their independence from uncontrollable market factors. Thus solar energy will be increasingly attractive to them.

AGRICULTURAL SECTOR PROGRAMS

<u>PROGRAM NUMBER</u>	<u>PROGRAM TITLE/DESCRIPTION</u>
1.	<u>Agricultural Energy Consumption Survey</u> - Obtain national energy consumption to the county level on specific end-use tasks.
2.	<u>Thermodynamic Needs Assessment of End-use Tasks</u> - Develop thermodynamic requirements of end-use tasks.
3.	<u>Survey of Renewable Availability for Energy Production</u> - Determine quantity and replacement rates for renewable resources; i.e., crop residues, manure, etc.
4.	<u>Agricultural Energy Models Development</u> - Develop models to analyze data from programs 1, 2, and 3 and integrate the information.
5.	<u>Agricultural Industry Advisory Council</u> - Develop advisory council to evaluate and update agricultural programs.
6.	<u>Institutional Barriers to the use of Solar in the Agricultural Sector</u> - Collect, analyze, and develop programs based on legislation and regulations on agriculture land, water, food processing, pricing, party supports, etc.
7.	<u>Invocative Finance Program--Needs Assessment</u> - Survey and assess current finance programs and implement new programs as needed.
8.	<u>Information Dissemination</u> - Develop information/training aid materials, determine information needs, and provide assistance to existing organizations.
9.	<u>Agricultural Uses of Solar Energy--Training Programs</u> - Survey existing data on agriculture solar projects and develop training programs for educational institutions, i.e., Vo-Tech, Agricultural Schools, etc.
10.	<u>Solar Energy Information Transfer--Financial Community</u> - Compile and analyze data on agricultural installations for making financial analyses to disseminate to rural financiers.
11.	<u>Market Analysis--Solar Crop Drying</u> - Survey the crop drying market and provide information to the solar industry.
12.	<u>Market Analysis--Small Wind Energy Conversion Systems</u> - Determine viable energy management techniques for wind, make market projections, and disseminate information.
13.	<u>Solar Crop Drying Demonstrations</u> - Survey current projects, develop designs, solicit farmer proposals, and construct installations.

14. Urban Solar Reliant Greenhouse Demonstrations - Solicit proposals, construct installations, and monitor results for urban greenhouses.
15. Dairy Hot Water Demonstrations - Solicit design proposals, make awards, construct installations, monitor results, and disseminate information on dairy hot water systems.
16. Space Heating/Ventilating of Livestock and Bird Shelter Demonstrations - Survey existing installations, develop designs, construct installations and disseminate results on solar shelter applications for hogs, feeder pigs, turkeys, and chickens.
17. Agricultural (On-Farm) Application of Solar Thermal Industrial Process Heat - For on-farm processing of food, survey applications, solicit design proposals, and construct installations.
18. Direct Combustion Demonstrations - To study and demonstrate direct combustion of wood or agricultural residues for such applications as crop drying, and process heat, design and construct appropriate installations.
19. Small Wind Energy Conversion System (SWEC) Demonstration - Solicit innovative design proposals, build installations and monitor results.
20. Small Wind Energy Conversion (SWEC)---Utility Interface Study - Determine cost-effectiveness of integrating various sized SWEC systems with utility grids.
21. Large Wind Energy Demonstration Programs - Solicit proposals, install equipment and monitor performance of large wind systems.
22. On-Farm (ETOH) Production/By Product Utilization Demonstrations - Determine optimum system for individual locales, solicit proposals and install demonstrations.
23. On-Farm Methane (CH₄) Production/By-Product Utilization Demonstration - Determine optimum systems on a bio-regional basis, construct demonstration systems and publish results.
24. Consumer Protection--Agricultural Sector - Monitor government programs, manufacturers, contractors, certification, and warranty programs. Work with the solar industry and consumers.

UTILITIES/SYTHETIC FUELS PROGRAMS

<u>PROGRAM NUMBER</u>	<u>PROGRAM TITLE/DESCRIPTION</u>
---------------------------	----------------------------------

1.	<u>Energy Cost/Value Assessment</u> - Analyze the American Energy infrastructure to determine methods and priorities in energy predictions.
2.	<u>Comprehensive Public Power Utility Assessment</u> - Research rate reform and develop data base for conservation and solar energy. Develop lending criteria and incentives for implementing solar and conservation with utilities.
3.	<u>Liquid and Gaseous Fuels from Municipal Waste</u> - Obtain waste material data, investigate waste conversion methods, and construct pilot projects.
4.	<u>Liquid/Hydrogen Storage</u> - Identify, analyze, and design model wind/hydrogen energy systems. Construct, monitor, and promote pilot demonstration systems.

REGIONAL COST SUMMARY

BY MARKET SECTOR

YEARLY COST
(IN THOUSANDS OF DOLLARS)

<u>Sector</u>	<u>1980</u>	<u>1981</u>	<u>1982</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>
Buildings	7,665	12,730	17,687	28,504	42,291	49,769
IPH	1,099	2,305	2,905	7,098	10,193	12,013
Agriculture	2,930	4,707	5,498	9,637	12,183	12,831
Utilities	938	1,566	1,884	4,131	4,559	4,559
 TOTAL	 12,632	 21,308	 27,994	 49,370	 69,226	 79,172

6 Year Total = \$259,702,000