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ENERGY RESOURCE MANAGEMENT
FOR
ENERGY-INTENSIVE MANUFACTURING INDUSTRIES

Claude W. Brenner
Joseph E. Levangie

October 1981

Prepared for
University of California
Lawrence Livermore National Laboratory

Subcontract No. 3151501

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FOREWORD

This work was sponsored by the United States Department of Energy, and was performed for the University of California, Lawrence Livermore National Laboratory, under Subcontract No. 3151501. The authors gratefully acknowledge the guidance and support of Mr. Cyril Draffin, DOE Program Manager, and Mr. Alan Casamajor, LLNL Program Manager. Appreciation is also extended to Mr. Richard C. Funk, President - Chief Operating Officer of the National Frozen Food Association, who identified target companies for the discussions reported herein and used his good offices to assist in introductions to key executives. Dr. Leo D. Pederson, Director of Engineering, Western Research Laboratory, National Food Processors Association, assisted in a similar vein.

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EXECUTIVE SUMMARY

Introduction

Energy Resource Management is an orderly four-step process designed to provide senior industrial decision makers with a sound basis for deciding upon an appropriate course of action to protect profits and to achieve security of energy supply for each plant and facility. Vulnerability of an industrial operation to conventional fuel or power supply interruptions or to rapidly escalating energy costs can be minimized if not eliminated by application of this approach.

- Reduce energy consumption now through cost-effective measures of efficiency, recovery and conservation.
- Integrate forecast energy demand with supply/cost projections, including energy shock, into the long-term strategic business plan to measure the amount, cost and availability of energy needed for production.
- Assess the plant-specific investment options to meet demand, including alternate-energy micro-utilities, and establish decision criteria as a function of
 - Energy demand
 - Federal tax incentives
 - State and local incentives
 - Financing methods
 - Return-on-investment hurdles
 - Competing investment needs
- Implement the energy supply plan in response to business goals and priorities.

Energy Resource Management provides an action plan tailored to each individual plant. There is no generalized solution. Each plant requires its own solution. The combination of energy

use patterns, history and forecasts of primary energy supply, economics of conversion, proximity to renewable or abundant resources, readiness of the technology of potential alternate systems, state and local incentives, codes and regulations - all in the context of the specific culture, practices and goals of the business - make each plant unique.

Because of the dynamics of the world energy supply/demand situation, an annual review and update of the Plan is essential.

This Program to introduce Energy Resource Management into energy-intensive manufacturing industries was undertaken with the following objectives:

1. To determine what the specific barriers are that may impede the introduction, and what incentives would serve to encourage its adoption.
2. To develop a model Energy Resource Management Plan for a selected manufacturer, integrating it into the company's long-term Strategic Business Plan.
3. To establish methods for communicating results of this Program together with its principal conclusions to manufacturing industries at large.

In meeting these objectives, discussions were first held with more than two dozen Trade and Professional Associations in five industries to select a candidate industry with which to work. The Food Industry (SIC No. 20) was chosen; and, with the assistance of the National Frozen Food Association and the National Food Processors Association, 20 companies were selected for interviews. These were geographically dispersed throughout the country, covered all basic food products and processes, and included companies from under \$20,000,000 in annual sales to over \$600,000,000, independents, subsidiaries and cooperatives. Of the thirteen companies visited, three were selected as candidates for the Model Plan, all agreed to participate, and a major national multi-plant fruit processor cooperative was chosen. Finally a Program was developed with Associated Industries of

Massachusetts to serve as a vehicle for a model Symposium for executive decision makers as one element of the overall communications and information dissemination strategy.

Barriers and Incentives

The general conclusions resulting from discussions with manufacturing executives and from the performance of the model Plan follow.

1. There is a wide variability in energy awareness and activity within the industry. With rare exception, executive familiarity with the energy outlook and governing parameters, is low, particularly in regard to relevant Federal and State legislation. Size of the company is not necessarily a determinant. In many cases, marketing considerations - and investments - overshadow energy concerns to a significant degree. There is, nevertheless, a highly evident need for educating decision makers to the necessity of treating energy cost and availability with the same respect that they give the more traditional business planning parameters.
2. The principal barrier to the adoption of Energy Resource Management and its thrust of capital investment in alternate-energy micro-utilities is financial. This barrier is exacerbated by the impact of rulings, regulations and requirements of a variety of Federal agencies.
3. The strongest financial incentive for investment in energy-related capital equipment may well be the provisions of PURPA. Where State PUC's have acted to interpret PURPA most favorably to industry, alternate energy investment decisions are more likely to be made. This is because favorable buy-back rates for electricity provide

a steady income stream to the industrial generators, and help to satisfy IROR criteria.

4. Energy Tax Credits are not directly available to, and therefore do not act as an incentive for the non-profit Cooperatives in the Food Industry. In addition, there is a number (that may be large) of companies which are marginally profitable, for whom Tax Credits are not an adequate incentive, despite their carry-back and carry-forward provisions.
5. Accordingly, if further Federal financial incentives are to be legislated, it would seem that those that are income generating, yielding above-the-line income stream, rather than one-time below-the-line credits would be a more effective means of encouraging capital investment in alternate energy systems at industrial plants.
6. In drafting legislation, Government must develop a sensitivity to industry-specific problems - such as that of the food cooperatives - to insure that intended incentives and benefits are realizable. In addition government at all levels must take steps to assure that regulatory and licensing delays for alternate-energy initiatives by industry do not defeat their purpose. Better two-way communications between government and the Trade Associations that represent industry must be developed so that government intent and purpose is clear and understandable. There can be no false signals to paralyze industry into inaction.
7. Industry, in turn, has a responsibility in its own self interest to develop energy consciousness

to the degree where their energy data base is known and current and energy efficiency programs are sustained and ongoing. In addition with energy-related capital investments capable of yielding highly competitive Internal Rates of Return, companies must not be deterred by their inability to finance such projects, but can take an aggressive posture with respect to the use of third-party financing.

8. Effective reduction of energy usage goes beyond the management of energy supply cost/assurance strategies. Changes in work practices and habits, and plant relocation to minimize the cost of transportation of raw material to manufacturer are additional avenues that must be examined. In addition, more energy-efficient processing equipment or packaging systems may offer more attractive returns on investment than an alternate energy system. The issue is one of demand reduction on the one hand, and supply displacement on the other.
9. Some businesses will inevitably fail as a result of continued energy cost inflation or of energy shock. There are two reasons for this. One is that they will not have planned adequately, if at all, for the eventuality. The other is that a combination of circumstances - e.g., inaccessibility to renewable resources, unavailability of land or roof area for installation of energy-conversion systems or storage of alternate fuels, uncertainty of supply of conventional power from their electric or gas utility, coupled with their own business condition - will prevent them from taking any suitable action to survive. The only option in those cases may be for the companies to move to more energy-secure locations, secure both

from the standpoint of conventional power and accessibility to renewables.

The Model Energy Resource Management Plan

The Company selected to serve as the model for the Energy Resource Management Plan was chosen for a number of reasons. First, as a Cooperative, it derives no benefit from Federal (or State) Tax Credit legislation. This is a critical issue for all Cooperatives in the Food Industry, and the model was expected to yield recommendations for dealing with this gap. Second, the Company is large, and multi-divisional with a wide geographic spread. Solutions in the Northeast will not be the same as solutions in the Southwest or Northwest. Third, the Company has taken some strong alternate energy initiatives, and is a fertile subject for the model. And fourth, they are perceived in the industry as aggressive, innovative and forward-looking, and their potential implementation of the modeling results would be watched closely and possibly reproduced by other companies.

Development of the model Energy Resource Management Plan required performance of the following steps:

1. Establish the Company's baseline manufacturing energy consumption and cost by primary energy (fuel) type and use in the manufacturing process.
2. Establish a projected energy cost for the Company during the strategic planning period.
3. Determine the impact of energy conservation measures in order to establish the "reasonable irreducible minimum" baseline energy requirement, expressed as a unit cost.
4. Assess the impact of energy cost/availability on manufacturing operations and costs, and hence on productivity and profits, in the context of three energy scenarios - low cost, high cost and energy shock.

5. Determine what, if any, site-specific, decentralized supplemental energy system would meet the Company's energy requirements in each scenario as a function of four levels of operating criteria - namely, survival, break-even, meeting short-term profit goals, meeting long-term growth goals.
6. Specify the alternate energy system, if any, as a function of:
 - a. Percentage of primary manufacturing energy it will be called upon to supply in the context of the four above-named operating criteria.
 - b. Alternate site-specific options that may apply, including wind, biomass, solar thermal, photovoltaics, hydro-electric, geothermal, ground-water or other energy conversion systems, as determined by local environment, as well as by the state of the art and comparative economics of each technology.
 - c. Federal, State and local incentives and regulations.
 - d. The date by which the system would be required to be on line.
 - e. Cost.
7. Assess the financial impact of an investment in a site-specific, alternate energy system on the basis of appropriate internal rate of return parameters in comparison with other demands on the Company's discretionary investment capital.
8. Develop with Company's management a set of decision criteria that would lead to such investment; and design the optimum financing mechanism for the investment.

The model Company is headquartered in the East, owns six plants in widely separate locations. The above methodology was first applied to the Company as a whole, and then was focussed

on one plant, located in the Midwest. This plant has a crop-residue incinerator coming on line. The principal results of the planning study are the following:

1. Company-wide (headquarters and six plants) energy costs in Company Fiscal Year 1981 were \$4,440,000. Application of median-case energy price escalation data to the forecast energy demand inferred from the Company's five-year Business Growth Plan boosts this figure to over \$25,000,000 in Company Fiscal Year 1986 without conservation or alternate/renewable energy initiatives.

2. The Company's ratios of energy costs to key fiscal indicators grow as follows:

	<u>1981</u>	<u>1986</u>
Percent of Sales	1.51	3.07
Percent of Net Proceeds	3.33	10.59
Percent of Administrative Dudget	22.01	55.32
Percent of Capital Budget	31.30	100.82

3. The Midwest Plant's incinerator will realize a cumulative savings in energy of 21.9% over the five-year period.
4. An 8 x 65kW wind farm at this Plant operating in an average wind of 14 mph, with utility buy-back under PURPA pegged at 2.2¢/kWh (1¢ below the utility rate) for 50% of the 1,6000,000 kWh generated each year, yields an internal rate of return (IRR) of 18%. This figure increases to 22% if the buy-back rate equals the utility rate. If the wind resource turns out to be as high as 18 mph, the IRR increases to 35%. (The same wind farm in the East would yield a 90% IRR at 14 mph, because electricity rates are effectively twice those in the Midwestern state of the plant's location where coal is the utility fuel.) Conversely, if the Energy Tax Credit is eliminated,

the baseline IRR (18%) drops to 7%. If PURPA buy-back is eliminated, this figure drops to 2%. The latter two results confirm quantitatively conclusions that were drawn qualitatively from discussions with executives:

- i. A Cooperative, unable to take direct advantage of Energy or Investment Tax Credits will not be motivated to invest in alternate energy systems, because it is not economic to do so. This argues for third-party financing as an attractive avenue for the Cooperative to pursue.
 - ii. If further Federal financial incentives are required to stimulate such investments, PURPA-like incentives are clearly the more attractive, not only because of the steady income stream previously perceived to be the motivator, but also because the IRR is significantly impacted - more so than by the Energy Tax Credit - as this study reveals.
5. The combined effect of a four-year progressive conservation program, the incinerator and the wind farm would reduce demand on conventional fuel sources from 213 to 126×10^9 Btu per year, or 41%.
 6. The Plant is in an area swept by tornadoes during the peak crop-processing season. A three-week electricity outage resulting from transformer destruction could cost as much as \$24,000,000 in lost sales. This argues from a tornado-invulnerable back-up electric power system, such as a biomass, crop-residue or coal-fired cogenerator.

Information Dissemination Strategies

Many companies employ energy professionals who are making effective progress in introducing energy reduction programs. But they are constrained both by short-term profit considerations, and by internal competition for funds in the more traditional, better understood, and therefore, more easily justified operational areas. In addition, as a result of this competition they have difficulty in gaining the ear of the key executive decision makers. There is an evident communications gap which exacerbates the inattention to the longer-term issues of planning for energy security.

The task of priority, if the results of this Program are to be understood, accepted and adopted by industry, is to address the Corporate decision makers. This audience includes Chief Executive Officers, Chief Operating Officers, Engineering, Manufacturing and Financial Executives and Chief Planning Officers.

The appropriate vehicle for reaching this group is that set of Professional Associations as well as Trade Associations to which these members of the industrial community or their companies belong. Symposia, seminars and workshops dealing with this issue - presented either as singular events, or as part of other programs - are a proven method by which these Associations communicate new information.

Associations which may serve as vehicles for this form of communication fall into several groups. There are the Professional Associations oriented specifically to Chief Executives such as the Young Presidents' Organization, the Chief Executives Forum and the Presidents Association. There are planning and management organizations for senior executives, which include the Planning Executives Institute, the Center for Planning and Implementation and the Industrial Management Society. There are national business associations which include The United States Industrial Council, the National Association of Manufacturers and the National Small Business Association.

At the regional level there are four regional associations serving small businesses, some of whom as manufacturers would

benefit from communication of the results of this Program. These regional small business groups serve New England, the Mid-Atlantic, the Mid-Continent and the Mountain States.

At the State level there are 40 manufacturers' associations similar to the Associated Industries of Massachusetts, the model vehicle used in this Program, all of whom are members of the Conference of State Manufacturers Associations. All States are represented (as well as Puerto Rico) with the exception of Alaska, Delaware, Hawaii, Maryland, Montana, Nevada, North Carolina, South Carolina, South Dakota and Wyoming.

In addition to these non-industry-specific or cross-cutting associations which are communication vehicles for senior executives, there are hundreds of industry-specific Trade and Professional Associations - for example, 88 serving the food and dairy industries - through which this information can be disseminated in a variety of ways. The Encyclopedia of Associations, the Directory of the National Industrial Council, and National Trade & Professional Associations of the United States and Canada and Labor Unions are sources which list and describe these organizations.

A model syllabus for a Symposium addressed specifically to executive decision makers was generated, as noted above, in cooperation with the Associated Industries of Massachusetts. It is structured first to lay the foundation for the need. This is accomplished by reviewing current energy supply patterns, supply patterns in the near future, and the status of technological development in recovery of conventional fuels and in renewables to the extent that each may represent supply options for the longer-term future. The steps to achieve base-line minimum energy consumption are then outlined as a conclusion to Part I of the Syllabus.

These data lay the groundwork for Part II, which examines the elements of Energy Resource Management, as discussed above. It develops with the integration of energy cost/availability scenarios with the long-term business plan, reviews Federal financial incentives for alternate energy capital investment, together with methods of financing a major piece of energy

equipment, and also reviews the impact of the various Federal, State and local regulatory agencies. The Syllabus was designed to demonstrate that an orderly, methodical procedure may be used to provide the Corporate decision maker with the structure and information by which he can make appropriate decisions affecting the security of his company's energy supply in the future. The Syllabus is sufficiently general so that its content may readily be adapted to any geographical area, or any given industry.

There are three additional elements of the information dissemination strategy. One is a parallel program of symposia, seminars and workshops addressed to the middle management level who have both the responsibility of recommending courses of action and for implementing Corporate decisions. With more emphasis on implementation aspects rather than financial issues, the model Syllabus is the mechanism for this communication. This two-pronged educational program may begin to close the gap in internal communications on energy policy and strategy that is perceived to exist in many industrial organizations.

A second element is to take advantage of the journals and periodicals published by the many associations discussed above for publication of articles describing this approach. A third is direct communication with company executives by distribution of this Executive Summary.

This Program has revealed that a broad-band educational program is needed to educate industrial management at all levels to the necessity of considering alternate energy strategies. All the above avenues of communication should be employed to convey the substance of this message to a diversity of audiences in the industrial sector. They should be buttressed by internal programs of education that ultimately involve all employees in addressing energy efficiency and alternatives.

SECTION 1

INTRODUCTION

Energy Resource Management is defined as the inclusion of energy requirements in the long-term strategic business plan of an industrial organization. Its purpose is to assess the impact of significant changes in the cost and availability of traditional fuels on operations, and hence on projected sales and profit goals, leading to a determination of an investment strategy for site-specific decentralized alternate energy systems, to ensure that business goals can be met.

Energy Resource Management is an orderly four-step process designed to provide senior industrial decision makers with a sound basis for deciding upon an appropriate course of action to protect profits and to achieve security of energy supply for each plant and facility. Vulnerability of an industrial operation to conventional fuel or power supply interruptions or to rapidly escalating energy costs can be minimized if not eliminated by application of this approach.

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- Assess the plant-specific investment options to meet demand, including alternate-energy micro-utilities, and establish decision criteria as a function of
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 - Financing methods
 - Return-on-investment hurdles
 - Competing investment needs

Energy Resource Management provides an action Plan tailored to each individual plant. There is no generalized solution. Each plant requires its own solution. The combination of energy use patterns, history and forecasts of primary energy supply, economics of conversion, proximity of renewable or abundant resources, readiness of the technology of potential alternate systems, State and local incentives, codes and regulations - all in the context of the specific culture, practices and goals of the business - make each plant unique.

Because of the dynamics of the world energy supply/demand situation, an annual review and update of the Plan is essential.

Productivity per unit cost of energy will continue to decline dramatically as the cost of traditional sources of power - oil, natural gas and electricity - for manufacturing operations continues to rise. With productivity as measured by traditional manufacturing parameters of output per unit labor cost also declining in the United States, Energy Resource Management offers one means of bringing the matter into control.

If Energy Resource Management is to be successfully introduced into energy-intensive manufacturing industries, then it is a first imperative to understand what barriers will impede its introduction, and what incentives would serve to encourage its adoption. Some insight into the magnitude of the problem to be encountered in meeting the Program's fundamental objective may be gained from a distillation of responses from a dozen discussions with senior executives from a number of different manufacturing companies during the formulative stages of the Program. All agreed that the concept was sound and that the approach needed to be done, but:

- We're a pragmatic operation. It's this year's - in fact, this quarter's - profits that we're focused on.
- Our concerns over the next five years deal with increasing our share of the market.
- Introducing our new product line will absorb all the discretionary funds we have available.

- We don't want to be in the utility business.
- We think our conservation measures will see us through.
- Our utility tells us there's nothing to worry about.
- We're more concerned over whether our sub-contractors and suppliers can keep up deliveries of feedstock for our product.
- If there's an energy crunch will the transportation system be able to deliver feedstocks to us and our products to our customers?
- They're discovering new oil and gas all the time, and the Synfuel Program should take the pressure off.
- No one can plan beyond five years.

One purpose of the Program, then, was to explore these potential barriers in greater depth and with finer focus, with a goal of identifying incentives that might overcome them. The first step in meeting this purpose was to select a single energy-intensive industry with which to work, and then to select a company from within that industry as the vehicle for performing a model Energy Resource Management Plan. Working with a single industry provided the necessary focus, and will allow extrapolation to other industries by analogy.

The methodology for this Program is detailed in the Sections that follow. The Food Industry was chosen by the process and for the reasons given in Section 2. With the support and assistance of the two major Trade Associations, the National Frozen Food Association, Inc. and the National Food Processors Association, 20 companies were identified nationwide as candidates for interviews. Thirteen were in fact visited, and the substance of the information gained and the principal conclusions drawn are given in Section 3.

Of the thirteen companies visited, three were selected as candidates for the model planning process. All agreed to participate and one, a National Cooperative processor of citrus and

other fruit products, was finally chosen for the model. The results of the model Energy Resource Management Plan are detailed at length in Section 4.

Finally, in order to realize maximum utility and benefit from this Program it is necessary to achieve widespread dissemination of the results. Accordingly, a parallel effort was undertaken to establish the most effective means of achieving this dissemination. It is clear that both industry-specific and general or cross-cutting Trade Associations are the appropriate vehicles for this purpose. A model approach was developed with the Associated Industries of Massachusetts, which is presented in Section 4, together with a list of those Trade Associations and other influential organizations considered as the most effective channels of communication for these purposes.

SECTION 2

SELECTION OF THE CANDIDATE INDUSTRY

2.1 Criteria

Six criteria were employed to select the candidate industry for this Program. They are that the industry:

1. Rank in the upper half of manufacturing industries in energy consumption.
2. Include a large number of small businesses, and not be dominated by giants.
3. Have a reasonably uniform geographic distribution of its member companies.
4. Have a strong network of Trade Associations in its support.
5. Be aware of, but still need help with management of the energy problem.
6. Engage in the manufacture of products critical to the fundamental needs of the society.

Table 1 ranks the Manufacturing Industries in the United States by energy intensiveness. Also shown is the number of companies with annual sales over \$1 million operating in each industry. This permits a re-ranking by average energy consumption per company, given in Table 2. This parameter is possibly misleading, because it is unweighted; it, nevertheless, suggests the potential for the company-by-company impact of the energy planning and management techniques developed in this Program. Of the top ten industries (the first selection criterion) in Table 2, Petroleum and Coal Products (SIC No. 29), Primary Metals (33), Chemicals (28), Paper (26) and Transportation Equipment (37) would tend to be ruled out by Criteria 2, 3 and 5. (The last filter is not meant to imply that they are unaware of the energy problem; rather that they are aware of the problem, and by all indications have made important strides in managing it themselves.) Tobacco (21) is of no interest both because of its relatively low energy consumption, and because of the very few companies in the industry. It might also be argued by some that it fails to meet Criterion 6.

TABLE 1
ENERGY INTENSIVENESS OF U.S. MANUFACTURING INDUSTRIES

<u>SIC No.</u>	<u>Title</u>	<u>BTU's x 10¹²</u>	<u>% Total</u>	<u>\$ x 10⁶</u>	<u>Companies</u>
28	Chemicals	2,940	23.1	6,393	1,100
33	Primary Metals	2,370	18.6	6,416	850
26	Paper	1,293	10.1	2,958	500
29	Petroleum and Coal Products	1,289	10.1	2,444	200
32	Stone, Clay and Glass	1,263	9.9	2,627	700
20	Food	981	7.7	2,610	1,500
34	Fabricated Metals	404	3.2	1,353	2,000
37	Transportation Equipment	389	3.0	1,418	650
22	Textile Mill Products	338	2.7	1,136	600
35	Nonelectrical Machinery	337	2.6	1,259	2,500
30	Rubber and Plastics	258	2.0	925	600
24	Lumber and Wood	254	2.0	772	700
36	Electrical Machinery	241	1.9	963	1,250
27	Printing and Publishing	95	0.7	423	800
38	Instruments & Related Products	76	0.6	267	550
23	Apparel	65	0.5	272	900
25	Furniture and Fixtures	52	0.4	193	450
39	Miscellaneous Manufactures	50	0.4	189	500
31	Leather	24	0.2	82	200
21	Tobacco	21	0.2	64	50
TOTAL		12,740	100.0	32,764	16,600

Source: Industrial Outlook for 1980
U.S. Department of Commerce, Industry and Trade Administration
Dun and Bradstreet Million Dollar Directory, 1980, Volume 1

TABLE 2

U.S. MANUFACTURING INDUSTRIES RANKED BY AVERAGE ENERGY CONSUMPTION

<u>SIC NO.</u>	<u>TITLE</u>	<u>BTU's x 10⁹/Co.</u>	<u>% Total</u>	<u>Companies</u>
29	Petroleum and Coal Products	6,445	10.1	200
33	Primary Metals	2,788	18.6	850
28	Chemicals	2,672	23.1	1,100
26	Paper	2,586	10.1	500
32	Stone, Clay and Glass	1,804	9.9	700
20	Food	654	7.7	1,500
37	Transportation Equipment	598	3.0	650
22	Textile Mill Products	563	2.7	600
30	Rubber and Plastics	430	2.0	600
21	Tobacco	420	0.2	50
24	Lumber and Wood	363	2.0	700
34	Fabricated Metals	202	3.2	2,000
36	Electrical Machinery	193	1.9	1,250
38	Instruments and Related Products	138	0.6	550
35	Nonelectrical Machinery	135	2.6	2,500
31	Leather	120	0.2	200
27	Printing and Publishing	119	0.7	800
25	Furniture and Fixtures	116	0.4	450
39	Miscellaneous Manufactures	100	0.4	500
23	Apparel	72	0.5	900

Accordingly, the group of industries that was chosen for first review are Stone, Clay and Glass (32), Food (20), Textile Mill Products (22) and Rubber and Plastics (30). It is true that the Textile Industry does not meet the geographic requirement of Criterion 3, but that is more than compensated for by the provisions of Criteria 2 and 6, and possibly 5 as well.

In addition, it was decided to include Paper (26) in this initial group, despite its failure to pass all the filters - it tends to be vertically integrated, with many of the smaller companies, in fact, subsidiaries of the major organizations; it is geographically focused in the Northeast, Southeast and Northwest; and it has had a strong and active energy conservation and waste material consumption program for many years. The last reason, however, suggested that the industry would be useful to work with in the first group as a basis for comparison with what is being done in the other industries selected.

2.2 The Trade Associations

On this basis then, extensive conversations were held with executives of twenty-five Trade and Professional Associations. The purpose was to determine the following:

1. The extent to which each Association is currently engaged in providing leadership, direction and support to its member companies in industrial process energy conservation.
2. The extent to which each association and its member companies are aware of the problems of energy assurance - that is, planning for constantly escalating prices of traditional energy sources, and planning for energy shock, the sudden, unexpected and prolonged interruption of supply.
3. The degree to which each Association serves as a catalyzing agent for energy awareness in its industry, and undertakes initiatives for solutions to current and future energy problems.

4. The manner in which each Association disseminates generally useful energy information to its member companies, and the extent of inter-company communication on energy matters.
5. The extent to which each Trade Association would support the effort of this Program first by identifying candidate companies from among its members to serve as the vehicle for the model Energy Management Plan, and second, by serving as a vehicle for dissemination of the Program results.

The responses from the organizations contacted varied widely. In all instances discussions were held with the Executive Director or other senior official. But some general observations can be made. While the major Associations do not count as members all companies in their industry, they do represent those companies responsible for the bulk of the production or shipments within their industry. The Associations, for the most part, are concerned with legislative and regulatory facets of industry problems. Current concerns relate to such issues as foreign competition, international trade, product liability, compliance with the multiplicity of Federal, State and local regulations, and assurance of high-priority status for allocation of fuel under the emergency provisions of pertinent Federal legislation.

With respect to energy matters, some Associations leave the issue entirely to their members. Some are more concerned with producing energy-efficient machinery for their customers than they appear to be about the energy they themselves consume in making the machinery. Yet others have active energy programs, including research, development and demonstration projects widely reported upon in their industry. Finally, some play a wholly passive role in industry issues, responding only to requests from their members for support on specifics. Others, however, will take the lead and develop annual programs designed to direct their members' attention to critical issues of the time.

A summary of the responses of specific Trade and Professional Associations contacted is given below, in order of decreasingly energy-intensive industries.

2.2.1 Pulp and Paper (26)

The organizations contacted in the Pulp and Paper Industry were:

- American Paper Institute
- American Pulpwood Association
- Paper Industry Management Association
- Paperboard Packaging Council
- Pulp and Paper Machinery Manufacturers' Council
- Technical Association of the Pulp and Paper Industry

Of the above, the dominant Associations are the American Paper Institute, The American Pulpwood Association, the Paper Industry Management Association and the Technical Association of the Pulp and Paper Industry. The first two are Trade Associations - that is, their members are corporations. The latter two are Professional Associations. Their members are individuals. The Paper Packaging Council represents an industry that is not, of itself, energy-intensive, but also tends to be vertically integrated with the large paper manufacturers. The Pulp and Paper Machinery Manufacturers' Association is a relatively inactive organization, representing only some 41 members whose activities were characterized by the Association's Executive Director as "mostly machine shop operations."

The American Paper Institute (API) represents 90% of the industry. Its activities are directed towards the industry's decision makers. While the Institute maintains an Energy Department, its principal role is to address the legislative and regulatory facets of the energy problem. The API responds to industry initiatives, and does not take the lead in dealing with major issues. The API would in all likelihood not raise the question of long-range energy planning or Energy Resource Management unless it were introduced first by a member company. They do hold an Annual Conference at which energy matters may

be addressed, but there is no dissemination of case histories of successful energy conservation or energy management programs among members. The API serves as the industry's agent in reporting annual energy consumption to the DOE.

The primary concern of the American Pulpwood Association (APA) is that of the management of the forest resource to maximum benefit for the paper manufacturing industry. Their tasks are to measure and report wood consumption, to estimate and measure wood availability, to identify the pulpwood potential of different stands of forestry, and to find energy-conservative ways of producing cordwood by different harvesting methods. Their concern with the energy problem is focused on finding ways to use wood as an energy supplement, although there has been insufficient time as yet to develop energy plantations. Member companies rely heavily on wood as an alternate fuel and that need is reflected in new attention to the fuel potential of privately-held woodlands.

Everything the APA does on behalf of its members is initiated by industry. An internal procedure does exist, however, for introducing new programs. The Association's Long-Range Plan is updated annually. It is formulated by a Planning Committee, consisting of both industry and staff members, for subsequent approval by the Board of Directors and then the membership. The APA is, however, essentially industry run; its eight-man staff provides support to the several industry-constituted Committees of the Association. Information is disseminated at periodic meetings in each of the Association's six regions; and there is an Annual Meeting, generally held in Atlanta. The Program Committee of industry members decides the theme and content of the meeting.

The 3,000-strong Paper Industry Management Association (PIMA) draws its membership from the middle management ranks of the paper industry. Its purpose is to keep its members informed of new developments in the industry. The principal vehicle for this is the seminar, and there is a very heavy and sustained program of these throughout the year in each of the PIMA's ten geographical

divisions. PIMA staff provides strong support for identifying both program topics and seminar leaders.

The program for the National Conference in June is also structured with heavy staff input to a member-constituted Program Committee. Meetings are planned years in advance - that for 1982 has already been finalized - so program slots for new topics are difficult to find. The National staff do, however, promote traveling seminars on some 50 to 60 different topics each year. These could be an effective mechanism for introducing the concepts of Energy Resource Management to PIMA's membership.

The Technical Association of the Pulp and Paper Industry (TAPPI) was spun off from the American Paper Institute approximately a decade ago in order to provide an exclusive technical focus for industry problems. Like the PIMA, it is a Professional Association with its membership drawn from the production executive ranks of the industry.

The Energy Management Committee of TAPPI's Engineering Division has the responsibility for developing new ways of conserving and using energy for the industry. The Committee, comprised of industrial members, establishes objectives for itself which are in turn part of the objectives of the Engineering Division. It is they who know, and are, therefore, best equipped to address the energy problem that the Pulp and Paper Industry faces. They and other TAPPI Committee Members meet with DOE twice a year to inform DOE of industry's needs, and specify the nature of the help the industry would seek from DOE.

The industry is very sensitive to its energy consumption. Every mill audits its consumption and reports this to DOE through the API (q.v.). In general, every department in every mill is given an energy budget - specified in MBTU's - and is expected by management to function within that budget. If not, they must give an accounting of why they failed.

The industry is aware that it has major access to a renewable energy source. Headquarters engineering of most major corporations in the industry are working on alternate energy systems - or at least examining their applicability.

Cogeneration has some real potential, with topping cycles favored, as the waste steam is used to run the pulping and paper lines. But here, particularly, the plant must shut down if the cogenerator is not producing at full load.

2.2.2 Stone, Clay and Glass (32)

The Associations contacted in the Stone, Clay and Glass Industry were:

- Glass Packaging Institute
- National Concrete Masonry Association
- National Precast Concrete Association
- Portland Cement Association

Of these, three are addressing the energy problem with vigor. The exception is the National Precast Concrete Association, which represents a segment of the industry that is not very energy intensive. Beyond conventional space-conditioning and transportation uses, its members consume very little energy in their process operations.

The Glass Container Industry (SIC No. 3221) is one of the fifteen most energy-intensive industries (by four-digit SIC Number) in the United States. The industry consumes about .15 Quads annually. The Glass Packaging Institute (GPI) reports annual industry energy consumption figures to the DOE, but gives its primary attention in the energy area to such issues as petroleum and natural gas deregulation, and the effects of regulatory issues on the industry. Matters of energy conservation, and long-range planning are dealt with by member companies on an individual basis.

The industry has been successful in reducing energy consumption - a normalized 15% since 1973 - but it is an extremely competitive industry, and such information is not shared among companies. The GPI perceives its role as more effective in dealing with such matters as bottle bill legislation than with issues such as energy cost reduction practices, where the relative competitive positions of their member companies may be affected.

The National Concrete Masonry Association (NCMA) is very aware of the role of its members as suppliers to an energy-sensitive industry, the building contractors and architects. The efforts of the NCMA, therefore, are vigorously directed towards furnishing their membership with information and marketing tools for selling their products as elements in passive-solar building designs.

With DOE support through the Southern Solar Energy Center, the NCMA has prepared a Guidebook on the virtues of concrete masonry as a passive solar product, and will be conducting a series of twenty-four seminars nationally to present the substance of this material to groups of architects and engineers. Two monthly publications, Concrete Masonry Pictorial and Technical Notes, frequently carry articles on passive solar design, heat transfer and insulation. Two full issues of each periodical will be devoted to these subjects in 1982. The Association also provides a computer service through which builders can have their plans analyzed for the best passive solar treatment.

Their members' own consumption of energy is widely disparate. Energy is used in the curing process, but the amount used may vary by orders of magnitude, depending on geography, climate, the type of aggregate used and the degree of shrinkage required. It may be noted that two or three concrete block plants are now solar powered.

For those companies that require steam autoclaving, the Association has published a Bulletin that addresses efficiency of autoclave operation and reduction of energy usage. Their conventions and trade shows regularly feature exhibitors who display more energy-efficient curing systems to this capital-intensive industry.

The NCMA has not explicitly addressed the question of long-range energy planning and energy security, but they are receptive to introduction of these new ideas. Their program is planned annually, and the Association would take the leadership in putting the matter before their members. Information transfer is an easy matter within the NCMA. Members freely share

information with each other, and there is a great deal of interchange at the CEO level.

The Portland Cement Association serves a highly energy-intensive industry which has been attentive to the problem of conservation for many years. Many plants which did not take action soon enough have been forced to close. Companies are already addressing alternative energy sources, and are turning away from oil and natural gas in favor of conversion to coal. Evidently the Association has not played a strong role in this area, and each company in the industry deals with the problem itself.

2.2.3 Food (20)

The Encyclopedia of Associations lists 88 Trade Associations serving the Food and Dairy Industries. These range from such product-specific organizations as the National Pimiento Canners Association to the broadly based National Food Processors Association. Seven were selected for discussion on energy problems and programs in the industry.

American Frozen Food Institute

American Institute of Food Distribution

International Foodservice Manufacturers' Association

National Association of Food Equipment Manufacturers

National Food Processors Association

National Frozen Food Association

National Independent Dairies Association

Of these, the American Institute of Food Distribution is strictly an information dissemination service for the industry. They perform no other function than distributing three weekly newsletters to a membership that is both the largest and most diverse of any in the Food industry.

Both the International Foodservice Manufacturers' Association and the National Association of Food Equipment Manufacturers also serve a highly diverse membership, from manufacturers of cutlery to baking ovens. This heterogeneity of membership does

not make for a coherent energy program that can benefit all the members. Both Associations recognize the two facets of the current energy problem - namely, the necessity for their members to manufacture energy-efficient equipment, and to achieve energy efficiency in their own operations. But neither Association conducts any energy program. Their efforts are directed towards sales and marketing matters.

The American Frozen Food Institute (AFFI) represents the larger packers and processors of frozen foods, a somewhat different constituency from that of the National Frozen Food Association (q.v.) who represent many more of the smaller, regional companies.

The initiative on all energy matters in the AFFI - other than legislative and regulatory - comes from its Energy Council, comprised of some twenty members from industry. In fact, the AFFI is basically run by its industry-member Committees, with the role of the staff to disseminate information, and to work on Federally-related policy issues. Energy topics are generally included in the annual convention, and members are not reticent at revealing their conservation measures and successes to each other. The AFFI expressed interest in participating in the present work to introduce Energy Resource Management into the industry.

The Energy Council has already raised the issues of long-range energy planning and energy security. One member company, for example, Ore/Ida Frozen Foods, is actively studying geothermal sources as an energy alternate. (They are already well known for their solar-powered applications.)

The AFFI periodically publishes an eight-page Bulletin on Energy. The first page discusses Federal legislation and regulation. The remainder is given over to a summary of State conservation programs, regulations and interpretation of Federal legislation such as PURPA. This material is prepared by the Grocery Manufacturers Association of America, and shared with the American Meat Institute, the Food Marketing Institute, the Potato Chip and Snack Food Association. The Energy Bulletin goes to the

Energy Manager in each member company. The AFFI also reports the industry's energy consumption statistics to DOE.

The National Food Processors Association (NFPA) represents some 95% of the total amount of food canned in the United States. Its historical concerns with food safety led to the establishment of three laboratories - in Berkeley, Seattle, and Washington, D.C. - with a concentration on thermal processing requirements for public health to insure the commercial stability of food products.

The scope of the laboratories' activities has, over the years, expanded to respond to new pressures - environmental, waste material management, water, other public health matters, and now energy. The Berkeley Laboratory has four technical divisions - Chemistry, Microbiology, Environment and Engineering. The Headquarters Office in Washington concerns itself solely with legislative matters.

When energy costs became an issue in the industry in 1975, the NFPA technical staff took the initiative and approached the DOE for support in taking measures to assist the industry. This resulted in a two-phase contract - first to measure and monitor the use of energy in the canning industry and other segments of the association; and second, to design and implement conservation solutions. The NFPA sub-contracted with the University of California, Davis, to do the bulk of this work in both phases. Since 1972 to date the food processing industry has achieved a 21% reduction in energy consumption.

Results are communicated largely through the Committee system which is extensive. The Committees bring staff together with their peers in industry at a high management level so things get done. The NFPA has worked with different segments of the industry as well as with individual companies on technology transfer. They have helped identify feasible process modifications and retrofits for energy conservation in this way. Again, because the food industry is diversified, neither solutions nor policy positions can be generalized. The seasonal aspect of the industry is also a major determinant. Processing

plants have been built to handle a large influx of product at harvest time, and tend to be overdesigned.

The NFPA has not yet explicitly addressed the issues of long-range energy planning and energy security. They have examined a variety of applications of renewables, including solar thermal, biomass and geothermal. But their response is presently indifferent. If they were persuaded that Energy Resource Management were a practical mechanism, they would support it through their Energy Advisory Committee.

The NFPA has a host of communications media - workshops, research highlight meetings, an annual convention, topical bulletins, a weekly newsletter and publication in a variety of other journals. Not the least important is that the NFPA manages the Food Processing Institute in Washington as an independent, non-profit training center and educational institution.

The National Frozen Food Association (NFFA) has approximately 1350 members of whom 350 are packers and processors. They are a vertically-integrated association, in that their membership includes all functions in the food chain from growers to packers to warehousemen, distributors, wholesalers and retailers. Their packers and processors tend to be the smaller regional companies.

The NFFA is one of the eighteen Trade Associations - including the National Independent Dairies Association and the Society of the Plastics Industry, each discussed below - who joined with the DOE, Small Business Branch, Office of Building and Community Systems to produce a Guidebook on Conservation tailored to their industry. The NFFA booklet is titled Reducing Energy Costs Means a Better Bottom Line. This was a highly successful, if costly, project. Copies were distributed gratis to Association members who are packers and processors, and sold to non-members, consultants and others. The NFFA was anxious to prepare a similar Guide for their Wholesaler-distributor members, but could not finance the project without DOE support. The NFFA, nevertheless, believes that industry must deal with such problems without government support, and

would proceed with the project if they could find a way to finance it.

The frozen food industry is sensitive to the issue of security of energy supply. They are already taking measures to prepare for supply disruption. They have brought conservation to a higher level of sophistication through a joint project with Westinghouse (partially DOE funded). That company is designing a fully energy-efficient food-processing plant which will be installed in two of the Association's member companies for trials and measurements. If the results are successful, the systems will be sold commercially. The NFFA is also tracking the Ore/Ida interest in geothermal sources as an alternate energy system.

The principal concern that the NFFA has with respect to the broad problem of Energy Resource Management is the capital financial burden that this implies for their membership. The smaller businessman must have the benefit of innovative methods of financing his capital investment - whether they be for new processing equipment (vital to maintaining modernity and hence competitiveness of the plant), or for an alternate energy system. Accelerated depreciation, increased tax credits and other methods of quickly recovering initial investment are important to the small businessman.

The NFFA offered their cooperation in working with this program, and suggested candidate companies to talk to. If Energy Resource Management is perceived to be a function that would be beneficial to their membership, NFFA would place the matter on the agendas of their two principal industry-member Councils - the Retail Council and the Food Service Council. They also work closely with other Trade Associations in the Food Industry as well, and thus would provide other information dissemination paths.

The National Independent Dairies Association (NIDA) is another of the eighteen Trade Associations that prepared a conservation Guide, The Dairy-Energy Connection, under the above-referenced DOE program. This resulted as much from DOE initiative as it did from concern of the Association's

membership over high energy costs after the oil embargo of 1977. The project was very successful from the Association's point of view, receiving international attention. Some 1500 Guides have been sold.

Despite this success, the NIDA has no interest in pursuing energy concerns to a higher level. Their membership - mostly small dairies - are focused on survival today. That means securing their share of the market in the face of competition from the national conglomerates, and coping with the current high price of oil, gas and electricity. Future issues do not capture the interest of the membership, despite the recognition that continually rising prices and energy shock could mean disaster for the industry. It is noteworthy that the March 1981 Annual Meeting did not have energy matters on its agenda.

2.2.4 Textile Mill Products (22)

The organizations approached in the Textile Mill Products Industry were:

- American Textile Machinery Association
- American Textile Manufacturers Institute
- American Yarn Spinners Association
- Textile Information Users Council
- Textile Research Institute

The two principal Trade Associations of the Textile Industry are the American Textile Machinery Association (ATMA) and the American Textile Manufacturers Institute (ATMI). The industry is supported by the Textile Research Institute which is not a Trade Association in the conventional sense. It bears somewhat the same relationship to the ATMA and ATMI as the three Research Laboratories bear to their parent, National Food Processors Association, discussed in Section 2.2.3 above.

Contact was also made with the American Yarn Spinners Association (ASYA). While energy may be a problem in the industry, that Association does not engage in dealing with the problem on its members' behalf. The industry is highly competitive and information sharing is not offered in what the ASYA considers proprietary areas. The Textile Information Users

Council, on the other hand, is, as its name implies, structured to disseminate information. Emphasis appears to be, however, on textile technology, patents, paper abstracts and indices. There is no active pursuit of new problems.

The membership of the American Textile Machinery Association (ATMA) is about 130, and all would be classified as small businesses. They are typical of the companies that manufacture capital machinery for all industries. They are small, produce very specialized pieces of machinery, are not energy intensive, and are principally concerned about survival in the face of fierce foreign competition.

Energy, therefore, is not a priority issue in this industry. Their customers, the textile mills, are not placing energy demands on them in terms of machine specifications and performance. The bulk of conservation work in textile manufacturing goes beyond the process. The one area that has received attention is that of finishing and dyeing. Companies who manufacture machines for those functions are indeed giving a lot of attention to the energy consumption of their products.

The ATMA is concerned about energy in its relationship to productivity. This was the impetus behind their DOE-initiated and -funded study reported in Assessment of Energy Conservation Potential at ATME-I 80 Textile Show in Greenville, South Carolina. The objective of the study was to determine if textile manufacturers could increase their productivity with no increase in energy expenditure. A principal finding, however, was that the claims by manufacturers at the Greenville Show as to the energy conserving properties of their products were unsupported and unconservative. They tended to be exaggerated sales claims.

ATMA's longer-term objective is to stimulate research into conservation in textile machinery, thereby improving the U.S. competitive position in the international industry. The Greenville Show was the first phase. The second phase would be to get DOE support to expand the study worldwide, and identify the best energy-conservation technologies for further R&D. The Association then proposes to set up guidelines for and assist

their member companies in obtaining DOE funding to perform the R&D, thus, at the same time, helping individual members with new product development. The ATMA is deeply concerned that the U.S. textile machinery industry is being overwhelmed by international competition - notably from the Swiss, Italians and Germans. They estimate that 75% of the machinery in U.S. textile plants today is foreign made.

Concerns of industry survival in the face of international competition tend to overshadow concerns for survival in the face of energy costs or supply interruption. This is not an issue high on ATMA's agenda.

The American Textile Manufacturing Institute (ATMI) has a membership of some 200 companies who represent 85% of the total output of the U.S. textile industry. The industry has about 5,000 companies, operating 6,000 plants. Thus the ATMI membership is made up of the major manufacturers.

The ATMI recognized the impact of the energy problem on its industry at the time of the 1973 embargo. They voluntarily initiated an energy conservation and reporting program for their industry at that time. This was well before the Congress mandated the annual statistical reporting of energy data to DOE and its predecessor organizations. The Institute acts exclusively on behalf of its members in dealing with DOE on issues relating to energy. Principal concerns, in addition to data reporting, are legislative and regulatory matters.

The ATMI has a strongly negative attitude towards the DOE. The Board of Directors resolved at their February 1981 meeting that DOE be phased out at the earliest possible time. There are several reasons for this hostility. One is that of credibility. It is ATMI's perception that while DOE and its predecessors were ordering reductions in industrial energy consumption, their own energy consumption increased by 2%. More important, however, is the regulatory morass that ATMI perceives the DOE to have created in the latter's attempt to fulfill its obligations under the five laws of the National Energy Act. These plus EPA, State and other regulations are held to be a

major impediment in the industry's decision-making process. They don't know what the government is going to do next, and hence are functioning in a highly uncertain environment.

For example, the industry is particularly sensitive to the problem of energy shock, having already faced it in the natural gas supply problem. They are attempting to make sound decisions on alternate fuels, but are severely hampered by the mass of regulations they have to contend with. The industry feels that the best way to deal with energy is to let free market forces work. Thus, they support the present Administration's approach wholeheartedly.

The ATMI believes that most of their members would say that additional tax incentives are needed to help with the alternate fuel/alternate energy problem. They see regulations as a massive disincentive, and would tend to maintain their energy status quo rather than do battle with the system. If DOE is to exist, it should focus exclusively on R&D.

The ATMI was reluctant to identify companies in their industry as candidates for the model Energy Resource Management Plan. They feel that this would jeopardize their posture of impartiality, of working for the industry as a whole and not for individual companies.

The Textile Research Institute (TRI) is a not-for-profit organization funded by some 70 to 80 companies. Member companies pay a relatively small annual membership fee, but fund individual research projects on a pro-rata basis if it is of benefit to their specific business. TRI first writes a proposal, from suggestions generated either internally or by member-companies, and then circulates the proposal through their membership for approval and funding. The Institute has a total staff of 50 with some 20 professionals.

The function of the Institute is to conduct basic research on anything that may impact the profits of the Textile Industry. They have no projects in energy directly, but are addressing themselves to the problems that utilities will have in converting from oil to coal. They are working to improve the efficiency of

baghouses through electrostatic filtration of particulates. Filters use fabrics - hence the textile connection. This work is being jointly sponsored by industry and the EPA.

There is also a program directed towards improving dyeing technology. They are looking at ways of changing the structure of polyester fibre (80% of fabrics contain polyester), so that the time taken for dye to penetrate is reduced, and thus the energy required for dyeing is reduced. Another program is addressed to heat recovery in tenter frames. Fabrics are dried under tension in these frames. The problem with hot air recovery under these circumstances is that there are solid materials in the fabric which could gum up heat exchangers.

It is also interesting to note that the program for the 51st TRI Annual Research and Technology Conference held in April, 1981, is titled Energy, Environment, and Textile Operations. Six of the thirteen papers are devoted to energy conservation. Despite this, the TRI sees the priority problem facing the industry as labor costs, particularly in relation to foreign competition. Energy costs and energy planning are a secondary issue. TRI, nevertheless, sees its responsibility as raising issues that are important to the industry, and will evidently press the energy issue on this scale of priorities.

2.2.5 Rubber and Plastics (30)

The Society of the Plastics Industry (SPI) is the third in the group of Associations contacted for this Program which joined with the DOE, Office of Small Business to prepare a Guide for energy conservation for its membership. The Guide, titled Reducing Energy Costs in the Plastics Industry, is distributed free of charge to all members of the SPI. There is an active program of promoting the principles in the Guide. An accompanying slide presentation has been prepared, and all Sections and Chapters will be offered the presentation as an introduction to use of the Guide.

Like certain other Associations contacted, the SPI is equally concerned with the energy impact of their members products on their market. To this end they are sponsoring a

study and will issue a report on plastics as an energy-saving material. The argument is put forth that the amount of energy required in manufacturing a plastic component is but a fraction of that in the metal counterpart that it replaces.

2.2.6 Cross Cutting Associations

Two non-industry-specific Associations, one Trade and one Professional, were approached for two purposes. One was to obtain impressions of sensitivity to energy issues on an industry-wide basis without specific focus on any given industry's problems, and at the same time to get a broad perspective on where the energy problems lie. The second purpose was to determine what role such organizations perceived for themselves, both in the area of raising issues and in developing mechanisms to address and solve problems.

The Associated Industries of Massachusetts (AIM) numbers some 2400 manufacturing companies in Massachusetts on its membership rolls. Recent public statements by its senior executives have demonstrated an acute awareness of the role that rising energy costs and supply disruptions will play in destabilizing industrial security. The Northeast, in general, and the Commonwealth of Massachusetts, in particular, are unusually vulnerable to these two problems.

The AIM is very responsive to the concept of Energy Resource Management. Since their points of contact in their member companies tend to be Presidents and Chief Executive Officers, the Association represents their point of view. The AIM perceives that the problem must be overcome with the company decision makers is twofold. One is the CEO's traditional preoccupation with the short-term bottom line. The second is the concern for the burden of up-front costs that would have to be borne in any capital investment for an alternate energy system.

The AIM believes that their industrial members must be made to recognize that Federal cost-sharing and demonstration programs are gone, and that industry must not lose the present

opportunity to serve its own interest in examining the potential for alternate energy systems as protection against disruptions in the energy economic and supply structure.

At the same time, the AIM stresses the need for a favorable Federal tax and depreciation structure to permit the kinds of capital investment required. They also recognize the necessity for educating their membership, irrespective of industry, on the value of long-term energy planning with all its implications for investment decisions. The AIM has suggested that they would be a vehicle for communicating the results of this Program.

The Planning Executives Institute (PEI) is the largest business planning professional organization in the world. Membership is 4500, belonging to 52 Chapters throughout the United States with two in Canada. The Institute has individual membership from a number of foreign countries, and is affiliated with planning groups in Mexico and Sweden. The bulk of the membership is in financial planning, but executive and strategic corporate planners are rapidly growing in numbers.

The main work of the Institute is to educate their membership through Monographs which they develop and sell. University faculty and consulting houses are sometimes retained to prepare these books. There is also an extensive program of seminars at the chapter and national level.

The Institute sees its primary function as being responsive to the current interest of its members. It is for this reason that strategic planning is getting a great deal of attention now. John R. Jenney, a noted business author, has defined strategic planning as: Concerning itself with the direction of the company as a whole, but examining all facets of its environment as it moves forward to its objectives. Thus, while the Institute has not addressed planning for energy explicitly, energy considerations would arise in strategic planning by Jenney's definition. The Institute believes that strategic planning goes beyond mere financial planning, and is not functional planning which looks only at one operating area of a business.

Issues for the membership to address are generally determined by the Research Committee. The Committee, appointed by the Board,

consists of three or four people, some of whom might be Board members. The Committee will evaluate proposals from individuals - Institute members or not - and organizations to undertake specific projects related to planning. The energy planning aspects of Energy Resource Management would thus be addressed by the Research Committee, through the monthly magazine, Managerial Planning, and through conferences and seminars. The Institute runs Conferences at four levels. There is an annual international conference, three topically specific conferences a year, 35 to 40 day-long Chapter Seminars, and each Chapter runs eight Technical Sessions a year.

The principal problem the Institute perceives is the emphasis that American business and its managers place on short-term results. The Manager knows he is being measured on short-term results, and has no real stake in the long-range future of the company. He can be fired or walk away from it at any time. His interest is in maximizing his short-term financial gain through salary gains, bonuses, and other rewards. Managers pay lip service to long-range planning, but they don't really practice it.

2.3 Selection

The discussions with the several Trade and Professional Associations reported above suggest the Food Industry as the most effective vehicle for developing the model Energy Resource Management Plans of this Program, with Textile Mill Products a second choice. It is not that the other industries are judged not to provide a satisfactory framework for the intents and purposes of this Program; rather, it is that the Food industry would appear to offer a superior relationship.

As noted earlier, Pulp and Paper (26) was examined principally as a basis of comparison with other candidate industries. While it is indeed one of the more energy-intensive industries, it is unique, as borne out by the discussions, in that it already consumes vast amounts of its product waste raw material as fuel. The American Pulpwood Association and the Technical Association

of the Pulp and Paper Industry have indicated the extent to which energy management and fuel displacement have already been introduced into the industry. The industry appears to be very much in control of its energy parameters, and is less needful of barrier removal and education than others. This, coupled with its general mismatch with the selection criteria listed in Section 2.1 above suggest that it is not the industry of choice.

Stone, Clay and Glass (32) embraces a widely disparate set of industries, companies, products and processes. The area of focus is difficult to define. Hydraulic Cement (SIC No. 3241) and Glass Containers (3221) are two of the fifteen most energy-intensive industries ranked by four-digit SIC Number, between them accounting for 5% of the total energy consumed by the manufacturing industries. But both are industries dominated by a few large companies - 49 and 19, respectively; and these evidently have their energy situation under control to their own satisfaction. The Trade Association that is apparently most energy conscious is the National Concrete Masonry Association. But, as noted earlier, they are addressing the problem (in a highly satisfactory manner) more from the standpoint of the energy-conservative qualities of their product than from the energy consumption patterns in their industry.

In terms of the selection criteria, the Plastics Industry is widely distributed geographically, and is comprised of a very large number of small companies. They, in turn, are aware of the energy problem and have sought help with it, and their Trade Association has been active in addressing the problem on behalf of its members. But of the candidate industries chosen for this investigation, Plastics is the least energy intensive, which suggests that other industries be examined first.

In choosing between the remaining two candidate industries, Food (20) and Textile Mill Products (22), the Food Industry emerged as the clear first choice. As shown in Table 1, it is the more energy intensive of the two, accounting for 7.7% of the energy consumed by the manufacturing industries, compared

with 2.7% for textiles. There are more companies with annual sales over \$1 million in the industry - 1500 as compared with 600; and as shown in Table 2, the average energy used per company is also higher by more than 16%.

Beyond this, while both industries manufacture products critical to the fundamental needs of the society, Food processing is widely distributed throughout the country, whereas textiles tend to be concentrated in the Southeast with vestiges remaining in the Northeast. And perhaps most important of all, the generally negative attitudes expressed by spokesmen of their principal Trade Associations may reflect the degree of the industry's receptivity to the objections of this Program.

The strength, interest and interrelationships between the several Trade Associations serving the Food Industry indicate a very strong network of support for their member companies. This translated to excellent support for this Program, both in terms of facilitating interactions with individual companies and in the potential disseminating of information. The National Frozen Food Association offered their help in identifying candidate companies for the model Plan. They and the National Independent Dairies Association are two Associations that took advantage of DOE support in developing conservation Guidebooks for their members. The NFFA presents workshops at the conventions of the Food Market Institute, and jointly runs an annual convention with the American Frozen Food Institute. The AFFI, in turn, publishes informational material jointly with the Grocery Manufacturers Association of America, the American Meat Institute, the Food Marketing Institute and the Potato Chip and Snack Food Association. Finally, the National Food Processors Association, with its network of three regional laboratories, has already done extensive work in conservation measures for their industry, is attentive to the potential of alternate energy systems, and offers a major educational and tutorial vehicle through its independent subsidiary, the Food Processing Institute.

For all these reasons - need, awareness, societal importance and Trade Association support - the Food Industry was chosen for the modeling activities of this Program. It is useful, therefore, to examine the changing patterns of energy usage in the Food Industry. Table 3 shows energy usage by source for the base year of 1972 and the following years 1976 through 1979. These data are from the Department of Energy Program in which 13 Trade Associations of the Food Industry and nine Corporations reported data for 1972 and 1976 through 1978, with 120 additional Corporations joining in reporting 1979 data.

The fact that these data show an aggregate energy usage of only 54% (including the AMI figures) of that shown in Table 1 from Department of Commerce data probably results from a difference in methods of data collection, analysis and reporting. There is no reason to doubt, however, that the two Tables are internally consistent - that is, that Table 1 reflects the actual relative energy intensiveness of food to other industries; and that Table 2 reflects the actual mix of energy usage by source for the industry as a whole.

In the latter regard, it is interesting to note the return to dependence on the apparently more abundant natural gas after a three-year growth in use of petroleum-based fuels. It is also interesting to note the steady growth in electricity usage - an increase in share in 1979 of 56% over the share in 1972.

This Table suggests that from an energy shock standpoint, the industry would be most vulnerable overall to supply disruptions in natural gas. On the other hand, manufacturing plants cannot function without electricity, no matter how small an amount used; and the apparent increasing dependence of the industry on electricity suggests that vulnerability to disruption of this source may also become an issue. In any event, vulnerability to power or fuel disruptions is very much a plant-specific matter.

TABLE 3
FOOD AND KINDRED PRODUCTS (SIC NO. 20)

ENERGY SOURCE	YEAR				
	1972	1976	1977	1978	1979
Natural Gas 10^{12} Btu %	252.69117 61.2	204.6071 52.0	222.69582 48.3	221.19384 47.5	256.3662 52.6
Petroleum Based 10^{12} Btu Fuels %	61.02253 14.8	88.79059 22.6	114.00725 24.7	118.47185 25.5	81.9116 16.8
Coal & Coke 10^{12} Btu %	60.67438 14.7	58.36414 14.8	68.45042 14.8	67.45618 14.5	77.5169 15.9
Steam (Purchased) 10^{12} Btu %	1.45148 0.4	1.5351 0.4	1.49464 0.3	2.04762 0.4	3.5668 0.7
Other 10^{12} Btu	0	0	0	0	.3257
SUBTOTAL 10^{12} Btu Non-Electric %	375.83956 91.1	353.29693 89.8	406.64813 88.2	409.16949 87.9	419.6872 86.1
Electricity 10^{12} Btu %	36.73844 8.9	39.99607 10.2	54.38687 11.8	56.16951 12.1	67.9829 13.9
TOTAL 10^{12} Btu %	412.578* 100.0	393.293 100.0	461.035 100.0	465.339 100.0	487.6701 100.0

* American Meat Institute data not included; AMI's 1972 energy consumption of 46.805 trillion Btu's was reported only as an aggregate number, i.e. source percentages were not provided.

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SECTION 3

BARRIERS AND INCENTIVES

3.1 Approach

Effective adoption of Energy Resource Management as a strategic planning tool can only be realized if the barriers to its introduction and useful incentives to overcome these barriers are understood. Accordingly, meetings were arranged with senior executives of a dozen companies in the Food Industry to explore, in depth, the attitudes, perceptions and objectives of the principal decision makers in each company. The National Frozen Food Association, under the personal direction of its President-Chief Operating Officer, played an extremely active role in arranging meetings with Chief Executive Officers of 14 of their member companies. The Berkeley Laboratory of the National Food Processors Association assisted similarly with respect to six of their member companies in the Far West.

Criteria were established for selecting the companies to be visited to assure that as wide a spectrum of organizations as possible would be included. The criteria were:

Product:	Meat, poultry, fish, dairy, bread, fruit and vegetables
Process:	Cooking, baking, canning, bottling, freezing
Structure:	Independents, subsidiaries, cooperatives
Sales:	From \$10,000,000 to \$500,000,000
Location:	Reasonable geographic distribution (given the limitation of travel budgets), but sufficient to assess the impact of different climates on choices of alternate-fueled micro-utilities.

The 20 companies approached met these criteria in total, as, in effect, did the 13 who agreed to visits. In nearly every instance discussions were held with either the Chairman of the Board, the President, or the Senior Operational Executive responsible for energy considerations.

These discussions were extremely fruitful in bringing to light the issues that bear on the potential adoption of Energy Resource Management in the Food Industry. The conclusions distilled from these discussions are presented below. They are followed by summaries of the discussions held with each Company. These are presented in some detail in the belief that the information may be instructive to readers from the Food Industry and from other industries as well.

Because each executive visited was particularly forthcoming and responsive to the issues raised in the discussion, the names of the companies have been withheld and their specific locations blurred so that responses can be presented as fully as possible with minimum danger that proprietary information will be revealed that might jeopardize or embarrass a respondent.

Finally, it is worthy of note that all but one of the companies visited agreed to serve as the model for the Energy Resource Management Plan. The Organization identified as Company H was selected for that purpose.

3.2 General Conclusions

1. There is a wide variability in energy awareness and activity within the industry. With rare exception, executive familiarity with the energy outlook and governing parameters, is low, particularly in regard to relevant Federal and State legislation. Size of the Company is not necessarily a determinant. In many cases, marketing considerations - and investments - overshadow energy concerns to a significant degree. This may, in part, be a bias that stems from the fact that the Food Industry enjoys priority allocation of critical fuels in the event of emergency. This fact notwithstanding, there are, on the other hand, companies both large and small that have taken aggressive steps to reduce energy consumption and maximize their energy security. There is, nevertheless, a highly evident need for educating

decision makers to the necessity for treating energy cost and availability with the same respect that they give the more traditional business planning parameters.

2. The principal barrier to the adoption of Energy Resource Management and its thrust of capital investment in alternate-energy micro-utilities is financial. This barrier is exacerbated by the impact of rulings, regulations and requirements of a variety of Federal agencies. Specific examples uncovered in this Program are:

- a. Management is resentful of the demands on capital for waste-water management and gaseous effluent control. This is a financial burden that produces no return on the investment. It is a drain on capital that might otherwise be used for modernizing plant (increasing productivity) or for energy security. (It is not being suggested here that such regulations be modified or eliminated. But it must be recorded as a strong reflection of management attitude, when the issue of investment in alternate energy systems is raised.)
- b. Capital funds in some Food Cooperatives are generated by a revolving cash assessment on each box which each grower/owner delivers to the Cooperative. The cash is returned on a revolving, seven-year basis. In the past, the assessment has been treated by the grower as a tax deduction on his personal Federal tax return, and the payout, seven years later, as income. The Internal Revenue Service has recently ruled that the assessment cannot be taken as a deduction, although the payout remains taxable. The result is that growers, reluctant to pay the tax, see no advantage to their membership in the Cooperative, and are now selling their product directly to other (profit-making) processors. Consequently, some Cooperatives are having an increasingly serious problem with capital formation, and thus their

ability to invest in major capital items, such as alternate energy systems.

- c. The poultry industry has brought to light important inconsistencies in USDA regulations concerning the amount of water to be used in processing poultry carcasses. The industry has gathered data which demonstrate that the amount of water, and hence the energy required to acquire the water, to power the refrigeration and to treat the waste water, can be reduced perhaps by half. The USDA has not accepted the data, and has suggested a protocol to settle the issue, but expects the industry to continue financing the study. The impasse remains. But obviously self-financing by industry of studies to update government regulations, and suggested programs of self-inspection, place drains on capital that might otherwise be used for other purposes.

(These examples raise the question, of course, of how many other barriers of a similar nature exist in different elements of the Food Industry, and beyond that in the manufacturing industry at large.)

3. The strongest financial incentive for investment in energy-related capital equipment may well be the provisions of PURPA. Where State PUC's have acted to interpret PURPA most favorably to industry, alternate energy investment decisions are more likely to be made. This is because favorable buy-back rates for electricity provide a steady income stream to the industrial generators, and help in satisfying IROR criteria.
4. Energy Tax Credits are not available to, and therefore do not act as an incentive for the non-profit Cooperatives in the Food Industry. In addition, there is a number (that may be large) of companies which are marginally profitable, for whom Tax Credits are not an adequate incentive, despite their carry-back and carry-forward provisions.

5. Accordingly, if further Federal financial incentives are to be legislated, it would seem that those that are income generating, yielding above-the-line cash flow, rather than below-the-line credits would be a more effective means of encouraging capital investment in alternate energy systems at industrial plants. (This qualitative conclusions reached from these discussions is confirmed quantitatively by the model Energy Resource Management Plan discussed in Section 4 below.) Tax credits should, of course, be retained. The issue is one of relative effectiveness.
6. While size may not be a determinant with respect to energy posture, structure may well be. There is strong evidence to suggest that operating divisions of major conglomerates do not have a free hand in addressing energy problems that may be locally critical. Energy policy matters flow from Headquarters.
7. Some businesses will inevitably fail as a result of continued energy inflation or of energy shock. (This has already occurred in the cement industry as reported by the Portland Cement Association in Section 2.2 above.) There are two reasons for this. One is that they will not have planned adequately, if at all, for the eventuality. The other is that a combination of circumstances - e.g., inaccessibility to renewable resources, unavailability of land or roof area for installation of energy-conversion systems or storage of alternate fuels, uncertainty of supply of conventional power from their electric or gas utility, coupled with their own business condition - will prevent them from taking any suitable action to survive. The only option in those cases may be for the companies to move to more energy-secure locations, secure both from the standpoint of conventional power and accessibility to renewables.

8. Effective reduction of energy usage goes beyond the management of energy supply cost/assurance strategies. Changes in work practices and habits, and plant relocation to minimize cost of transporting crop to processor are additional avenues that must be examined. In addition, in the competition for the scarce capital investment dollar, more energy-efficient processing equipment or packaging systems may offer more attractive returns on investment than an alternate energy system. The issue is one of demand reduction on the one hand, and supply displacement on the other. In either instance the decisions are not easily made in that they are dependent on the technology readiness, current or projected, of competing approaches.

3.3 Company Discussions

Company A

Product:	Juices and other fruit products
Process:	Canning, bottling, freezing
Structure:	Cooperative
Sales:	\$100,000,000
Location:	Southeast
Executive:	Vice President, Operations Chief Engineer Plant Engineer

Company A perceived the need four years ago to undertake energy conservation programs, motivated both by economic self-interest and moral obligation. Since that time they have become the leader in their industry in energy management, a perception held by others and which they hold of themselves. They have introduced standard conservation measures, waste heat recovery, and cogeneration. They have taken full advantage of the provisions of PURPA. They have modernized processing equipment for energy efficiency and have changed operating procedures on a broad scale. They have examined biomass, concentrating solar and photovoltaics. They have considered the use of

groundwater, and looked at the generation of methane from waste sludge. They have used sound business practice in making their investment decisions, and have realized major savings from the changes that have been introduced.

They perceive energy as a dynamically changing situation, conduct random audits of their operations during the course of the year, hold weekly planning meetings that address the future needs, and are sensitive to the potential impact of energy shock on their operations. They acknowledge that there is much yet to be done, but it is clear that of the companies visited during the course of this Program, this is the only one who is, in fact, practicing major elements of Energy Resource Management.

The Company's original goal was a 15% annual reduction in energy usage by department. Early results were so encouraging, that the decision was quickly made to hire a full-time Energy Engineer who reports to the Vice President, Operations. Initial conservation measures included insulation, computer-controlled refrigeration cycles, reduction of air-conditioning loads in the plant, and control of air conditioning in office space by turning it off six minutes in each half hour.

Waste heat recovery is now so effective that all heat in the plant is regenerative. Waste heat from the refrigerators is used to pre-heat the boiler feed water. Waste steam from the gas-fired cogenerator, which furnishes 6% of their total electricity needs, is used as the low-pressure steam in their evaporators. (They expect eventually to cogenerate 25% of their electricity.) Boilers are checked daily and maintained at efficiencies of between 82% and 85%.

The decision to install a 2150kW cogenerator posed a moral problem as well as an economic problem. The moral problem dealt with the recognition that they were continuing to burn natural gas, a potentially scarce commodity, even though this would give the company cheap electricity. The issue seems to have resolved itself since natural gas is becoming increasingly abundant in their region as the electric

utilities begin to switch to coal for their primary fuel. In addition, there is so much growth in their region that the electric utilities will have marginal capacity to meet demand, and self-generation of electricity eases that burden.

The economic issues were solved conventionally in terms of reasonable payback, but the icing on the cake was their State's PURPA provision (for which Company A is now a trial case) that requires the utility to buy back electricity at peak rates in summer, and off-peak in winter. The utility is summer peaking. (A similar economic advantage under PURPA gave Company K a very short payback on their cogenerator investment, as discussed below.)

Natural gas is not an issue with respect to energy shock. There is some probability that the plant would lose electricity altogether, in which event their natural gas cogenerator would keep the plant alive. All processing would be halted, and the self-generated electricity would be used to power the refrigeration systems. It is their judgement that for decades to come only a major catastrophe in the Louisiana fields, or destruction of the pipeline would interrupt their natural gas supply.

The Company has also improved energy consumption by investing in new capital equipment. They recently invested \$1,000,000 in a 40,000-pound, seven-effect evaporator (seven pounds of fruit-juice condensate for one pound of steam) to replace a 30,000-pound two-effect unit. At the time of the decision, electricity was at 5¢/kWh and steam at \$5/klb. This resulted in a 3.2-year payback. Since then electricity has risen to 6¢ and steam to \$6, so that the payback period is even more attractive.

Capital budgets are determined on the basis of what is essential to the operation, irrespective of payback. Then investments in energy-related capital equipment are required to compete on an equal basis with other investments with regard to IROR hurdles. But they are now realizing such good paybacks overall with the energy program, that these investments receive a lot of attention.

One area in which major savings in energy have been realized is in work procedures. It is judged that this area probably has returned even greater savings than their conservation measures. A four-day work week, reducing wasteful turn-ons and shut-offs was one such successful measure. Procedures which became "frozen" as tradition have been altered through extensive retraining of workers, and there is widespread metering, monitoring and reporting.

The Company believes that ultimately the Food Industry must go back to paper packaging because other materials are so energy intensive. The recently introduced "Brick Pack" may be an answer since it requires no refrigeration in the plant, store or home. Eventually, it is suggested, the Food Industry may reach the point of stating how much energy went into manufacturing the product on each package, for consumer information and awareness.

With respect to alternate fuels, it has been determined that the entire steam requirement of the plant could be met with wood. The mortality rate for orange trees is 2 to 3% per year. But the logistics problems are currently overwhelming. While there are twelve Main Members in the Cooperative, each has thousands of growers, some of whom own as little as three acres. Harvesting the dead trees, removal, shredding, transportation, and coordination all currently present insurmountable problems. In addition, it remains more economical to grind limbs and leaves together with the byproducts into cattle feed, than to consider them as fuel.

The Company has also examined a parabolic dish application for steam generation which would yield electricity at 7.5¢/kWh, but offers a 25-year payback. They are anticipating a breakthrough in photovoltaics, although they remain skeptical. They are presently generating methane from waste sludge on a small scale, but don't have the capital to put up a full-scale plant. They perceive Hydrogen as the fuel of the future.

They can't use groundwater as a heat source or sink because water is a scarce commodity in their area. They

recycle water because of the need to conserve, and spend a large amount of money on cleaning the sugars, oils and caustic clean-up chemicals from the waste water.

Being in a competitive industry, Company A is not anxious to share their cost-reduction successes with everyone. They realize, however, that eventually others catch up. They, themselves, seek to learn from others, and would use the meetings, seminars and symposia of the Citrus Association, the Citrus Division of the ASME and the American Energy Association for information exchange.

Company B

Product:	Poultry and specialty items
Process:	Cooking and freezing
Structure:	Privately held
Sales:	\$20,000,000
Location:	Midwest
Executive:	President

Company B is located in a high-density urban residential area, and is dependent wholly upon the local electric and gas utilities. Their most recent monthly electric bill was \$27,000, and gas was \$11,000. The cost of energy as a percentage of product cost was not known. There is no person in the company charged with energy responsibility - the burden would fall upon the President.

Dominating management considerations are efficiency of operation and cost reduction. In that context, several energy conservation programs have been introduced. Examples are waste-material combustion for steam pre-heat; stack economizers for the same purpose; electricity demand management by on-off cycling of refrigerator/freezers. The company has not availed itself of the NFFA/DOE Guidebook on Energy Conservation.

The Company does not have sophisticated planning practices. They are only now beginning to consider a five-year plan and address such issues as Return on Investment. The Company has been highly profitable in the past, pays cash

for its capital equipment, and because the owner is not in need of further riches does not make investments to make money. The planning activity is new, and long-term energy considerations are being given lip service at best.

In the event of a major energy supply shortfall - electricity blackouts, gas shortages - the Company would lose its refrigerated products after 48 hours. In the event of a crisis they would either be forced to move or to fail. Company B cannot avail itself of alternate energy forms. The roof area of its plants is fully utilized with exhaust blowers, stacks and the like; and there is no adjacent land area in the dense urban environment, available for solar-related energy conversion systems.

Company C

Product:	Fruit products and juices
Process:	Cooking, canning, freezing
Structure:	Privately held
Sales:	\$25,000,000
Location:	Midwest/Southeast
Executive:	President

Company C is a multi-plant operation with the main fruit processing plant in a Midwestern fruit-growing area; other processing, warehousing and distribution in a Midwestern city; and warehousing in the Southeast.

The Company uses all conventional forms of fuel and power in its several operations, but does not keep accurate track of energy costs. Energy is acknowledged as a "tough problem," but the Company has coped so far. They have not introduced conservation practices to any great extent. They would like to do something about waste-heat recovery, but this has not become a high enough priority yet. They have reduced electricity in their cold-storage plants by installing more modern units. (Their Southeastern warehouses may well be candidates for solar-powered refrigeration, but this was not discussed.)

They have looked at alternate sources from time to time, if only to discard the systems as too expensive. These have included a conversion of their process-plant boilers to biomass combustion, and the use of wind turbines as an electricity supplement. (The latter was rejected when it was found that the wind doesn't blow during the peak processing season.) These considerations were motivated as much by a sense of patriotism as by economics.

By similar token, the Company would not be motivated by the financial incentives of the Energy Tax Credit, because they believe this to be an inappropriate way to encourage introduction of alternate systems. They can neither form the capital to procure such a system, nor would they contravene a long-standing policy of not leasing capital equipment.

Company C is apprehensive about a major energy shortage. They think of themselves "only as safe as the Government is competent." A catastrophe would put them out of business, since they would lose their market and be swallowed up by the "biggs" in a day.

Company D

Product:	Fish
Process:	Preparation for freezing
Structure:	Division of National Conglomerate
Sales:	\$25,000,000
Location:	Northeast
Executive:	Director of Government Relations

Once an independent company, Company D became an operating division of a major National Food Conglomerate in 1968. The result is that day-to-day conservation matters are handled by the Division, but all issues related to energy policy, planning, attitudes to tax and other incentives, etc., are developed at Corporate Headquarters and translated into action policies for the operating divisions.

The Company is a marketer of frozen fish products. Processing energy - 40% electricity and 60% gas - is used for

cleaning, cutting, filleting, sizing, shaping and blanching the fish. Freezing is done by a contractor.

The Division has had reasonable success with conservation practices. All personnel are encouraged to think conservation, and electric power consumption in the headquarters building has been reduced 25% by careful monitoring of lighting and heating. Similarly in the processing operations, steam and hot water requirements have been cut, and certain changes in work practices introduced which have achieved reductions in factory energy consumption. The parent corporation issues monthly comparisons of all Divisions' energy consumption, as an incentive for continued attention to the problem.

On the other hand, energy is such a small percentage of the parent's costs - between 1% and 2% - that it does not apparently receive much attention at the Corporate level. It was suggested that increases in costs due to increasing energy costs would be made up by increasing marketing efforts to sell more product. If one operating division is having financial difficulties because of local energy shortages or disruptions, the likeliest Corporate action would be to close (or sell) the Division and move its product line elsewhere. In other words, the decision would be made on financial considerations alone similar to any decision affected by poor market performance, or whatever else may affect the annual profit goal.

Two proposals for energy management by Company D were rejected by the parent. One was put forward four years ago. That was to erect a 1.5 mW, coal-fired (anthracite), electric utility on Company-owned shore front, using barge delivery of the fuel. The project was demonstrated to be cost-effective, and the local electric utility had agreed to buy the excess capacity (60%). But the idea was rejected on the grounds that the Company is in the fish business, not the utility business. The other proposal was to alter work shifts to take advantage of time-of-day rate structures. But this was again not considered, as it was judged too disruptive of established practices.

There is no apparent sensitivity to the issue of energy shock, nor interest in alternate-energy systems for fuel displacement or cost reduction.

Company E

Product:	Dairy items
Process:	Freezing
Structure:	Privately held
Sales:	\$18,000,000
Location:	Northeast
Executive:	President

Company E is unusual in that it is in two separate, albeit energy-intensive, businesses. One is as a processor, manufacturing frozen dairy items. The other is as a frozen-food warehouse and distributor. Despite the fact that the warehousing/distribution business is the largest element of the overall business, ice-cream manufacturing is the more important, because its profitability is more readily controlled.

The Company's operations are electricity intensive. Its 1980 power costs were roughly \$1,250,000 representing perhaps 7% of gross sales. Many conservation measures have already been introduced. These include converting to sodium vapor lighting, correcting power factor, matching new electric motors to need. The Company also uses a great deal of motor fuel in its distribution operations. They first shifted from gasoline- to diesel-powered tractors, and are now buying Volvo units, displacing their Chevrolet-built tractors. The Volvo gives nearly triple the gas mileage, and is expected to have a longer operating life.

Many years ago the Company looked at the possibility of harnessing the low-head capability of a nearby river. The institutional barriers for a small company were too great, however, and the idea was discarded. It has not been re-examined. The administrations of several cities were involved, together with the Army Corps of Engineers, the Regional River Basins Commission and the local electric utility.

Company E would give consideration to solar-applications, but a major factor affecting any investment decision is the very nature of their business. As a distributor of a wide variety of national-brand frozen foods to a number of area supermarket chains, all their capital is tied up in inventory. In fact, they borrow against inventory and receivables to finance new purchases of stock. The cost of this money puts very severe restrictions on investments for business-growth or protection.

In the event of any shock or disruption, their strategy would be to cease all operations - that is, in effect, keep the freezers sealed. But any disruption longer than two days, that didn't allow them to move stock to unaffected storage, would put them out of business. For that reason, alternate energy back-up would be of interest, particularly at their 135,000 sq. ft. storage and computer facility. But it is judged that 100% capacity would be required, and the cost effectiveness of this would be suspect.

Company F

Product:	Meats
Process:	Freezing
Structure:	Privately held
Sales:	\$70,000,000
Location:	Northeast
Executive:	Chairman of the Board

Company F is a processor of controlled-portion meats - beef, veal and pork - for the fast-food market. They have three plants in the Northeast, but their markets extend from the Midwest to Florida.

Energy management is not a critical issue with the company, although they have from time to time looked at conservation and alternate energy measures. Energy management is the responsibility of the Maintenance Manager; it is not a full-time responsibility. The Company is electricity-intensive, and it is estimated that the annual bill in the three plants is of the order of \$1,000,000, or 1-1/2% of sales.

Engineering studies have been made on changing entrance-ways for conservation, on high-side metering of electricity for cost saving, and on other unspecified conservation approaches. Some have been implemented, but it is clear that the issue is not a high-priority one.

A measurement program was conducted for several months to determine the adequacy of the wind profile on the roof of the headquarters plant for possible installation of a but the results were negative, and the program was shelved. (The validity of the results is questionable - three-mph average, in what is known to be a high-wind region; and the Company that performed the test is no longer in business.) They have also looked at the possibility of burning waste packaging material as a heat source, but there is insufficient volume of waste to justify this measure.

The Company remains open to any investment that will reduce operating costs. Energy-related capital equipment would get the nod over an investment to increase market share, but it would suffer in competition with investment for replacing worn-out processing equipment or introducing more efficient equipment. Raising capital is also a problem.

The Company has not addressed the problem of energy shock or done any contingency planning although it could hold out for a week, if electricity were shut off, or two by halting operations and keeping their freezer closed. There was not an apparent awareness of current Federal tax-credit legislation, nor has any attention been given to what legislation is required to encourage alternate energy investment. On the other hand, the Company is in the service area of a controversial but soon-to-be-completed nuclear power plant. They support the completion of this plant most strongly, and have addressed the issue directly with the Governor and the two United States Senators.

As a member of the American Meat Institute, Company F relies for information principally on that organization's newsletter, in which energy issues are addressed from time to

time. The Company is also a member of the NFFA and the local Chamber of Commerce. The Company expressed positive interest in serving as a model for the Energy Resource Management business plan of this Program.

Company G

Product:	Bakery items
Process:	Baking, freezing
Structure:	Privately held
Sales:	\$30,000,000
Location:	Northeast
Executive:	Executive Vice President Corporate Planner

While Company G is a part of the baking industry, they identify more strongly with the frozen food industry - they are in frozen foods with a bakery item. Attention over the past decade has been given almost exclusively to market growth (from \$1 to \$30 million) and to the development of equipment unique to their needs. Energy is, nevertheless, of great concern; it represents perhaps in excess of 15% of the factory cost, and is considered a product ingredient in the same manner that wheat and yeast are.

Waste heat recovery is now a mandatory consideration in all new baking and refrigeration equipment (both mechanical and cryogenic freezing are used); dual-fueled (oil and gas) ovens are always specified; equipment manufacturers are responsive to energy performance specifications; and the architect for new facilities has been instructed to design for energy conservation and control.

Transportation costs also are important since they distribute nationwide. They lease a fleet of six diesel trucks, but use common carrier as the principal medium. They have found Conrail to be unreliable, costly and not credible.

The Company, nevertheless, has limited manpower resources and the pressures and demands of a rapidly expanding business force them into the position of being followers in energy matters,

just as they have been pace-setters in bakery/freezing equipment development. They will take full advantage of energy knowledge developed in the industry as disseminated by their Trade Association. They want to be sure that anything they do in the future has the latest energy technology designed into it. Similarly, while they are not current in energy legislation matters, they would follow initiatives in this area, developed by the Trade Association, that would be in the industry's interest as a whole.

Again, because of pressures on growth and expansion, there has not been much attention given to planning until very recently. They hold business interruption insurance, but have not addressed the question of energy interruption. An electricity outage of longer than 15 minutes would result in spoilage of everything then in the baking line. How long the business would survive is not clear - it would related to how much frozen inventory could be protected in the event of a major interruption.

Company H

Product:	Fruit juices and fruit products
Process:	Cooking, canning, bottling, freezing
Structure:	Cooperative
Sales:	\$290,000,000
Location:	Northeast, Southeast, Midwest, Northwest, Southwest
Executive:	Vice President - Manufacturing

Company H operates nine manufacturing plants, six of which it owns. A three-effect, oil-fired steam evaporator is used to make citrus juice. Other fruits are cooked with both electrical and steam power. Freezing, despite its expense, is used to store product, since the fruits are seasonal, but their processing can be undertaken year-round. This turns out to be the most economical approach overall. The total cost of energy to the Company was not known

The Company perceives itself to be and is managed as a marketing enterprise. It was suggested that continued development and promotion of various new product lines would probably divert most of the Company's discretionary funds from other projects, including energy-related investment.

The Company, nevertheless, has undertaken a number of important energy projects under the direction of the Central Engineering Staff at Headquarters. They use recovered waste heat in their manufacturing operations. More importantly, they have used their Midwest plant as a model to install a waste-material burner, an approach which they expect to reproduce elsewhere. There is some reservation, however, with respect to government barriers. The Midwest plan was chosen as the pilot because it was felt that the regulatory environment was most favorable in its State. Even so, it took one year to obtain the necessary permits.

At two other plants they have attempted to sell waste steam from their processing to other users. These attempts failed because of local institutional barriers.

There is a general anti-government attitude. The Company feels that the government has not done its job properly in not making it attractive for businesses to operate. They perceive increasing government involvement with capital investment decisions. There is resentment at the amount of capital that had to be invested in waste-water and solid-waste management. They can't do the things they'd like to do, because of these high environmental-control costs. Because they never seem to have enough capital to supply all their needs, they do use leasing extensively.

The Company is, nevertheless, proceeding with new energy approaches. A proposal has been put forward to install a wind turbine on the Headquarters Building to provide power for the building's lighting needs. This, in addition to its Public Relations value, would provide a learning tool for the engineering department. Its effectiveness could lead to installations for processing power at other plants.

Company H has given thought to energy shock. Presently they can operate any of their plants at full power for 14 days, as they could provide for fuel storage of that duration. It was noted that as a forward-looking company, they would be interested in serving as the model for Energy Resource Management business plan of this Program.

Company I

Product:	Frozen dough, desserts, pie fillings, seafood
Process:	Baking, cooking, freezing
Structure:	Privately held
Sales:	\$300,000,000
Location:	National and Eastern Canada
Executive:	Corporate Controller

Company I operates 15 manufacturing and processing plants throughout the United States with two in Eastern Canada. The individual plants are operated as cost centers that are required to meet budget and manufacturing standards, but there is only one profit center - the Corporation itself. On the other hand, each location treats energy problems on its own, since energy is not yet perceived as a major problem by the Corporation, even though it represents 3-1/2% of factory cost and 12% to 13% of profits. There is one engineer on the Corporate Engineering Staff who is working on energy issues.

The Company recently established a Presidential Task Force to address broadly a wide variety of Company problems. The Task Force consists of the Controller, the Vice Presidents of Manufacturing and of Special Projects, and the President of the Canadian Operations. Market share and diversification is their first priority, with energy fairly low on the agenda.

The general attitude towards energy is that it is budgeted as a line item, but if the budget is exceeded, it is accepted with a certain fatality. There is more concern with supply availability than with cost which is seen as tied directly to inflation. For example, consideration is being given to establishing a freezer operation in a Far Western plant, but there is

concern that the electric utility does not have the necessary capacity, and that blackouts might result.

In general, the Company's time perspective is relatively short. Concerns are more with immediate problems. The Far West operation is the first instance in which a longer view has been taken. Even so, more current concern is given to distribution costs which have tripled in 10 years, than to energy availability matters. There is apparent little familiarity with Federal tax incentive legislation or with the provisions of PURPA. No attention has been given to alternate energy systems.

Company J

Product:	Citrus juices and fruit products
Process:	Bottling, canning, freezing
Structure:	Cooperative
Sales:	\$600,000,000
Location:	Far West
Executive:	Operations Manager, Products Group Manager, Industrial Engineering, Products Group

Company J brought to light a number of problems which are evidently unique to food cooperatives. In some instances the problems are shared equally by all cooperatives; in others, the problem is a matter of degree. The problems, however, are stated from Company J's particular point of view.

First they have no control of their raw materials. The volume of fruit may vary by a factor of two from year to year, depending on weather and the market for fresh fruit. The latter market has first priority on the high-quality fruit, and the juice processors get the residue. When crops are small, fruit for processing is small. When crops are large, the fresh-fruit market is quickly saturated and the processors have an enormous volume of material to deal with. The problems in raw material fluctuation are monumental.

There is a second aspect to this problem which is even more serious, and has disincentive ramifications for major

capital investment. The Cooperative generates its capital funds by assessing each owner/grower a fee per box of product shipped. These monies are held for seven years, and then paid out to the member. It is thus a revolving capital fund generator. The farmers take a tax deduction when the assessment is paid, and pay taxes on the assessment when they receive it back as income. The IRS has now ruled that the assessment cannot be treated as a tax deduction, even though income taxes must be paid on its return. As a result, the farmers are turning to the market directly, as well as to other processors, to sell their product in order to avoid both the assessment and the later tax. As a result, the Cooperative has reduced access to product, and reduced capital formation capability.

Finally, as a Cooperative, the organization is a non-profit under IRS regulations. Accordingly they obtain no leverage from tax-credit legislation designed as inducements to alternate-energy installation.

Company J has, nevertheless, undertaken a number of major steps to reduce energy costs, some requiring significant capital investment. The Board of Directors is very responsive to energy-reduction projects, but have fairly strict IROR criteria against which all projects must compete evenly. Two- to three-year pay-backs are the rule. But because of both limited staff and capital resources, not all projects desired can be implemented.

Among the projects underway or under consideration is the closure of one processing plant and building of a replacement closer to the source of fruit. The new plant's location will result in annual savings of 750,000 gallons of diesel tractor fuel alone. In addition, current necessary expensive wastewater treatment practices can be discontinued and used in land-spreading and irrigation instead. (This relocation was studied for 20 years before the decision was taken.)

Similarly, the question of balancing the economies of scale of the central processing plant at Headquarters against a number of satellite plants nearer the crops have been examined from time to time. The figures are now suggesting the latter course to be more desirable.

In operational matters, all housekeeping items for energy conservation have been completed. Steam boilers have been fitted with economizers. New steam evaporators are now five-effect - that is, five pounds of juice per pound of steam, and the newer plants will have seven-effect evaporators.

Passive solar drying of product waste for cattle feed has been used in certain locations. Cost trade-offs now are looking at active methods for drying vs hauling the feed wet. (But wet feed is 80% water, and the cost of transporting the liquid over other than local distances is prohibitive.) A \$2,000,000 investment in a gas-fired cogenerator is now being analyzed for installation in the Headquarters processing plant. While coal is normally not thought of in the California context, its use in fluidized-bed combustors is now feasible, and it will be considered in the future.

Everything that Company J has done or is doing in energy management is directed to driving costs down in the face of inexorably rising fuel prices. The prospects of energy shock have not been addressed at all. One reason is that the credibility of the issue has been obscured by the off-again, on-again behavior of their gas utility. They don't know what to believe in terms of the reality of the threat, although they appreciate that it can happen.

Company K

Product:	Fruit, field crops, tomatoes
Process:	Cooking, canning
Structure:	Cooperative
Sales:	\$900,000,000
Location:	Far West
Executive:	Vice President Engineering and Special Projects

Company K is owned by some 400 to 500 large farmers, has twelve processing plants in a Far Western State and is headquartered in a major Western City.

It is evident that the Company has been a leader in energy management for their industry. They have reduced energy by 25% of 1972 usage through 80/81, and are seeking to achieve a 50% reduction. They recognize, however, that housekeeping methods achieved the first half of the reduction, but new processes and new equipment will be required to go the rest of the way. The financial burden will be such that some kind of assistance, through favorable tax treatment or leasing mechanisms, will be required.

Ninety percent of their energy is used for processing steam, with gas, No. 2 and No. 6 oils as the fuel. The 10% remaining is electricity, of which 80% is used in processing. Audits of steam usage were started three to four years ago under the aegis of both the National Food Processors Association and a State Trade Association. As a result of this work, which was funded by DOE and executed by a State University, efficiencies in steam retorts were increased from 27% to 57%. The Company retrofitted 40 cookers to achieve these results and realized a one-year payback; but it must be realized that with a four-month canning season, one year is in reality four months. The DOE support and program results are considered a model of how Federal dollars should be spent in support of industrial energy-reduction programs.

Evaporation is also a problem. The Company is converting all theirs to three-effect at an investment of \$150,000 with a two-year payback. The Company has also retrofitted a package boiler to burn woody products such as fruit pits and sawdust. This requires 20% sustaining gas. It has been found that pulverizing the fruit pits is a problem. They have, nevertheless, installed a 100% biomass cogenerator which delivers 4500 kW and 25,000 lbs per hour of steam at 50 psi. The cogenerator also has oil and gas capability.

Their State Public Utilities Commission has enacted rules which will have a very beneficial effect on the growth of biomass cogenerators in that State. The PUC, under the enablement of PURPA, has ordered the utilities to pay peak-load rates

(7.1¢/kWh) for all biomass-generated electricity. The Companies are paying only 2¢/kWh to the local Irrigation District. As a result, the cogenerator will pay for itself in three years. The State also provided incentives through low-interest financing, by allowing the investment to be financed through State-backed bonds at 10% interest.

Company K views biomass as an important low-cost, widely available fuel, and believe that they can generate 10 to 15% of their energy with it.. They have given serious attention to solar, but feel that recovery of waste heat in their processing is more cost effective than low-temperature solar, and that high-temperature solar is too expensive in land use and equipment. The potential for wind energy conversion systems is very high at one of their plants, however. There are 800 acres available for a wind farm, and studies have shown that wind is available in the canning season.

Transportation energy costs are a constant worry. Plant location is important, and the siting of new plants is in large part dictated by these considerations. Company K has also been working with the State legislature to allow three trailers to be hauled by a single tractor, although trucking industry forces are opposed to this.

It was noted that it is difficult to sell management on the concept of energy insurance. Cost savings and return on investment remain the only criteria. And come what may, food must be packed and shipped to feed the nation, which is why food processors are on priority allocations for fuel and gas.

Company L

Product:	Poultry
Process:	Cooking, freezing
Structure:	Privately held
Sales:	\$110,000,000
Location:	Mid-Atlantic
Executive:	Vice President - Manufacturing Plant Engineer

Company L has a five-year plan which calls for a 3% after-tax profit based on 15% per annum real growth. But they are not meeting either of these targets. Their 1980 net profit was only 1.8% after tax. This financial performance which is attributed both to escalating costs and to declining market interest in their products heavily influences the Company's thinking and ability to invest in major capital items.

The Company is highly energy-intensive, since everything they do is fully processed. Electricity is used for refrigeration and freezing. They have reduced freezing costs by 70% by switching from cryogenic to mechanical blast freezing. They have reduced the cost of heating water by 50% by switching from electricity to gas. They are now approximately 50/50 gas and electricity. They are vulnerable to gas shut-offs should the outside air temperature fall below 17°F, at which point the utility would not have sufficient capacity for home and emergency use. But so far there has been no problem.

The Company is sensitive to energy problems - the Board has addressed the issue. But the failure of the business to meet its growth and profit goals, the cost of achieving the progress that has been made, and the severe financial impact of meeting EPA and USDA requirements on waste treatment and bacterial control, coupled with the cost of money, have together dwarfed any financial incentives that tax credits might offer. With money at 20%, a tax credit of 20% is wiped out. As a result, energy projects are difficult to sell internally. In addition the Company doesn't see energy as a real problem of the next five years.

The foregoing notwithstanding, the Company has not ignored energy in their operations. They are planning to use packaging waste as combustibles. They are planning to recover steam for pre-heat in a new protein recovery plant. They are, in general, trying to refine their recovery of energy. They are also considering an active solar project, although for space heating, not for process energy. The issue remains financial, however. They have limited internal technical resources, and find it difficult to hire consultants because

of their financial constraints. They recognize that some companies may fail as a result of inaction on the energy problem, but point out that a company can't go bankrupt implementing plans to survive a future energy shock.

Perhaps the overriding consideration with them has been the cost of compliance with EPA and USDA regulations. The poultry industry has developed data which indicate that the amount of water necessary to process a carcass may be cut in half, thus halving the energy to acquire and heat the water, and treat the waste. The USDA will not accept the data, and evidently expects the industry to perform new tests at their own expense. Copies of correspondence between the local Member of Congress and the USDA dealing with this issue were made available. It was also noted that the current cost-cutting program in government has resulted in the USDA asking industry to undertake its own inspection, at its own expense, further adding to the cost burden, and thus the drain on capital for other program.

Company M

Product:	Fruit juices and fruit products
Process:	Cooking, canning, freezing
Structure:	Cooperative
Sales:	
Location:	Northeast, Midwest, Northwest, South
Executive:	Senior Vice President - Operations Vice President - Engineering

Company M has already experienced one energy shock when there was severe curtailment of gas supply at their plant in the Northeast. This led them to drill five gas wells on their land at that plant, four of which are producers. These wells have the capacity of furnishing 15% of production needs over a 10-year period. The entire plant could be run off these wells for a short period, of course, but there is the grave risk that the wells would be ruined by water inflow if they were pumped too rapidly.

Originally the wells were judged to give an unsatisfactory IROR, but a combination of steadily increasing prices capped by the supply disruption forced the decision, even though the economics were not fully justified. While the original intent was to use the gas immediately, it is now being held in reserve until deregulation of gas prices impacts the cost of utility gas, at which time the Company will use their own gas to reduce overall cost. Their fallback position in the event of another shortage is to turn to No. 6 oil. But they believe that unless there is Federally-ordered redistribution of gas from their area elsewhere, the national linkages should keep them supplied for 10 years.

The energy situation is assessed annually in preparation for the Board of Director's meeting. The Board has established a lower IROR hurdle for energy projects than for other major capital investments - 25% vs. 30% (based on discounted cash flow). Projects that are being assessed include a coal cogenerator, with crushed coal or coal slurry as the preferred fuel. The Far West plant is ideal for solar applications, but the cost of solar- or wind-generated steam remains prohibitive, and is judged to be 10 years away. A technical energy company made a proposal to DOE for a cost-shared 125 psi solar steam generator demonstration at that plant, but the project was not funded.

Company M's operations are not electricity intensive, but they are electricity sensitive. Shortages would damage them during certain seasons. They have not looked at the PURPA incentives, because they believe the economies of scale are negative for a local micro-utility. They have not addressed the issue at all of achieving energy self-sufficiency, other than the emergency measures described above which apply only to certain plants. And, as with other cooperatives, the tax-credit legislation is not an incentive, since they are non-profit.

SECTION 4

MODEL ENERGY RESOURCE MANAGEMENT PLAN

4.1 Approach

Application of the principles and practices of Energy Resource Management to an actual company in real time is considered essential to assess its efficacy as a strategic planning tool for use by management in assuring some measure of energy security for their manufacturing operations. Accordingly, three of the companies visited, as reported in the foregoing Section, were formally approached to serve as models for the Plan. They were Companies E, F and H. Each had indicated its willingness to participate. But each is quite different from the others, and thus each offered unique circumstances which would make its Plan interesting and useful to the purposes of the Program.

Company E was an interesting candidate because it has both a manufacturing operation and significant cold-storage and distribution activities, which offer an unusual mix of problems from the energy standpoint. They are privately held, moderately sized, have undertaken major energy conservation measures, have given thought to energy futures, and, therefore, would provide a receptive environment in which the model Plan could be developed.

Company F was attractive, first, because it is a privately-held, moderately-sized company, characteristic of so many companies in the Food Industry. Second, the Company is multidivisional with a limited geographic spread, but a broad geographic market, which bears importantly on transportation energy issues. Third, the Company has been vague and tentative about its energy options, albeit aware that something should be done, again not unrepresentative of a number of companies of its kind. Accordingly, there would be much to be learned from this model that would be useful to others.

Company H offered an interesting modeling opportunity for a number of reasons. First, as a Cooperative, it derives

no direct benefit from Federal (or State) Tax Credit legislation. This is a critical issue for all Cooperatives in the Food Industry. Second, the Company is large, and multidivisional with a wide geographic spread. Solutions in the Northeast will not be the same as solutions in the Southwest or Northwest. Third, the Company has considered some strong alternate energy initiatives, and is a fertile subject for the model. And fourth, they are perceived in the industry as aggressive, innovative and forward-looking, and their potential implementation of the modeling results would be watched closely and possibly reproduced by other companies.

After each Company was formally invited to participate, and, in turn, formally agreed, Company H was selected for the single plan which time and budgetary constraints permitted to be developed. The principal reason for selecting Company H over the other two was the fact that it is a Cooperative, with attendant significant implications regarding the utility of Energy Tax Credits. Its geographic dispersion of plants, suggesting a good variety of plant-specific solutions, was a second reason. Remaining reasons, of course, derive from its candidacy in the first place.

In developing the model Energy Resource Management Plan presented in this section, a Planning Methodology of the following steps was first to be performed:

1. Establish the Company's baseline manufacturing energy consumption and cost by primary energy (fuel) type and use in the manufacturing process.
2. Establish and agree upon a projected business-as-usual energy cost for the Company during its strategic planning period of five years.
3. Determine the impact of energy conservation by factoring in those cost-effective measures not yet introduced, in order to establish the "reasonable irreducible minimum" baseline energy requirement expressed as a unit cost.

4. Assess the impact of energy cost/availability on manufacturing operations and costs, and hence on productivity and profits, in the context of three energy scenarios:
 - a. A low-cost scenario based on current Energy Information Agency and other authoritative agency forecasts.
 - b. A high-cost scenario based on certain worst-case projections of these same agencies, utilities and others.
 - c. Energy shock - the unexpected, sudden and prolonged interruption of primary energy supply.
5. Determine what, if any, site-specific, decentralized supplemental energy system would meet the Company's energy requirements in each scenario as a function of four levels of operating criteria - namely, survival, break-even, meeting short-term profit goals, meeting long-term growth goals.
6. Specify the alternate energy system, if any, as a function of:
 - a. Percentage of primary manufacturing energy it will be called upon to supply in the context of the four above-named operating criteria.
 - b. Alternate site-specific options that may apply, including wind, wood, other biomass or waste materials, solar-thermal (both low- and high-temperature), photovoltaics, hydro-electric, geothermal, ground-water, or other energy conversion systems, as determined by local environment (insolation and wind profiles, adjacency to energy sources, etc.), as well as by the state of the art and comparative economics of each technology.

- c. Federal, State and local incentives and regulations.
 - d. The date by which the system would be required to be on line.
 - e. Cost.
- 7. Assess the financial impact of an investment in a site-specific, alternate energy system on the basis of appropriate internal rate of return parameters in comparison with other demands on the Company's discretionary investment capital, such as increasing market share or introducing new products, that are required to achieve the financial goals of the company, as well as on the basis of self insurance in order to maintain operations in the face of energy shock.
 - 8. Develop with the Company's senior management a set of decision criteria that would lead to such investment; and design the optimum financing mechanism for the investment.

This planning methodology must be adapted to each company individually in order to give recognition to the qualitative factors that make each company unique - its culture, personality, way of doing things, way of looking at things. Thus there are no generalized solutions. Each company will have its own. The model analysis that follows, however, while integrating the qualities of one company is fully illustrative of what can be expected from this approach.

4.2 Model Company Background

The model Company is a progressive, growing, national food cooperative, with over fifty years of experience in the fruit products marketplace. Approaching \$300 million in annual revenues, the Company operates nine manufacturing plants, six of which it owns. The six Company plants have broad geographical distribution. They are located in New England, Mid Atlantic, Southeast, Midwest, Southwest and the Northwest.

The Company is managed by a small, multi-disciplined headquarters staff. The Company's management organization is shown in Figure 1. The President and Chief Executive Officer (CEO), with assistance from several key staff offices, operates the Company through two major Group Organizations - Finance and Administration and Operations. Operations is managed by a Group Vice President, who is in charge of Manufacturing, Marketing, Research and Development (R&D) and Manufacturing Control functions.

For purposes of this energy model study, the organizational interface was established with the Engineering Department, which, together with Standards Planning and Distribution, Purchasing, and the Division Manufacturing Managers, who run the East Coast and West Coast plant operations, reports to the Senior Vice President, Manufacturing, in the Operations Group. The key individuals involved were the Senior Project Engineer and the Manager-Process Plant Systems. Through them, access to appropriate Corporate planning, manufacturing planning, distribution planning, financial and tax personnel was made possible. The Company offered full cooperation in support of this study, making available all pertinent information.

Interviews were held with a representative cross-section of the Company's key personnel. As a result, it was possible to construct a rough flow diagram of the Company's approach to strategic business planning. As shown in Figure 2, a summary of the Company's planning can be reduced to a simple simulation model that considers a few major items: Functional Plans, the Capital Budget, the Five Year Plan, and Measures of Performance. Before addressing the specific issue of Energy Resource Management, it was considered paramount to understand and document the strategic context within which the Company conducts its business and makes its investment decisions.

The Company's planning process begins with the on-going development of its Functional Plans. The Marketing organization .

FIGURE 1
MODEL COMPANY - FUNCTIONAL ORGANIZATION CHART

FIGURE 2
STRATEGIC PLANNING MODEL

is concerned with the sales forecast for each product category, by package size and type, and by geographical sector. Marketing is, of course, also interested in the test marketing and introduction of new products. The R&D organization is concerned with a number of technical activities including food research, quality control, packaging engineering, process development and product development. The Manufacturing organization is responsible for operating the Company's nine plants (six company-owned). To support that activity, the headquarters staff is concerned with distribution and logistical planning, specific engineering projects - e.g., packaging facilities, waste water treatment, new warehousing - and purchasing. In time, energy management will become an increasingly important function of the manufacturing organization. The Financial Plan is concerned with the capital structure of the Company, its cash management and managing the return on investment for the grower-owners of the Company.

The Functional Plans provide the informational and analytical basis for the development of the Capital Budget, which is scoped for five years, revised annually, and presented for approval at the Annual Meeting of the Company's Board of Directors. The Capital Budget is structured into the eight categories shown in Figure 2. Administrative projects include improvements to the Company headquarters facility and computer equipment for the Management Information System. Government projects are those required to comply with Federal, State and local regulations - e.g., OSHA, EPA. Containers are added for on-going product storage needs, and forklifts are bought predominantly as replacement items. Research and Development (R&D) and Quality Control (QC) projects involve both test equipment and pilot plants. Manufacturing equipment needs stem from capacity expansion and process change and improvement. The Buildings category comprises new facilities for warehousing, freezing and packaging.

Two key aspects of the Capital Budget process are, first, the selection criteria by which investment projects are included

in the budget, and, second, the capital financing methods employed in making the investment. The prime investment criterion is discounted rate of return on investment. While formal analysis is not performed on some projects - notably, projects imposed by government regulation - the Company requirement is that the return on the entire capital budget must exceed 25%

Choice of financing methods is also quite significant in the strategic planning process. Two issues are key - namely, whether internal capital (debt or equity) is available for investment, and whether additional tax benefits, and hence lower net investments, are available to the tax-exempt Company by use of third-party financing, whether through leasing arrangements or limited partnerships. Understanding this financing issue demands an understanding of how the Company - as a tax exempt cooperative - manages its business for its owner-growers in the context of the relevant IRS tax code.

This works as follows. The Company receives raw product from its grower-owners. As it processes end products during the course of the year, the Company makes cash advances (patronage dividends) to the grower-owners based upon the quantity and quality of current-year deliveries. Stock dividends (based roughly on total historic deliveries) are declared from time to time. The Company's effective objective is to manage the operation to break-even by distributing the Company's net proceeds in the form of patronage and stock dividends. In this sense, tax-related elements of cost, such as depreciation, can be used to offset any taxable income the Company may have. Since the only Company income tax liability derives from non-grower-owner income, items such as the Investment Tax Credit (ITC) usually cannot be fully utilized. Accordingly, the ITC is either passed through on a pro-rata stock ownership basis to the grower-owners (many of whom do not know how to use the ITC) or is used in negotiating a lower-cost lease with an equipment lessor (or limited partnership). On the issue of the

Energy Tax Credit (ETC), it is presently the interpretation by the Company's Tax Department that the ETC cannot be passed through to the grower-owners; obviously, third-party financing takes on a most important role for energy-related capital projects.

It follows that the Company's Five Year Plan is directly and significantly influenced by the make-up and financing methods of the various projects in the Capital Budget. That set of projects, in combination with the sales and financial forecasts, helps simulate the strategic future of the Company. A variety of scenarios, forecasts and assumptions can be assessed. The primary measure of performance will be the impact on Net Proceeds to the grower-owners. While it is not the current policy of the Company in its formal financial reporting, it may be relevant and desirable in the future to account for ("take credit for") Investment Tax Credits passed through to owner-grower (plus Energy Tax Credits when and if allowable). Lastly, this strategic simulation must be finely tuned in consideration of a number of financial ratios - namely, debt to equity, working capital to sales and equity to assets.

In summary, the purpose of the Strategic Planning Model developed for the Company is to establish a context for viewing Energy Resource Management. The intent is to measure the impact of energy cost and supply trends and possibilities. As such, energy use and supply for the Company must be determined; trends must be assessed; energy-related capital projects must be analyzed and competed against other capital projects; and the financial performance of each Five Year Plan simulation scenario be measured. The Company's Capital Expenditure Budget is shown in Table 4.

TABLE 4
CAPITAL EXPENDITURE BUDGET
(Dollars in Millions)

<u>Company Fiscal</u> <u>Year</u>	1981	1982	1983	1984	1985	1986*
<u>Total</u>	14.2	15.9	17.0	18.7	23.0	25.2

* Extrapolated from the 1981-1985 Plan

The Company is presently at an annual sales level of around \$290 million. In order to protect the proprietary financial data of the Company, detailed Company income statements and balance sheets are not presented in this report. Suffice it to note that the Company expects to grow in excess of 20% per year. Net proceeds from Operations are projected to grow at an annual rate in excess of 25%. Specific annual objectives have been established for various categories of expenses, as well as for such ratios as debt to equity; working capital to sales; return on assets employed to long term cost of capital; return on net assets; and equity to assets. It is within this strategic planning context, therefore, that the planning methodology of Energy Resource Management, set forth above, was applied to the Company.

4.3 Baseline Energy Profile

Step one in the Energy Resource Management planning methodology was to establish the Company's baseline manufacturing energy (fuel) type and use in the manufacturing process. At the start of this study, no energy data base existed within the Company. A plant-by-plant compilation of utility and fuel bills was accomplished for 1981. These are summarized in Tables 5, 6 and 7 and represent the output of an energy model discussed in Section 4 below. Company energy costs by plant and fuel mix are given in Table 5, together with a listing of the cases of product shipped from each. (There is no final product shipped from Plant 6. It is a processing facility whose product is shipped for packaging elsewhere.) Company energy use for each fuel is given by plant in Table 6, expressed in uniform units of billions of Btu. The data of Table 5 divided by those of Table 6 then give unit cost data for each fuel reduced to dollars per million Btu as shown in Table 7.

The total energy cost for CFY 1981 of approximately \$4.44 million does not appear to be a significant amount. It translates (Table 5) to an average of only 18.1¢ per case

TABLE 5
CFY 1981 COMPANY ENERGY COST - BY PLANT AND FUEL MIX
(000's)

	<u>CASES OF PRODUCT</u>	<u>NATURAL GAS</u>	<u>OIL</u>	<u>ELECTRICITY</u>	<u>PROPANE</u>	<u>TOTAL</u>
PLANT 1	1,820	\$ 70.0	-	\$ 139.3	-	\$ 209.3
PLANT 2	5,467	244.9	\$ 373.1	442.8	34.3	1,095.2
PLANT 3	6,871	476.2	167.8	394.1	47.2	1,085.3
PLANT 4	6,923	599.8	-	280.8	48.0	928.6
PLANT 5	3,478	-	255.7	46.9	8.8	311.3
PLANT 6	-	-	298.9	191.4	-	490.3
HEADQUARTERS		-	15.0	75.0	-	90.0
(UNIDENTIFIED)						240.0
TOTALS	24,560	\$ 1,390.9	\$1,110.5	\$1,570.3	138.3	<u>\$4,440.0</u>

TABLE 6
CFY 1981 ENERGY USE - BY PLANT AND FUEL MIX
(10⁹BTU)

	<u>NATURAL GAS</u>	<u>OIL</u>	<u>ELECTRICITY</u>	<u>PROPANE</u>	<u>TOTAL</u>
PLANT 1	27	-	11	-	38
PLANT 2	55	51	31	6	143
PLANT 3	100	16	20	5	141
PLANT 4	178	-	30	5	213
PLANT 5	-	51	12	1	64
PLANT 6	-	60	11	-	71
HEADQUARTERS	-	2	3	-	5
TOTALS	360	180	118	17	675
UNDISTRIBUTED					33
GRAND TOTAL					<u>708</u>

TABLE 7
CFY 1981 COMPANY ENERGY USE - UNIT COST
(\$/10⁶ BTU)

	<u>Natural Gas</u>	<u>Oil</u>	<u>Electricity</u>
Plant 1	2.59	-	12.66
Plant 2	4.45	7.32	14.28
Plant 3	4.76	10.49	19.71
Plant 4	3.37	-	9.36
Plant 5	-	5.01	3.91
Plant 6	-	4.98	17.40
Headquarters	-	7.50	25.00
Totals	3.86	6.17	13.31

of product shipped. It is a mere 1.5% of sales, 2.9% of the cost of goods sold, and 5.3% of the operating budget. What is more, it represents 22% of the administrative budget and 31% of the capital budget. In absolute terms, it is not a small number, and a dollar of energy cost is available for application elsewhere: for operating expenses, for capital investment, or for increasing Net Proceeds.

Step 2 of the planning methodology, to project business-as-usual energy cost for the planning period, was performed with the above data as a starting point. The Five Year Plan projects business growth at an average of 22% annually. The specific growth rate for each year was applied to the baseline energy use data to develop the energy demand forecast for each year from 1982 to 1986 given in Table 8. (The 33 billion dollars of undistributed in Table 6 were first allocated to the four fuels - that is, the 1981 data for each fuel was increased by 5% to account for this undistributed amount. It was also assumed that the mix of fuels would remain the same throughout the planning period. Table 8.

TABLE 8
COMPANY ENERGY DEMAND FORECAST FOR CFY 1982-1986
(10⁹ BTU)

	<u>1982</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>	<u>1986</u>
Gas	479.3	596.7	722.0	875.8	1,051.0
Oil	239.7	298.4	361.0	437.9	525.5
Electricity	157.1	195.6	236.7	287.1	344.5
Propane	22.6	28.2	34.1	41.4	49.6
Totals	898.7	1,118.9	1,353.8	1,642.2	1,970.6

a 1981 base of roughly 700 billion Btu (Table 6), Company annual energy demand - in the absence of any conservation initiatives - could grow to almost 2 trillion Btu in five years.

Energy price projections were obtained from the Energy Information Agency, derived from models developed by Data Resources, Inc. These data are presented in Table 9 for three scenarios - optimistic, median and pessimistic - for the five years, 1981 through 1985. Because the Company Fiscal Year (CFY) begins near the middle of the preceding calendar year - for example, CFY 1982 began in mid 1981 - the price escalators for each calendar year were applied to the next CFY. In addition it will be noted that while the escalators, particularly those for natural gas, are high, there is no significant overall deviation of either the optimistic or pessimistic projections from the median. Thus the median projection was used for all subsequent calculations. Finally, the projections for gasoline and oil were applied to the forecast demand for propane in the Company.

The price escalation data of Table 9 applied to the unit cost data of Table 7 then provide the forecast unit cost of energy by fuel type given in Table 10. Finally combining these unit cost forecasts with the energy demand forecast of Table 8 yields the Company's energy cost forecast for the five-year planning period shown in Table 11. It is seen that the

TABLE 9
PRICE OF FUEL FORECASTS
% INCREASE EACH YEAR

		<u>1981</u>	<u>1982</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>
<u>Gasoline & Oil</u>	low	12.2	11.5	11.5	11.5	10.7
	mid	14.4	13.9	13.9	13.9	12.9
	high	16.7	16.3	16.3	16.3	15.0
<u>Fuel Oil & Coal</u>	low	11.4	10.6	10.6	10.6	10.0
	mid	13.8	13.2	13.2	13.2	12.5
	high	16.6	16.2	16.2	16.2	15.1
<u>Electricity</u>	low	13.6	12.7	12.7	12.7	11.6
	mid	14.1	13.3	13.3	13.3	12.2
	high	14.6	13.8	13.8	13.8	12.7
<u>Natural Gas</u>	low	19.0	18.5	18.5	18.5	16.7
	mid	19.9	19.4	19.4	19.4	17.4
	high	19.9	19.4	19.4	19.4	17.4

combination of projected Company business growth with forecast energy price escalation causes the total Company energy bill to skyrocket at a compound rate of approximately 40% per year, from a current total cost of \$4,440,000 to more than \$25,000,000 in 1986, and a total of \$72,000,000 for the five years of the planning period.

It is also useful to examine the cost of energy as a ratio of other key Company financial categories. These indices are shown in Table 12, compared against the 1981 data referenced earlier. Thus not only does energy become a more and more expensive element of cost on absolute basis, but it assumes a more significant proportion of other cost factors, rising, for example, to more than 10% of Net Proceeds, and exceeding 100% of the Capital budget.

TABLE 10
ENERGY UNIT PRICE FORECAST FOR CFY 1982-1986
(\$/10⁶ Btu)

<u>SOURCE</u>	<u>1982</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>	<u>1986</u>
Gas	4.63	5.53	6.60	7.88	9.41
Oil	7.02	7.95	9.00	10.18	11.46
Electricity	15.19	17.18	19.46	22.05	24.74
Propane	9.31	10.61	12.08	13.76	15.54

TABLE 11
ENERGY COST FORECAST FOR CFY 1982-1986
(000)

<u>SOURCE</u>	<u>1982</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>	<u>1986</u>	<u>Total</u>
Natural Gas	\$2,219	\$3,300	\$4,765	\$6,901	\$9,890	\$27,075
Oil	1,683	2,372	3,249	4,458	6,022	17,784
Electricity	2,386	3,360	4,606	6,330	8,523	25,205
Propane	210	299	412	570	771	2,262
Totals	\$6,498	\$9,331	\$13,032	\$18,259	\$25,206	<u>\$72,326</u>

TABLE 12
KEY 1982-1986 FORECAST ENERGY COST RATIOS
(%)

	<u>1981</u>	<u>1982</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>	<u>1986</u>
To Sales	1.51	1.74	2.01	2.32	2.68	3.07
To Net Proceeds	5.33	6.05	7.06	8.10	9.12	10.59
To Administrative	22.01	27.98	33.05	39.58	48.09	55.32
To Capital Budget	31.30	40.87	54.89	69.69	79.39	100.82

In the context of the Strategic Planning model for the Company (Figure 2), it is evident that escalating energy costs - to some measurable degree - will have a deleterious effect on the Company's future operational performance. The funds to pay for these increased expenses represent an opportunity cost and must come from some other Company budget - R&D, product development, capital expenditure, advertising, administration, or, perhaps, Net Proceeds. Indeed, it could be presumed that the current projection of continued outstanding Company performance in terms of Net Proceeds as a percentage of Net Sales is overstated because it either minimizes or possibly ignores the negative impact of energy costs. If so, the energy cost to Net Proceeds ratio will not only be affected in the numerator (higher energy costs), but in the denominator (lower Net Proceeds) as well - causing this ratio to increase faster than shown.

To the Company, this possible planning scenario is discouraging in the absence of management options to ameliorate the energy cost impact on the Company. In order to structure, analyze, and understand these options - as well as options that involve the possible interruption of supply - it is necessary to develop some form of Energy Resource Management model. With such a model, the remaining steps in the planning methodology can be addressed.

4.4 Company Energy Model

With the full participation of key staff of the Company, a simple energy model for the Company was developed. Represented graphically in Figure 3, the basic approach to energy modeling is relatively straightforward. Its purpose is to develop and analyze the major energy issues for the Company. Unchecked, undesirable trends must be understood. Specific solutions must be postulated and assessed. Their financial dynamics must be related to Company investment criteria and to management attitudes towards the future.

FIGURE 3
ENERGY RESOURCE MANAGEMENT MODEL

The model depicted in Figure 3 can be implemented in a step-wise function. An Energy Use Model can be developed which can integrate such factors as historical usage with production forecasts, and include conservation (energy reduction) and renewable (energy displacement) options in a variety of combinations. It can also look at changes in mix of conventional fuels - all on a plant-by-plant basis. Similarly, an Energy Supply Model can be developed which will factor issues of where the fuel or power is coming from, how much it will cost and what happens in the event of interruption or energy shock. The energy cost/use data of Tables 5, 6, 7, 8, 10 and 11 are initial outputs of these models.

These then provide the basis for an overall Energy Management Model as a formal analytical tool. With such a format, it becomes possible to answer a number of important energy-related questions. For example:

- If management does nothing, what does Company energy demand look like?
- On a case example basis, what impact can conservation have?
- What impact can major capital investment have on saving energy on a cost effective basis?
- How sensitive is the cost effectiveness of such investment opportunities to energy savings, tax credits, depreciation, method of financing, and utility buyback (Public Utility Regulatory Policy Act mandate)?
- What energy measures of performance are relevant, important and useful to the management of energy in the Company?

Addressing these questions leads to the performance of Steps 3 and 4 of the planning methodology - to reduce the energy to the "reasonable irreducible minimum," and to examine the impact of a variety of cost/availability scenarios, including energy shock, on operations. In a multi-plant organization

such as that chosen for this study, these steps can only be performed on a plant-by-plant basis. Accordingly, it was necessary to select one of the six plants for this purpose. A brief description of each of the plants follows. Their use of fuel by type is summarized in Table 6 above.

Plant 1

Plant 1 is located in the Southwest. It is the newest of the Company's facilities, having been in production only 18 months. Its two streams of energy are electricity and natural gas which are purchased from a large public utility. Electricity is used to operate production line equipment and compressors for freezers and air conditioning, and to provide lighting. Natural gas is used as fuel in two 600 horsepower boilers. The steam generated - water is purchased from the local municipal system - is used to heat treat the products, and for hot water and building heating. This plant is not only a production plant, but a distribution center as well. It is served by railroad and truck lines.

The plant has 154,000 sq. ft. of production area, and freezer and warehouse capacity. Eleven acres of land are available for expansion.

Plant 2

Plant 2, located in the Northeast, is the world's largest consolidated plant of its type. On a site of over 100 acres, the plant has over 430,000 sq. ft. dedicated to receiving, cleaning, grading and later processing and packing of the Company's products.

The major energy sources are natural gas, No. 6 fuel oil, electricity and propane. Natural gas or fuel oil is burned in the plant's three 600 horsepower boilers. The steam produced is used to heat treat the various products and containers, and to heat hot water and building space.

Electricity is used to operate production lines, air and refrigeration compressors and lighting. Propane is used as

motor fuel in the plant's fleet of forklift trucks. Natural gas and electric power are purchased from a large local municipal light and gas company. Fuel oil is purchased from a local supplier, as is propane.

Plant 3

Plant 3 is located in the Mid-Atlantic region. It is an older facility converted to the Company's use. There are 164,000 sq. ft. of process and storage area in the plant with adequate acreage for expansion. The plant is served by rail and truck lines.

The major energy sources are natural gas, No. 4 fuel oil, propane and electricity. Natural gas, when available, is burned in the plant's three boilers (one-750 HP, and two-525 HP) and No. 4 fuel oil is burned as the alternate fuel. Steam produced is used for heat treating the products, for water heating and for space heating. Some natural gas is used for space heating as well. Electricity powers the production lines, process areas, refrigeration and air compressors, and lights the building. Natural gas and electric power are purchased from a large statewide utility company. Fuel oil is purchased from a local supplier. Propane to power forklift trucks is purchased from a local branch of a major national supplier of compressed gasses.

Plant 4

Plant 4 is located in the Midwest and is the second largest facility in area within the Company, but is the leader in terms of gross cases of product produced. There are 207,000 sq. ft. of process and warehouse area, including a freezer.

The major fuel supply is natural gas purchased from a statewide utility company. The alternate fuel is No. 2 fuel oil with 90,000 gallon storage capacity on site. It is purchased during off heating season from the lowest bidder on the local scene.

Electricity used to power production lines, process areas, and air and refrigeration compressors is purchased from the

same statewide public utility as the natural gas. Propane for forklift trucks fuel is purchased from a local supplier.

The Company recently finished the installation of a crop-waste incinerator with waste-heat boiler at this plant. The incinerator consumes the entire combustible waste stream from the plant, and the waste heat from this combustion is used to generate steam for use in heat treating the products. In addition to the 13,000 lb/kW waste heat boiler the plant has four-600 HP boilers in place.

Plant 5

Plant 5 is situated in the Northwest part of the country. It is a small size consolidated plant which can receive, clean, grade and freeze the raw materials, and later process and package the finished products.

The plant is equipped with two-300 HP oil-fired boilers burning No. 4 fuel oil to generate steam for heat treating the products and to heat hot water and the buildings. Fuel oil is purchased from local suppliers at the best possible price.

Electricity is purchased from the state-wide public utility at the lowest cost per kilowatt hour of any location the company owns (Table 7). Electricity is used primarily to power process and packaging systems; a small amount is used for heating.

Propane for life truck fuel is purchased from a local branch of a large national company.

The plant's remote location requires that a minimum 12,000 gallons of fuel be stored in inventory; it depends on its own water wells, and has a complete waste treatment plant on site.

Total plant area is 114,000 sq. ft. with adequate expansion acreage available. A new freezer has been added this year and is now operational.

Plant 6

Plant 6 is located in the Southeast, with about 60,000 sq. ft. of process area and freezer. Due to the nature of the process, some equipment is located out of doors. The boiler

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natural gas, and oil. Further, three facilities each used over \$900,000 in energy.

The corresponding data for energy use - expressed in billions of Btu - is displayed above in Table 6. It is noted that 14 of the 20 Company plant site/energy type sources each provided over 10 billion Btu in 1981. The Company-wide demand approached three quarters of a trillion Btu in 1981.

The ratios of the costs of Table 4 to the energy use by facility and energy type of Table 5, expressed in terms of dollars per million Btu have been shown in Table 7. What this geographical mosaic of energy unit cost per source portrays is a broad range of cost by location and by fuel type. Natural gas, for example, ranges from \$2.59/million Btu in the Southwest to \$4.76 in the Mid-Atlantic region. Oil ranges from \$4.98 in the Southeast to \$10.49 in the Mid-Atlantic region. Electricity ranges from \$3.91 in the Northwest (hydroelectric) and \$9.36 in the Midwest (coal) to that of the oil-fired utilities of New England (\$14.28), the South (\$17.40) and the Mid-Atlantic region (\$29.71). Average Company cost per energy type ranged from \$3.86 for natural gas to \$13.31 for electricity. Average Company cost per location ranged from \$4.36 for the Midwest to \$7.66 (New England), to \$7.69 (Mid-Atlantic) and to \$18.00 (Headquarters). This varying array of costs underscores the fact that the economics of each energy application must be viewed on a plant-specific basis.

For the steps that follow, therefore, Plant 4 was chosen as a representative case.

Although this particular plant already has the lowest unit energy cost in the Company, the Company staff involved in this study felt that if significant results could be forecast for this facility, then the efficacy of implementing a formal system of Energy Resource Management would be most compelling to the Company's executive management.

Step One of the Energy Resource Management planning methodology has established the Company's baseline manufacturing energy consumption by primary energy (fuel) type for

each Plant. Step Two has established an agreed-upon projected "business-as-usual" baseline unit energy cost for the Company, by Plant, during its five-year strategic planning period. Step Three is now to determine the impact of energy conservation by factoring in those cost-effective measures not yet introduced, in order to establish the "reasonable irreducible minimum" baseline energy requirement for Plant 4.

Three comparative energy conservation scenarios were considered. Scenario A was a "do nothing" option. This scenario assumes that additional housekeeping ("quick fix") energy conservations measures are not considered important enough to merit even small investment. Plant 4 is presently operating in excess of 90% capacity. Accordingly, it is planned that future production loads will be about equal to the present level. The forecast Scenario A energy demand for Plant 4, therefore, is programmed to be constant at the present 213 billion Btu/year.

The other two energy conservation scenarios are based upon the considered professional opinion of Company engineering staff that energy conservation improvements can indeed be made - at minimal expense - to the extent of a cumulative 15% improvement over the five year planning period. Scenario B ("Go Slow") assumes that nothing is done in CFY 1982, but that a major campaign is mounted to achieve energy use savings of 5%, 4%, 3%, and 2% per year in the years 1983-1986. Scenario C ("Go Fast") assumes that energy conservation is embraced in CFY 1982 and results in a 10% energy use savings in 1983 and 5% in 1984.

The three conservation scenarios are summarized in Table 13. As shown, over a period of five years, Scenario B saves 83 billion Btu and Scenario C saves 114 billion Btu. Based on the current Plant 4 average unit energy cost of \$4.36 per million Btu - lowest in the Company - the five year savings of Scenarios B and C are \$360 thousand and \$500 thousand, respectively. These savings do not reflect the anticipated price escalation of conventional energy sources.

TABLE 13
PLANT 4 - CONSERVATION SCENARIOS
(10⁹ Btu)

	<u>1982</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>	<u>1986</u>	<u>Total</u>
A. Do Nothing	213	213	213	213	213	1065
B. Go Slow (5-4-3-2)	213	202	194	188	185	982
C. Go Fast (10-5)	213	192	182	182	182	951

For purposes of establishing a Step Three baseline and for reasons of planning conservation the "Go Slow" case was chosen. Its impact on Plant 4's 1982-1986 demand is shown, by energy source, in Table 14. This baseline was employed in investigating the impact on the Company of issues associated with major energy capital investments and energy shock.

TABLE 14
PLANT 4 1982-1986 DEMAND FORECAST
(10⁹ Btu)

	<u>1982</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>	<u>1986</u>	<u>Total</u>
Gas	178	169	162	157	154	820
Electricity	30	28	27	26	26	137
Propane	<u>5</u>	<u>5</u>	<u>5</u>	<u>5</u>	<u>5</u>	<u>25</u>
Totals	213	202	194	188	185	<u>982</u>

Step Four of the planning methodology of Energy Resource Management is to assess the impact of energy cost/availability for the Plant in the context of various price forecasts and of energy shock. As noted in Table 9 above the deviation of the high and low forecasts of fuel prices from the median is nominal. As a result only the median forecast was used. It was applied to the energy unit cost by energy source for Plant 4 as given in Table 7 above, yielding the projections shown in Table 15.

TABLE 15
PLANT 4 1982-1986 UNIT PRICE FORECAST
(\$/10⁶ BTU)

	<u>1982</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>	<u>1986</u>
GAS	4.04	4.82	5.76	6.88	8.07
ELECTRICITY	10.68	12.10	13.71	15.53	17.43
PROPANE	10.98	12.51	14.25	16.23	18.32

Multiplication of these unit cost figures by the forecast energy demand of Scenario B in Table 13 results in the projected total energy cost for Plant 4 shown in Table 16. It is interesting to note that even with "Go Slow" conservation measures in place that account for a 15% reduction in demand over the five-year planning period, plant energy costs still nearly double in that time.

TABLE 16
PLANT 4 - TOTAL ENERGY COST FORECAST
(\$000)

	<u>1982</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>	<u>1986</u>	<u>TOTAL</u>
GAS	719.1	814.6	933.1	1080.2	1242.8	4789.8
ELECTRICITY	320.4	338.8	370.2	403.8	453.2	1886.4
PROPANE	54.9	62.6	71.3	81.2	91.6	361.6
TOTALS	1094.4	1216.0	1374.6	1565.2	1787.6	7037.8

While expected energy cost escalation clearly has a significant impact, that of energy shock - the unexpected, sudden and prolonged interruption of supply - may be even more severe. For a better understanding of this energy management issue, several questions must first be addressed:

- Is an energy disruption a real possibility?
- How does the timing of the shock relative to the growing-harvesting-processing cycle impact the Company?

- How might the Company manage such a crisis?
- How can this impact be quantified?

There are few easy answers to these key questions. The potential impact of Energy Shock is at best poorly understood or at worst ignored. Every facility is unique. As described above, some Plants have dual-fuel boiler capabilities, several independent sources of fuel, and/or nearby satellite organizations that can provide short-term production capability. On the other hand, some plants have no options at all.

Causes of energy shock can take several forms. An Arab embargo can cause severe oil shortages. Cold winters and poor planning can cause gas shortages. Various events - fuel shortages, power plant accidents, acts of God - can shut down the electrical grid. The Company has indeed experienced electricity shock at more than one plant site in recent years.

Since Plant 4 has fuel flexibility with a gas/oil boiler system, it is not considered vulnerable to natural gas shock. But, it has had electrical black outs, typically caused by tornados, which tend to happen at harvest time. The following example was developed by the Company to illustrate the effects of energy shock at Plant 4.

A tornado completely destroys the plant's high voltage service and transformers on the second Saturday of Harvest Time 1983. This plant is scheduled to run two shifts that day. The immediate effects are complete loss of electric power and resultant loss of products in production. The loss is about 4000 cases of lost production and 1000 cases of material in production. At a per case sales price of \$10 per case this is a loss of \$50,000. There is minimal damage to windows, doors, awnings and door seals. But the large high-voltage transformer cases are damaged when poles supporting the primary and secondary feeders are broken and fall on the transformers, rendering them irreparable, since the cases are split and input and output taps destroyed.

Without electric power the plant is completely out of business. Efforts are made to rent gasoline or diesel driven

generators, but none can be found which are large enough to carry the load of the entire plant. The largest that can be located has capacity enough to provide limited lighting and enough power to run the refrigeration compressors and a boiler on low fire.

The ability to run refrigeration compressors saves what raw materials are in frozen storage. The ability to operate a boiler on low fire saves the raw materials which must be kept hot. The major concern is to replace the transformers with new ones, at a cost of \$30,000 each or \$60,000 in all, a process which could take from one to three weeks.

The plant was scheduled to produce 600,000 gross cases in 26 working days during the month of the shock. This equals 25,385 cases per day. Juice production can be increased at other plants and at satellites, provided there is process time at other plants. Increased overtime for workers and added transportation to transfer raw materials and packaging supplies to other locations will cost \$200,000. Production of other products can also be increased at these plants where time permits. But again large increases - estimated at \$100,000 - in transportation and labor costs will result. Production schedules are tied to orders. One possible solution is not to try to produce the orders until the plant is repaired and running, and to fill whatever orders that can be filled out of safety reserve.

Normally during the crop harvest a large amount of fruit is processed and canned to conserve freezer space, and to save the cost of freezing the fruit unnecessarily. If the outage is long enough, all available freezer space would be taken up and fruit would spoil if not processed or frozen. There is a possibility that 200,000 barrels of fruit could be lost. The financial impact would be about \$6 million. The longer term impact would be that the lost fruit would not be available for processing later in the year. The impact of loss of 200,000 barrels of fruit would be staggering. Each barrel of fruit represents 12 cases of finished product, or 2,400,000

cases. At a sale price of about \$10 per case the potential loss would be \$24 million.

In summary, then, if the outage lasted one week, the impact on the crop harvest would be minimized in that containers of harvest fruit could be stored in freezers. Cost of the damage would be roughly \$400,000.

A two-week outage would probably see all of the available containers filled and freezer space at a premium with unfrozen fruit left to spoil. Cost of the damage would be \$3 to \$6 million.

A three-week outage would see all containers and freezer space used up, and the remainder of the crop left unharvested and threatened by frost, which would make it unusable. Cost of the damage under these circumstances would be from \$12 to \$24 million.

This example clearly illustrates that even though Plant 4 is not electricity intensive, its vulnerability to electricity shock can have near catastrophic economic consequences, with losses ranging from \$400,000 to \$24 million, depending on the length of interruption. The steps that the Company might take to protect the production at Plant 4 will depend very much on management's assessment of the likelihood of the event, of the risks that may be taken and of the value of self-insurance through installation of a self-sufficient electricity system such as a biomass- or waste-fuel co-generator. Wind farms and photovoltaic arrays are also possibilities, although these are also vulnerable to tornado.

But electricity shock can result from other causes. In fact at Plant 2 during the 1979 harvest the Company was forced to rent standby generator capacity to protect against frequent - six times daily - electricity interruptions that were ultimately traced to a faulty relay in the utility distribution net. Vulnerability to electricity shock can also result from the future inability of the local utility to meet growing industrial demand, and certainly to interruptions of the utility's fuel, and to power plant accidents such as Three Mile Island. In the discussion that follows of the final steps in the Planning Methodology,

relating to choice of investment in energy options, a wind farm is used for illustrative purposes at Plant 4.

4.5 Capital-Intensive Energy Alternatives

Step Five of the planning methodology addresses a policy level issue that appears in both the Strategic Planning Model (Figure 2) and the Energy Resource Management Model (Figure 3). Its purpose is to determine what, if any, site-specific, decentralized supplemental energy system would meet the Company's energy requirement as a function of four levels of operating criteria - namely, survival, breakeven, meeting short-term profit goals, meeting long-term growth goals.

The operating criteria for the Model Company can be derived from its present and projected financial condition. With a projected sales growth of 22% annually and projected Net Proceeds from Operations averaging in excess of 25% - the Company is not concerned with either survival or breakeven possibilities. Rather, within the constraints of meeting short-term (Annual Plan) performance objectives, the Company's major operating criterion is optimizing long-term profits (Net Proceeds). The tradeoff in the financial dynamics reduces to a balancing of long-term energy savings against the resource consumption — of short-term capital investment in energy projects. Indeed, only by a review of specific investment proposals can Step Five be adequately addressed.

Step Six generated this list of possible capital-intensive energy alternatives. The Company has already considered a number of such projects. Costs, savings, resource quality (biomass waste, wind profiles, solar insolation) and timing need to be assessed.

Step Seven determines the financial impact of such site-specific, alternate energy systems in terms of appropriate internal rate of return parameters. Step eight is to develop investment decision criteria and to design appropriate methods of financing.

A review of the Company's projected 1982 capital budget suggests that little serious attention has been paid to energy

projects in this area. The projects, all at Plant 6, number only three, and total only \$291,000. They are listed in Table 17. They represent 2.0% of the total capital investment budget (\$14,186,000) and 1.7% of the total number of projects (176). These three projects may be small in number and straightforward in technology, but are very attractive in terms of internal rate of return (IRR). Their IRR's are 38%, 43% and 54% respectively. While good by most conventional standards, they had to compete against other capital investment projects with IRR's ranging from 25% to 200% - with a substantial fraction in excess of 60%. Energy projects are treated just as any other capital proposal. Accordingly, even in a successful, growing, but capital constrained organization such as that of the Model Company, energy projects face keen internal competition. A company with profitable growth of 22% per year is market-oriented. Sales and new products easily attract management's attention, while energy interests must articulate their positions well to receive adequate resource allocation.

TABLE 17
1982 ENERGY RELATED CAPITAL PROJECTS

<u>PROJECT</u>	<u>INVESTMENT (\$000)</u>	<u>ROI (%)</u>
1. Add 2 Additional Effects to Evaporator	183.8	38.1
2. Provide Computer Control for Evaporators	38.3	42.6
3. Provide Deaerating Feed Water Heating System	69.0	53.6
	<u>291.1</u>	

The Model Company has, nevertheless, funded energy projects in the past, has just brought on-line a waste incinerator for Plant 4, is actively investigating wind applications for several sites, and is generating - in part, due to participation in this study - an expanding list of possible future projects.

The waste incinerator at Plant 4 is intended to displace natural gas by burning crop residue and other wastes. Although delayed over a year by state and local regulations, the incinerator was on line in September, 1981. Electricity equivalent to one billion Btu annually is required to power the incinerator. But the incinerator will displace 55 billion Btu of natural gas annually, for a net annual savings of 54 billion Btu. This impact is shown in Table 18 applied to the baseline demand forecast of Table 13. By 1986 the annual reduction amounts to 29.2%. Table 19 translates the energy savings into dollar savings. The net five-year energy cost savings is seen to be 21.9%. These savings do not include savings associated with not having to haul and dump the solid waste.

TABLE 18
PLANT 4 - EFFECT OF INCINERATOR ON DEMAND
(10⁹ BTU)

	<u>1982</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>	<u>1986</u>	<u>TOTAL</u>
GAS	123	114	107	103	99	550
ELECTRICITY	31	29	28	27	27	142
PROPANE	5	5	5	5	5	25
TOTALS	<u>159</u>	<u>148</u>	<u>140</u>	<u>134</u>	<u>131</u>	<u>717</u>

TABLE 19
PLANT 4 - EFFECT OF INCINERATOR ON ENERGY COST
(\$000)

	<u>1982</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>	<u>1986</u>	<u>TOTAL</u>
GAS	509.2	549.5	616.3	708.6	790.9	3182.5
ELECTRICITY	331.1	350.9	383.9	419.3	470.6	1955.8
PROPANE	54.9	62.6	71.3	81.2	91.6	361.6
TOTALS	<u>895.2</u>	<u>963.0</u>	<u>1071.5</u>	<u>1209.1</u>	<u>1361.1</u>	<u>5499.9</u>

$$\text{NET SAVINGS} = \frac{7037.8 - 5499.9}{7037.8} = 21.9\%$$

The Company has shown considerable interest in a variety of alternate and renewable energy applications. High on the list is wind energy. The Company staff feels that more than one Company site may have a suitable wind resource. Instrumented anemometer testing to determine wind profile is presently underway at one Company site. Accordingly, another capital-intensive energy project considered for Plant 4 is a possible wind energy conversion farm, consisting of eight 65 kW turbines. It is estimated that the wind resource at Plant 4 is 14 mph. From manufacturer's literature, it is estimated that each wind turbine will produce 200,000 kWh/year; half of this output will be used internally, half sold back to the utility grid. The Public Utility Regulatory Policy Act (PURPA) rate is pegged at 2.2¢/kWh, 1¢/kWh less than the average electrical rate in 1981 for Plant 4.

The investment is \$600 thousand. For purposes of this analysis, it is planned that a third-party financing entity will take advantage of the depreciation, the 10% Investment Tax Credit and the 15% Energy Tax Credit. Lastly, it is assumed that the liquidation or terminal value of the investment in the N^{th} year is equal to eight times the after tax profit in year N.

A five year ($N=5$) pro forma base line cash flow (before the cost of capital) is shown in Table 20, resulting in a modest 18% internal rate of return (IRR). Several other cases were analyzed for sensitivity. For example, if the Federal Government were to eliminate the Energy Tax Credit, the IRR would be only 7%. Similarly, if PURPA were eliminated, the IRR would be a mere 2%. On the upside, the sensitivity to PURPA rates shows an IRR of 20% if the sell-back rate is only 1/2 ¢/kWh less than the average utility rate and an IRR of 22% if the sell-back rate equals the average utility rate: By comparison, if the wind farm enjoyed the PURPA rates prevalent on the East Coast, nearly twice those of the Midwest, a highly acceptable IRR of 90% could be achieved. Thus as

utility rates (and, hence PURPA rates) continue to increase the wind farm will begin to offer an IRR that exceeds the Company's hurdle. Finally, if the wind resource were 18 mph, (i.e., the Company finds a better-than-regional-average site near Plant 4) the IRR would be 35%.

TABLE 20
PLANT 4 - WIND FARM
- BASELINE PRO FORMA -
(\$000)

IRR = 18%

	<u>1982</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>	<u>1986</u>
SAVINGS	25.2	58.2	67.0	77.0	87.4
DEPRECIATION	<u>200.0</u>	<u>160.0</u>	<u>120.0</u>	<u>80.0</u>	<u>40.0</u>
PROFIT BEFORE TAX	(174.8)	(101.8)	(53.0)	(3.0)	47.4
PROFIT AFTER TAX	(87.4)	(50.9)	(26.5)	(1.5)	23.7
DEPRECIATION	200.0	160.0	120.0	80.0	40.0
INVEST. TAX CREDIT	60.0				
ENERGY TAX CREDIT	90.0				
TERMINAL VALUE					189.6
INVESTMENT	(600.0)				
NET CASH FLOW	(337.4)	109.1	93.5	78.5	253.3

The object lesson from this sensitivity analysis is that quality of the energy resource and level of utility rates are critically important, and that government incentives that are made available on an annuity basis - e.g., PURPA - are more important than a one-time incentive - e.g., the ETC.

The wind farm could provide five billion Btu/year. Accordingly, if moderate conservation, the waste incinerator, and the wind farm were all implemented, the energy demand of Plant 4 could be reduced from 213 to 126 million Btu/year, or a full 41%.

In part, due to their participation in this study, the Company has informally identified a number of potential capital-intensive energy projects for various facility sites to be

implemented on an indeterminate time schedule. Among them are:

- solar thermal absorption refrigeration
- additional waste incinerators
- additional wind farms
- use of low level waste heat for warehouse heating
- piggy-back refrigeration with air to air heat exchange
- micro computer controls for energy management
- upgraded compressor system
- new food sterilization techniques
- centralization of juice extraction at fruit storage facilities to minimize transportation/logistical expenses

The foregoing list - particularly the last two items - underscore the true complexities of the Energy Model depicted in Figure 3. The reference model addresses formally one of three energy considerations - i.e., in-plant, conventional, and alternate energy fixes. Such applications range from housekeeping conservation measures to major capital expenditures such as adding effects to an evaporator, or installing a waste incinerator or a wind farm.

A second method - not considered explicitly in the model - is taking a less conventional approach to in-plant energy management. This can involve a totally new look at production scheduling - e.g., packing more end product sooner and, thereby freezing less raw product or introducing new, energy-saving food processing approaches - e.g., new sterilization techniques.

A third approach to Company energy saving - also yet to be investigated - lies in the whole area of out-of-plant activity. New packaging can improve shipping densities. Improved plant siting can minimize inter-plant product transfers. Better control of transportation and logistics can help minimize liquid fuel consumption.

In summary, capital-intensive alternate energy application - as demonstrated in the Plant 4 case study - can make significant contributions in reducing energy expense and in reducing dependency upon external energy supply. It is seen, however, that the Model Company can still choose from a long list of possible energy management initiatives not yet including, for example, the entire area of cogeneration which has been largely ignored to date. Finally, even Energy Resource Management must also directly address unconventional production/process changes and in-plant or out-of-plant energy savings options involving packaging, plant siting or improved logistics.

4.6 Conclusions

Several important energy policy issues have evolved from this study's application of Energy Resource Management planning methodology to the Model Company. Important conclusions and lessons can be drawn for both the Government - which sponsored the study - and Industry, which on its own can become more energy self-reliant by implementing Energy Resource Management. For Government, there are lessons on what legislation to draft, how to implement regulations and how to disseminate information concerning energy. For Industry, there are a series of steps which link the daily management of its energy needs to the objectives of its strategic business plan. Several specific conclusions can be summarized.

First, the Government continues to assume a major responsibility in the process of industry's adoption of energy conservation and alternate/renewable energy applications:

1. Government should accurately forecast and communicate to industry the continued high level of energy price escalation expected. Ignorance of the scope of the energy problem is indeed the biggest barrier to confronting it. The Model Company personnel, for example, had not previously seen the DOE/EIA energy price forecasts. They were, of course, impressed not only by the high rate of price growth,

but also by the lack of significant divergence of either the pessimistic or optimistic forecast from the median forecast. Their reaction was that "It seems like a sure thing!"

2. Government should not communicate false signals about existing incentives to industry. The Model Company personnel made such comments as, "I read where they're taking away the energy tax credits; what do we do now?" and "Should we really count on PURPA? I see where 29 states are not going along with it." Similarly, new legislative initiatives, yet to be enacted, can paralyze industry into inaction. The Wallop-Heftel Industrial Energy Incentives Act of 1981, for example, holds out the promise of an additional 10% of federal tax credit for certain industrial energy applications without being yet the law of the land. As a result, management asks, "Shouldn't we wait on this until that new law passes?"
3. In designing new incentives (which are retroactive to at least the date of submittal of the bill) the Government should favor on-going, annuity-like approaches like PURPA over one-shot methods like tax credits. This was reflected in the wind farm analysis which showed that the return on investment was far more sensitive to PURPA at even a very low rate (2.2¢/kWh) than to the ETC at the full 15%. Further, private sector decision-makers - including several in the Model Company - relate better to the business of selling power back to the utility grid than they do to taking a "subsidy" (tax credit) from the Government.
4. In the process of enacting legislation impacting industry, Government should attempt to understand better the character of specific industries. The food processing industry, for example, has a large number of tax-exempt cooperatives who cannot fully

take advantage of the tax code for energy investment incentives. It is the considered opinion of the Model Company's Tax Department that food cooperatives cannot pass through the ETC to their grower-owners. If better informed, the Government might have anticipated this problem and resolved it at the outset.

5. The Government might try to lessen and minimize non-economic effects of capital-consuming requirements of governmental regulations such as EPA and OSHA. The Model Company, for example, lists at least 10 projects of this type totalling \$340,000 in its Capital Budget. This diverts funds from potential energy investments.
6. The Government might try to minimize and eliminate licensing delays for new energy installations. The model Company, for example, had to wait over a year before gaining permission to install the waste incinerator at Plant 4.
7. To avert or mitigate some of the aforementioned problem areas, the Government must constantly seek to improve its two-way communication with industrial trade associations. For example, the technical people in the model Company look to the National Frozen Foods Association to watch out for their interests; the financial people work through the National Society of Accountants for Cooperatives.

It is in Industry's self-interest to understand and implement Energy Resource Management.

1. Energy data bases should be developed by Industry from existing raw energy information. The Model Company, for example, kept a record of fuel and utility bills, but never totalled or analyzed them. No one knew to the nearest million dollars what the Company was spending on energy. More important, cost per million Btu by energy source by facility

was not known at all. Future analysis by the Company might include segregating fixed from variable energy use for each plant in order to understand more precisely how energy demand will be influenced by growth in business volume.

2. Low-cost energy conservation measures can be taken by Industry to reduce energy demand substantially. The Model Company, for example, sees a 15% reduction potential for Plant 4. In their 1982 Capital Budget is the example of a simple microcomputer to monitor and control an array of evaporators.
3. Selective capital-intensive energy projects can be pursued that provide Industry with excellent returns on investment. The Model Company as an example intends to add two additional effects to an evaporator, investing \$184,000 and expecting a 38% return.
4. A more aggressive attitude by Industry towards third-party financing for energy investments will eliminate the traditional barrier of up-front cost. Food cooperatives and other tax exempts must be concerned with how to take advantage of the ITC, ETC and depreciation tax benefits. For its part, the Model Company has negotiated a number of operating leases and utilized limited partnerships (arranged by non-Cooperative partners) to acquire capital property, although none is yet in the area of energy.
5. The way Industry allocates its investment capital should be reviewed. The energy area is apparently being neglected. Whereas other functional entities such as marketing, production, R&D, and finance have organizational momentum, on-going programmatic activity and vested interests - there are few who speak up for the concerns of Energy Resource Management. The Model Company, for instance, has only 2% of its 1982 Capital Budget allocated to energy projects.

6. Industry needs to adopt educational programs for promoting new energy alternatives. Co-generation, solar energy and wind energy need to be exposed as viable investment options. Solar insolation, wind and biomass resources should be assessed. In this regard, the Model Company has shown initiative, it has installed the crop waste incinerator, is taking wind measurements at another facility, and is open minded about solar thermal process heat for its Southwest plant.
7. Industry needs to include adequate monitoring and control instrumentation to complement its energy initiatives. The Model Company recognized this by asking "is our waste incinerator really doing what the brochure said it would?" The Company is addressing this need, as well as planning to put microcomputer controls in all its plants.
8. Energy shock - because of its extensive possibilities for economic damage to Industry - needs to be addressed by each Industry, each Region, each Subregion, each Company, and each Company facility. Studies have shown that the cost to industry of a forced shutdown averages 25 to 50 times the cost of the missing energy. Prior to participating in this study, the Model Company never considered the issue of energy shock. The possibility of dramatic problems have been revealed in the analysis of electricity shock at Plant 4.
9. Industry must seriously address at the executive level the prospects for both significant energy price escalation and possible energy shock. Within the Model Company several key people were "more than a little impressed" that the five-year planning

period could forecast a rise in total energy costs by a factor of 5.3 to over \$25 million and conceivably envision energy shock at just one of six plants for three weeks that could cost \$24 million. These figures were viewed as "awesome." The repeated question was "What in the world are we going to do?" The methodology of Energy Resource Management offers an answer.

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SECTION 5

INFORMATION DISSEMINATION STRATEGIES

What the present Program has taught is that while there are many companies who are aggressively pursuing reduction in energy consumption in industrial processes, there is, in general, a woeful lack of awareness of or sensitivity on the part of the industrial enterprise to their vulnerability to inexorable escalations of energy cost, and inevitable disruptions of energy supply. Despite the local, regional and national energy shocks that industry has experienced in the last decade, industry remains dominated by market considerations - market penetration, market expansion or new product development. While energy conservation measures are grudgingly acknowledged as something "the Government" has insisted on, energy is not a resource that gets much attention at the top executive levels of most companies.

Some companies have, of course, employed Energy Engineers, Energy Directors, and in some instances, even Energy Executives. These professionals are making effective progress. But they are constrained both by short-term profit considerations, and by internal competition for funds in the more traditional, better understood, and therefore, more easily justified operational areas. In addition, as a result of this competition they have difficulty in gaining the ear of the key executive decision makers. There is clearly a communications gap which exacerbates the inattention to the longer-term issues of planning for energy security.

If the many barriers to the introduction of Energy Resource Management in energy-intensive industries, perhaps the most important is the lack of appreciation for its need. When the energy component of factory cost is a small percentage of the cost, even its doubling may not be a severe enough impact to capture executive management attention, so that planning for major cost escalation or severe supply disruption in the foreseeable future is not considered to have value.

This awareness barrier may be overcome in part by a well-structured program of information dissemination. Being the complex task that it is, this requires multiple channels of communication. A general strategy calls for both oral and written communication. But it is clear that the task of priority, if the results of this Program are to be understood, accepted and adopted by industry, is to address the Corporate decision makers. This audience would include Chief Executive Officers, Chief Operating Officers, Engineering, Manufacturing and Financial Executives and Chief Planning Officers.

The appropriate vehicle for reaching this group is that set of Professional Associations as well as Trade Associations to which these members of the industrial community of their companies belong. Symposia, seminars and workshops dealing with this issue - presented either as singular events, or as part of other programs - are a proven method by which these Associations communicate new information. Associations to whom the results of this work will be sent fall into several groups. Those serving executive officers include (with headquarters city shown):

Young Presidents' Organization, New York

Chief Executives Forum (YPO's who have graduated at age 49), West Palm Beach

Presidents Association (Division of American Management Association), New York

Financial Executives Institute, New York

Planning Executives Institute, Oxford, Ohio

American Society of Association Executives
Washington, D.C.

American Chamber of Commerce Executives, Washington, D.C.

Planning and management organizations include:

Association for Corporate Growth, Stamford, Connecticut

North American Society for Corporate Planning, Dayton,
Ohio

Center for Planning and Implementation (Division of
AMA), New York

Industrial Management Society, Des Plaines, Illinois

International Management Council, New York

Project Management Institute, Drexel Hill, Pennsylvania

General business associations fall into national, regional and state categories. National associations include:

The Business Council, Washington, D.C.

The Business Roundtable, New York

The National Business League, Washington, D.C.

United States Industrial Council, Nashville, Tennessee

United States Chamber of Commerce, Washington, D.C.

National Association of Manufacturers, Washington, D.C.

National Small Business Association, Washington, D.C.

There are a number of regional organizations serving small businesses.

Smaller Business Association of New England, Waltham, Massachusetts (Connecticut, Maine, New Hampshire, New Hampshire, Rhode Island and Vermont)

Smaller Manufacturers Council, Pittsburgh, Pennsylvania (New Jersey, Pennsylvania)

Mid-Continent Small Business United, Lenexa, Kansas (Iowa, Kansas, Missouri, Nebraska)

Mountain States Association, Denver, Colorado (Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah and Wyoming)

At the State level there are, of course, the Chambers of Commerce. But these have too broad a constituency to be the most effective means of providing information useful to the industrial sector. A more effective group is the membership of the Conference of State Manufacturers Associations (COSMA). There are 40 manufacturers' associations similar to the Associated Industries of Massachusetts, the model vehicle used in this Program, all of whom are members of COSMA. All States are represented (as well as Puerto Rico) with the exception of Alaska, Delaware, Hawaii, Maryland, Montana, Nevada, North Carolina, South Carolina, South Dakota and Wyoming. There are also State small business associations headquartered in Rochester, New York; Peoria, Illinois; Edina, Minnesota; Milwaukee, Wisconsin; and Salt Lake City, Utah. In addition there are small business councils in Chicago, Cleveland, Toledo, Dayton, Cincinnati and Washington, D.C.

The foregoing lists of associations represent those non-industry-specific organizations through which the need, logic, methodology and options of Energy Resource Management can most effectively be communicated to top-level executives in energy-intensive industry through the medium of the seminar. During the course of this work, a model syllabus for such a Symposium was generated in cooperation with Associated Industries of Massachusetts.

It was structured first to lay the foundation for the need. This is accomplished by reviewing current energy supply patterns, supply patterns in the near future, and the status of technological development in recovery of conventional fuels and in renewables as they may each represent supply options for the longer-term future. The steps to achieve base-line minimum energy consumption are outlined as a conclusion to Part I of the Syllabus.

These data lay the groundwork for Part II, which examines the integration of energy cost/availability scenarios with the long-term business plan, reviews Federal financial incentives for alternate energy capital investment, together with methods of financing a major piece of energy equipment, and also reviews the impact of the various federal, state and local regulatory agencies. The Syllabus was designed to demonstrate that an orderly, step-by-step procedure may be used to provide the Corporate decision maker with tools and data by which he can make appropriate decisions affecting the security of his company's energy supply in the future. The Syllabus is sufficiently general so that its content may readily be adapted to any geographical area, or any given industry.

Industry-specific Trade and Professional Associations are another large medium through which this information, appropriately tailored, as noted above, can be disseminated. Some industrial Trade Associations are exclusively information disseminators (an example is the American Institute of Food Distribution), but do so only through written bulletins and periodicals. Others, of course, hold conventions at which workshops form a part of the program. It is inappropriate here to

list all the potential Trade Associations which might be communicators of this information. For example, the Encyclopedia of Associations lists 88 Trade Associations serving the Food and Dairy Industries, alone. The Solar Energy Research Institute has published a Market Development Directory for Solar Industrial Process Heat Systems which lists, among other things, 167 Trade Associations by four-digit SIC Number in 19 Industries (16 manufacturing). There are several other directories and listings in addition to the above two. Two are the National Trade & Professional Associations of the United States and Canada and Labor Unions and the Directory of the National Industrial Council. All these readily yield candidate Trade Associations for the information dissemination approach discussed.

To this point the discussion has dwelt on the mechanism of a structured symposium addressed to senior executives of energy-intensive manufacturing companies under the aegis of either general or industry-specific Trade or Professional Associations. There are three additional elements of the information dissemination strategy which must be introduced. It has already been noted that there is an apparent gap in communications between managers responsible for energy planning and implementation and their chief executives. Accordingly, the first additional element is a parallel program of symposia, seminars and workshops addressed to this latter audience in order to convey the substance of Energy Resource Management as an approach that Corporate decision makers will then be pursuing. With more emphasis on implementation aspects rather than detailed financial issues, the model Syllabus can serve as the mechanism for this purpose.

A second element is to take advantage of the journals and periodicals published by the many associations discussed above for publication of articles describing this approach. A third is direct communication with company executives by distribution of the Executive Summary of this Report.

This program has revealed that a broad-band educational program is needed to educate industrial management at all levels to the necessity of considering alternate energy strategies. All the above avenues of communication should be employed to convey the substance of this message to a diversity of audiences in the industrial sector. They should be buttressed by internal programs of education that ultimately involve all employees in addressing energy efficiency and alternatives.