MASTER

NATIONAL PLAN
FOR THE
ACCELERATED COMMERCIALIZATION
OF
SOLAR ENERGY

FINAL REPORT

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

SEPTEMBER 1979

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34

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FOREWARD

The final report of NPAC consists of four separate reports covering the following market sectors:

- o Buildings
- o Industrial Process Heat (IPH)
- o Agriculture
- o Utilities/Synthetic Fuels

Originally each report was written and submitted to MITRE/METREK Corp., the NPAC integration contractor for the Department of Energy. Concepts written by attendees of a regional planning meeting were included with the appropriate market sector. The entire list of attendees of that meeting are included at the end of this volume.

MID-AMERICAN SOLAR ENERGY CENTER

NPAC SUBMITTAL

BUILDINGS SECTOR

MAY 31, 1979

TO

UNITED STATES DEPARTMENT OF ENERGY

OFFICE OF CONSERVATION AND SOLAR APPLICATIONS

BARRIERS AND INCENTIVES BRANCH

TABLE OF CONTENTS

INTRODUCTION - THE MID-AMERICA REGION AND MASEC

The Region

The Mid-American Region consists of the states of Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota and Wisconsin.

The Mid-American Region has its own peculiar needs and shares in national concerns for future fuel availability, for protected access to clean air and water, and for social and economic progress in quality of life. Climate considerations of the continental heartland (long and intense winters and summers with high heating and cooling degree-day building design requirements and high prevailing wind) and significant agriculture and agri-business resources of the Region make Mid-America especially responsive to the national solar commercialization programs.

The Mid-American Region views the emerging national solar commercialization goals as a major step to begin to offset the huge energy deficit found in Mid-America.

In 1975 the Mid-American Region consumed over 28 percent of the total energy consumed nationally, produced (within its regional boundaries) only 9 percent of the nation's energy and imported (from outside its regional boundaries) 126 percent of the net energy imported by the United States from outside its national boundaries!

Such statistics underscore the Mid-American Region's backing of those solar commercialization programs which point to near-term savings of conventional fuels by tapping renewable energy resources readily found in the Region.

The Mid-American Region views the first solar commercialization program goals and objectives as a start toward lessening the impact of the energy crisis by interceding in the normal fuel consumption and conservation processes to provide a larger and earlier reliance on renewable energy sources and conservation activities.

As a solar commercialization program gains momentum and its goals sharpen and focus, the strong public and private commitment to solar must be nurtured carefully and realistically. The Region can then begin to realize the potential of meeting a large part of its energy needs by the year 2000 through solar and conservation related applications.

As an example, this commitment to solar and conservation integral to solar is reflected not only as the conscious decision to make do with less but also with investment decisions to use more efficient energy products and practices in residential, farm, and commercial buildings and in industrial processes. Such investments could include increased insulation, incorporating passive building design features in new and retrofit construction projects, and the use of counterflow waste heat exchangers.

Energy saved by active conservation practices along with solar energy collected and used in a variety of ways are the primary candidates for replacing nonrenewable sources of energy in the Mid-American Region.

The Mid-American Solar Energy Complex -

The Mid-American Solar Energy Complex (MASEC) is one of four Regional Solar Energy Centers funded by the United States Department of Energy (DOE) to act as DOE's lead institutions for the commercialization of solar energy and conservation integral to solar applications.

The MASEC COMPLEX consists of:

The CORPORATION - A Minnesota not-for-profit corporation (the MASEC corporation) governed by a region-wide Board of Directors, under contract to the Department of Energy to manage the MASEC Complex.

The CENTER - A professional staff employed to coordinate regional solar activities and to implement solar energy and conservation programs, both directly and through a system of grants and subcontracts to performers in the Region.

The Center is well structured to effectively manage programs for the Mid-American Region. Reporting to the Director are the Analysis and Assessment Division, Program Coordination Division, and Information Dissemination Division.

The Analysis and Assessment Division is concerned with the identification, collection, collation, analysis, evaluation and assessment of data and information relevant to the accelerated commercialization of solar energy applications in Mid-American Region.

Its key responsibilities are technology assessments, systems and component evaluations, applications and performance test evaluations, installation and maintenance procedures, socio-economic and environmental analyses and needs and resource assessments.

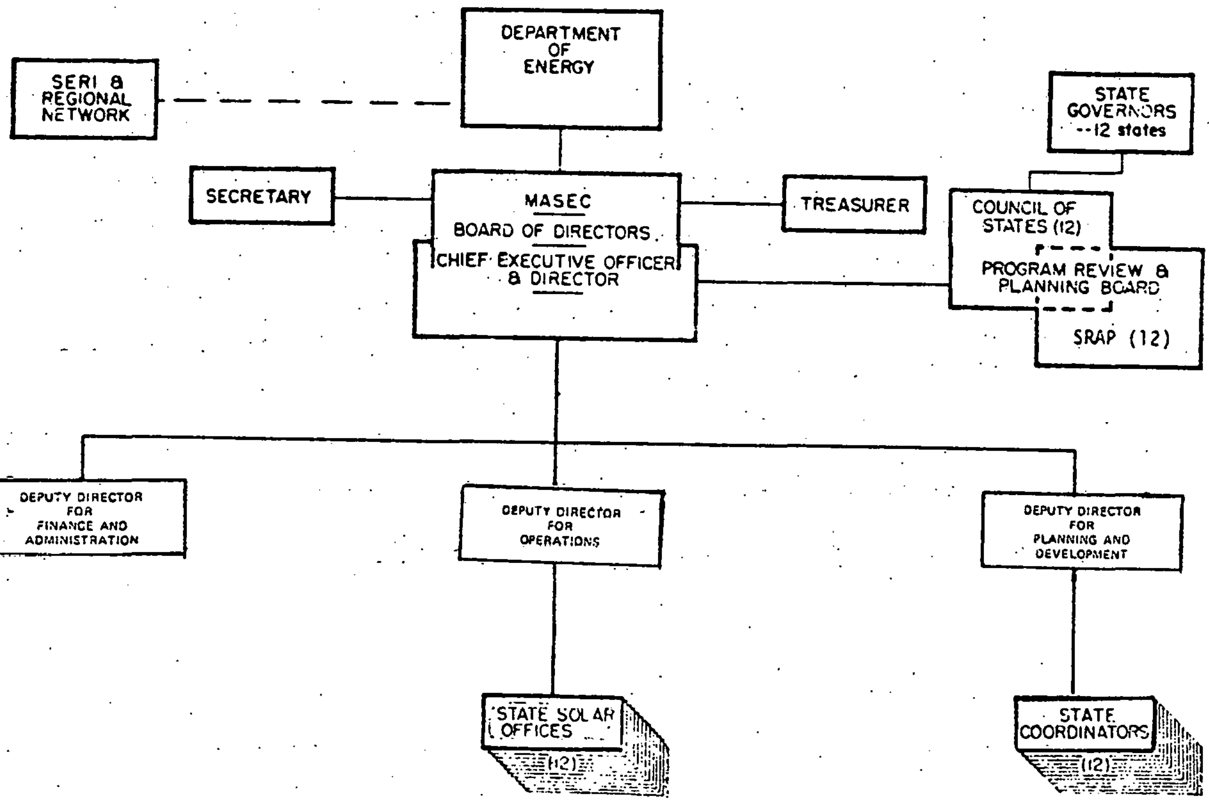
The Program Coordination Division ensures that the programs of MASEC throughout the region are integrated into the solar energy fabric of the region, contain a minimum of duplication and overlap and are responsive to the needs of the region. Its major activities are technical program management, technology and commercialization program planning, implementation and market development, coordination with regional institutions and coordination external to the Region.

The Information Dissemination Division plans, coordinates, and accounts for the proper balance and activity level of MASEC's information evaluation, packaging, delivery, exchange, and feedback functions. This set of interacting activities may be viewed as an education and public information outreach function which relies heavily upon information and data services, and data and education package development.

Its major activities are commercialization outreach to specialized and general audiences, information services (including the MASEC library and data bank) and communication services.

Staffed with competent, experienced professional, these divisions perform all the activities necessary to accomplish the objectives of the Center and to bring the results of their accomplishments to the people of the Region. Figure 1 shows the organizational structure of the MASEC Center.

Governance, organizational and
functional structure
of MASEC



BOARD OF DIRECTORS
12 board members, one per state, gubernatorial appointment
1 board member, Chairperson of Council of States } ex officio, non-voting
1 board member, Chief Executive Officer

FIGURE 1.

REGIONAL LINKAGES

Board of Directors

The Board of Directors is comprised of members nominated by the Governors of 12 states in the Mid-American Region. Its organization, functions, responsibilities, and rules by which it is governed are embodied in the Articles of Incorporation and Bylaws of MASEC.

COS

Council of States; a body comprising individuals from each MASEC state, appointed by their Governors to serve on the PRPB, to represent the Governors and to provide a communications link from the Governors and PRPB members to the Board of Directors and MASEC management as concerns policy, program, and other matters.

PRPB

The Program Review and Planning Board; a 24 member board comprised of the 12 Council of States representatives and 12 regional Solar Resource Advisory Panel members elected as members of the PRPB.

SSO

State Solar Offices; a facility in each MASEC state funded by a grant formula and responsible for serving as the primary in-state interface between the state supported solar activity and MASEC supported solar activity.

SSO Coordinators

The individual in each MASEC state chosen by the state authority and responsible for the SSO operations.

State SRAP

State Solar Resource Advisory Panel (SSRAP); a group of interested, knowledgeable, informed experts in each MASEC state who serve as an advisory resource group to MASEC in various solar related disciplinary areas.

Regional SRAP

Regional Solar Resource Advisory Panel (RSRAP); five members of the SSRAP elected by that group in each state to serve as regional representatives at an annual meeting. One of the five is elected chairperson and serves as a member of the PRPB.

In carrying out its program responsibilities, MASEC shall necessarily establish and maintain contact with a wide range of organizations and institutions, public and private, at the national, state, and local levels with whom and through whom programs will be implemented. Particular emphasis will be placed on those organizations which, because of their unique position and role, can have a significant multiplier effect on the nature, extent, and rapidity with which solar technology commercialization can be fostered among potential users.

The MASEC program management approach is a continuing cycle of program development, implementation, evaluation, and regional education. The

The major planning cycle operates on a yearly basis and culminates in the Annual Operating Plan. However the planning is versatile so that programs may be started at any time in order to accelerate key activities.

The basic steps in program planning are:

* Survey the Region for needs, resources and appropriate actions. The topical conferences and the NPAC planning meeting provided good methods of surveying the Region. Other methods are: interviews with key people, focused workshops, and inputs from the SRAP, PRPB, and SSO linkages in the states. Regional surveying is an <u>ask</u> and <u>listen</u> process directed toward finding barriers and opportunities for the commercialization of solar energy and defining the actions, activities, and programs which should be undertaken to move ahead.

* Define the goals and objectives to be accomplished; compare needed actions with the activities of DOE, SERI, and others. For this reason, the activities of DOE, SERI, the government labs, and many other sources are monitored and compared with the Regional needs. Then a determination is made whether to develop a Regional program or to express the need to one of the other agencies which is more capable or farther ahead in the development process.

SECTION 1

REGIONAL PROFILE

1. REGIONAL PROFILE

The Mid-American Region is comprised of the following twelve states: Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin. They constitute 21.5% of the nation's land area and contain approximately 27% of the United States' population.

It is the heartland of American agriculture, employing 37% of the farmers and farm managers in the United States in 1970. The Region produces an estimated 86% of the nation's corn and about 55% of its wheat. In addition, a large amount of the nation's beef and pork originate from this region.

The states in the East North Central Division (Illinois, Indiana, Michigan, Ohio, and Wisconsin) are more heavily populated, housing approximately 71% of the Region's 57 million people. In addition, the first four of these states are the core of the Region's primary industrial output. Some industries of national prominence within the MASEC Region produce transportation equipment, machinery, primary metals, fabricated metal products, food and kindred products, and rubber and miscellaneous plastics.

The Region is an energy-deficient area in terms of aggregate energy resources. In 1974, only two of the twelve states in the Region, Kansas and North Dakota, were net exporters of energy. The Region as a whole imported approximately 74% of its net energy from outside the Region.[1]

Table 1 shows the aggregated energy consumption for the MASEC Region, yielding the total amount of coal, petroleum products, natural gas, nuclear energy, hydroelectric power, and electricity used by the various sectors, as well as the Region's dependence upon specific fuel types within the total mix.

ENERGY CONSUMPTION BY SECTOR
IN TRILLION BTU'S

MID-AMERICAN REGION 1974

	AGRICUL.	INDUST.	TRANSP.	COMM'L.	RESID.	ELECTRIC GENERATION	TOTAL
COAL	0.0	1587.8	0.0	57.6	0.0	3608.4	5253.8
COKE	0.0	73.5	0.0	0.0	0.0	0.0	73.5
TOT-COAL	0.0	1661.3	0.0	57.6	0.0	3608.4	5327.3
	0.0 PCT	31.2 PCT	0.0 PCT	1.1 PCT	0.0 PCT	67.7 PCT	27.7 PCT
MO-GAS	251.5	153.3	3174.7	0.0	0.0	0.0	3579.5
AV-GAS	0.0	0.0	11.0	0.0	0.0	0.0	11.0
JET-FL	0.0	0.0	237.8	0.0	0.0	0.0	237.8
KERO	0.0	0.0	0.0	0.0	77.4	0.0	77.4
DIST	179.8	201.7	420.9	40.1	777.8	114.5	1734.7
RESID	0.0	326.2	12.4	98.7	0.0	126.6	563.9
ASPHAL	0.0	295.9	0.0	0.0	0.0	0.0	295.9
MISC-P	14.3	156.6	0.0	0.0	0.0	0.0	170.9
TOT-PETRO	445.5	1133.7	3856.9	130.8	855.2	241.0	6671.1
	6.7 PCT	17.0 PCT	57.8 PCT	2.1 PCT	12.8 PCT	3.6 PCT	34.6 PCT
LP-GAS	79.3	93.3	0.0	31.0	282.0	0.0	485.6
NAT-GAS	39.5	1963.1	177.9	825.3	2228.3	510.8	5744.9
OTH-GAS	0.0	221.1	0.0	0.0	0.0	3.9	224.9
TOT-GAS	118.8	2277.4	177.9	856.4	2510.4	514.7	6455.5
	1.8 PCT	35.3 PCT	2.8 PCT	13.3 PCT	38.9 PCT	8.0 PCT	33.5 PCT
NUCLEAR	0.0	0.0	0.0	0.0	0.0	429.0	429.0
	0.0 PCT	0.0 PCT	0.0 PCT	0.0 PCT	0.0 PCT	100.0 PCT	2.2 PCT
HYDRO	0.0	0.0	0.0	0.0	0.0	55.6	55.6
	0.0 PCT	0.0 PCT	0.0 PCT	0.0 PCT	0.0 PCT	100.0 PCT	.3 PCT
ELEC	26.3	617.1	2.5	418.0	493.4	-1574.8	-17.3
OTHER	0.0	297.0	0.0	43.0	0.0	0.0	340.0
	0.0 PCT	87.3 PCT	0.0 PCT	12.7 PCT	0.0 PCT	0.0 PCT	1.8 PCT
TOTAL	590.6	5986.5	4037.3	1513.8	3859.0	3274.0	19261.2
	3.1 PCT	31.1 PCT	21.0 PCT	7.9 PCT	20.0 PCT	17.0 PCT	100.0 PCT

SOURCE: U.S. DEPARTMENT OF ENERGY, 'END USE ENERGY CONSUMPTION DATA BASE', 1978.

TABLE 1.

The regional distribution of energy demand by primary consumers is similar to the national distribution with some differences in the relative consumption of various types of fuels. The sector demand in the MASEC Region is as follows: the industrial sector uses approximately 31% of the Regional total; transportation uses 21%; the residential sector used 20%; electric utilities, 17%; the commercial sector, 8%; and agriculture, 3% of the Regional total. The only noteworthy difference in the sector demands as an aggregate of the total is that the residential sector comprised a slightly higher percentage of the total (20% as compared to the national figure of 15.9%). Indeed, 42% of all natural gas used in the residential sector across the nation is utilized by consumers in the MASEC Region.[2]

While the distribution of primary fuels among the total Regional fuel mix follows the stratified national order, there are notable differences in the dependence upon the big three fuels. The Regional fractions for such fuels are: 34.6% for petroleum, 33.5% for natural gas, and 27.7% for coal. The national distribution is: 42.6% for petroleum, 33.7% for natural gas, and 17.7% for coal.[3] Coal contributes a significantly higher proportion to the Regional fuel mix as compared with the nation. In fact, 42.5% of all the coal used in the U.S. in 1974 was expended within the Region, primarily on the generation of electricity. Indeed, 42% of the total coal used by electric utilities in the nation was consumed by utilities within the Region. The Region imports 5.6% (84 billion Btus) of the electric power needed to meet its aggregate demand.[4] The Region accounts for 22.4% of the gross national consumption of petroleum, and 27.4% of that for natural gas.[5] Nuclear and hydroelectric power, along with "other" non-specified fuels constitute less than 5% of the total. Approximately 36% of all nuclear-generated electricity is produced within the MASEC Region. The Region's hydro resources are quite poor, only accounting for 5.4% of the

U.S. total hydroelectric generation. And of all the energy consumed in the U.S., 27.5% is expended in the Region, an amount which is comparable to the Region's population as a percentage of the national total.

2. MARKET CHARACTERIZATION

Buildings in the residential and commercial sectors afford a large opportunity for the increased utilization of solar energy. For as the nation moves from an era of abundant, cheap energy into an era of scarce, expensive energy, then strategies for the buildings sector need to go beyond simple conservation efforts such as turning down thermostats, adding insulation, and installing storm windows. It is desirable for strategies addressing this market sector to employ a dual approach. First, it is necessary to reduce the energy consumption in buildings through increasing the efficiency of the buildings as energy using mechanisms. Through appropriate design, construction and management, buildings can be made to consume substantially less energy without any basic impact upon their users. Second is the reduction of demand upon conventional forms of energy by utilizing proven solar technologies. It is estimated that 5 Quads of conventional fuels can be saved by 1983 through energy conservation and solar applications in the Region.[6]

The most applicable solar technologies for this sector in the near-term are passive, hot water heating, and space heating applications and to a lesser extent wood combustion and small-scale rural applications of wind. Energy conservation is an integral part of, and must precede, solar if the system employed is to be effective in satisfying a large portion of the building's energy needs.

Passive solar applications employ building design concepts which utilize solar energy naturally without the requirement of complex and costly mechanical hardware. An "active" approach to solar heating uses a carefully designed and rather sophisticated solar collector system, with a heat transfer medium which is pumped to a storage area or heat exchange unit, then delivered to the dwelling area. In contrast, a passive approach to solar heating and cooling involves a proper orientation to the sun, a maximization of natural ventilation in the interior, and the use of many materials already common in the buildings industry (glass, masonry, insulation, etc.). Proper passive building design takes maximum advantage of the sun's energy for winter heating, but also minimizes its effect in producing undesirable summer cooling loads. Prevalent passive measures include: south facing window areas, massive structural elements, and heat/cool conserving thermal insulation techniques. Low maintenance and high reliability are key characteristics, with strong conservation techniques integral in the design. Regionally and locally oriented building designs must be developed in order that passive may help reduce the Region's large heating demand.

Economic readiness has been demonstrated in several building types. Passive heating compared favorably on a life-cycle basis with electrical space heating for nearly all of the United States, with oil in most places, and with regulated natural gas in a few places in 1978.[7] Passive heating is generally predicted to be more economical on a life-cycle basis than active solar heating for the same amount of energy delivered.

A large potential market for passive design exists for residential, commercial, and institutional buildings. Most building types can increase their energy efficiency and lower their space conditioning costs by integrating simple passive design concepts into building envelopes.

Most of the solar water heaters that have been experimentally and commercially used can be placed in two main groups:

1. Circulating types, involving the supply of solar heat to a fluid circulating through a collector and storage of hot water in a separate tank.

2. Non-circulating types, involving the use of water containers that serve both as solar collector and storage.

The circulating group may be divided into the following types and subtypes:

1. Direct heating, single fluid types in which the water is heated directly in the collector and transported by thermosiphon circulation between collector and storage, or by pumped circulation between collector, load or storage.

2. Indirect heating, dual-fluid types in which a non-freezing medium is circulated through the collector for subsequent heat exchange with water, where the heat transfer medium is either a non-freezing liquid or air.

While there may be water heating systems of the thermosiphon or single tank type in place in the Region, most of these will have been do-it-yourself projects. Most of the commercial sales have been of the two-tank system type using a liquid heat transfer medium. Circulated on the basis of a regionally-average 70% annual solar contribution, the optimal size for a solar water heating system is about 120 ft^2, with the cost of an installed system being approximately $3,000.[8] Commercially-built systems tend to be somewhat undersized, usually being sold in the range of 50-80 ft^2. The severe cold in the northern part of the Region dictates the use of double glazing on collectors to reduce heat loss and necessitates some form of positive freeze protection, the most common types of which are drain-down/back systems or non-freezing liquid in the collector loop. At present, glycol antifreeze is usually used as the non-freezing liquid, which necessitates double-wall protection between the collector loop and portable water. Solar water heating systems are usually added as a retrofit to an existing building, in addition to new construction.

Most of the solar space heating projects in the Mid-American Region are of the flat-plate collector type. There are specialized projects, usually of a demonstration nature, using evacuated tube-type collectors and both Fresnel lens and parabolic trough concentrators. Many of these involve some space cooling as well.

Both air and liquid flat plate collectors are used for space heating systems. The liquid systems are either open fluid flow (trickle) or closed fluid flow, with the closed-flow type being the most common. Storage materials are the usual pebble-bed for air systems or water for liquid systems. Very limited use has been made of phase change materials for storage.

As with domestic water heating systems, the severe cold in the northern part of the Region dictates the use of double-glazing for both types of collectors and positive freeze-protection for the liquid-cooled type. Because of the snow cover during the winter months, collectors which are used primarily for space heating can be placed vertically without serious loss of system performance, especially in the extreme northern areas of the Region. The cool weather conditions result in large energy requirements for space heating; thus, to achieve a given solar fraction, a larger system (or better energy-conservation measures) must be used here than in other areas of the country: for example, a 50% solar fraction required 675 ft^2 - Minneapolis, but only 335 ft^2 - St. Louis, Missouri.[9]

Most solar space heating systems are installed in new construction rather than as retrofit applications.

There is a limited potential for woody biomass applications in some areas of the Region. Northern Minnesota, Wisconsin, Michigan, and to a lesser extent the southern-most portions of Missouri and Ohio hold the only significant forest land within the 12-state Region (see Figure 2: Land

Resource Map). USDA statistics indicate that the MASEC Region holds only 11.42% of the potential wood feedstock resource in the United States, with 8% of that concentrated in the northern-most Great Lakes States.

Due to the limited wood resources in a concentrated area of the Region, this biomass application holds a rather small role in Regional renewable energy programs. Agricultural biomass applications hold a great potential in supplying that sector with renewable alternatives.

Some potential for wind generation exists, especially in the Region's vast rural areas. There is an identifiable need to assess the technological readiness of wind generation and to identify target areas within the states where wind energy is a significant resource.

SECTION 2

MARKET CHARACTERIZATION

Residential Market Characterization

The definitive fact concerning residential energy consumption in the MASEC Region is that space heating accounts for approximately 73.5% of the total regional energy demand for the sector (see Table 2), an amount significantly higher than the national residential space heating demand of 63.7%. Approximately 40% of all residential space heating demand in the nation in 1974 was accounted for by consumers in the MASEC Region.[10] While there is diversity in the regional demand for space heating, an approximate six- to eight-month heating period is required due to climatic conditions.[11] Naturally, states in more northern latitudes have a greater heating requirement for a longer period of time than those of more southern latitudes. And, since solar heating technologies are the more advanced and economical as opposed to cooling technologies, the region has a viable alternative to reducing its heavy dependence upon natural gas, which supplies nearly 70% of the residential heating requirement.

ENERGY CONSUMPTION FOR THE RESIDENTIAL SECTOR
IN TRILLION BTU'S

MID-AMERICAN REGION 1974

	SPACE HEATING	SPACE COOLING	WATER HEATING	REFRIG.	COOKING	LIGHTING /APPL.	CLOTHES DRYING	TOTAL
KERO	64.4	0.0	12.3	0.0	.7	0.0	0.0	77.4
DIST	760.9	0.0	16.2	0.0	.7	0.0	0.0	777.8
TOT-PETRO	825.3	0.0	28.5	0.0	1.4	0.0	0.0	855.2
	96.5 PCT	0.0 PCT	3.3 PCT	0.0 PCT	.2 PCT	0.0 PCT	0.0 PCT	22.2 PCT
LP-GAS	220.7	0.0	41.4	0.0	19.9	0.0	0.0	282.0
NAT-GAS	1745.9	0.0	371.2	0.0	92.9	0.0	18.3	2228.3
TOT-GAS	1966.6	0.0	412.6	0.0	112.8	0.0	18.3	2510.4
	78.3 PCT	0.0 PCT	16.4 PCT	0.0 PCT	4.5 PCT	0.0 PCT	.7 PCT	65.1 PCT
ELEC	44.2	37.5	87.6	105.7	41.6	146.7	30.2	493.4
	9.0 PCT	7.6 PCT	17.7 PCT	21.4 PCT	8.4 PCT	29.7 PCT	6.1 PCT	12.8 PCT
TOTAL	2836.1	37.5	528.7	105.7	155.8	146.7	48.5	3859.0
	73.5 PCT	1.0 PCT	13.7 PCT	2.7 PCT	4.0 PCT	3.8 PCT	1.3 PCT	100.0 PCT

SOURCE: U.S. DEPARTMENT OF ENERGY, "END USE ENERGY CONSUMPTION DATA BASE", 1978.

TABLE 2

While water heating is the next principal energy use in the region, its energy demand is quite modest in comparison to space heating. Again, natural gas is the primary fuel supplying 78% of the energy requirement for this end use. Domestic solar hot water systems can certainly alleviate such dependence.

The residential component of the buildings sector in the MASEC Region stresses the importance of both urban and rural applications, since 56% of the housing units built since 1970 are urban with the remaining 44% being rural. The dispersed nature of the rural housing stock might permit easier applications due to better siting and access opportunities in areas of lower population density.

The solar market is largest for new and retrofit installations in single-family detached homes. In 1976, approximately 69% of all housing units were of this type, and since the majority of these (69%) are owner-occupied, there exists a prime target for solar applications. Custom homes are a significant target of opportunity because the income status of these owners generally permits easier financing.

Small apartment buildings containing 2 to 4 units comprised 13% of the Region's housing stock in 1976. Large apartment buildings containing 5 or more units comprise 12% of the total housing units. The vast majority of these units are renter-occupied. Within this segment of the housing market there are some conversions being made to condominiums. Building managers, rent control authorities, builders, and construction financers must be addressed in order for solar to be considered viable for this market segment.

Commercial Market Characterization

In the near-term the commercial component of the builidngs sector affords a large opportunity for the utilization of proven solar technologies, especially passive and hot water systems.

The majority of energy consumption in the commercial sector is for space conditioning. Table 3 indicates that approximately 67% of the Region's commercial energy is used for space heating and cooling. Hot water heating demands account for 6% of the total commercial consumption. Natural gas is the primary fuel which supplies 65% of the total space conditioning need and 79% of the hot water demand. Solar is an entirely appropriate energy source for meeting a portion of the demands of these end users.

ENERGY CONSUMPTION FOR THE COMMERCIAL SECTOR
IN TRILLION BTU'S

MID-AMERICAN REGION 1974

	TOTAL HEATING COOLING	WATER HEATING	REFRIG.	COOKING	LIGHTING	OTHER	TOTAL
COAL	53.3	3.7	0.0	0.0	0.0	.6	57.6
TOT-COAL	53.3	3.7	0.0	0.0	0.0	.6	57.6
	92.6 PCT	6.5 PCT	0.0 PCT	0.0 PCT	0.0 PCT	1.0 PCT	3.8 PCT
DIST	28.5	5.7	0.0	0.0	0.0	6.0	40.1
RESID	90.0	6.7	0.0	0.0	0.0	2.0	98.7
TOT-PETRO	118.5	12.4	0.0	0.0	0.0	8.0	138.8
	85.4 PCT	8.9 PCT	0.0 PCT	0.0 PCT	0.0 PCT	5.7 PCT	9.2 PCT
LP-GAS	14.1	5.1	0.0	11.8	0.0	.1	31.0
NAT-GAS	645.2	68.8	0.0	36.5	0.0	74.8	825.3
TOT-GAS	659.3	73.9	0.0	48.3	0.0	74.9	856.4
	77.0 PCT	8.6 PCT	0.0 PCT	5.6 PCT	0.0 PCT	8.7 PCT	56.6 PCT
ELEC	143.0	0.0	32.3	12.7	190.4	39.7	418.0
	34.2 PCT	0.0 PCT	7.7 PCT	3.0 PCT	45.5 PCT	9.5 PCT	27.6 PCT
OTHER	35.7	2.6	0.0	0.0	0.0	4.7	43.0
	83.0 PCT	6.0 PCT	0.0 PCT	0.0 PCT	0.0 PCT	11.0 PCT	2.8 PCT
TOTAL	1009.8	92.6	32.3	61.0	190.4	127.8	1513.8
	66.7 PCT	6.1 PCT	2.1 PCT	4.0 PCT	12.6 PCT	8.4 PCT	100.0 PCT

SOURCE: U.S. DEPARTMENT OF ENERGY, 'END USE ENERGY CONSUMPTION DATA BASE', 1978.

TABLE 3.

Retail trade buildings comprise 59% of the total commercial buildings inventory in the MASEC Region,[12] and are the single largest commercial consumer of energy in the Region accounting for 24% of the total. Solar can make an important impact, even if market penetration is small, due to the large proportion of buildings of the retail trade type.

There is a large potential for the utilization of solar in public and government buildings. The public sector has attractive finance capabilities as compared to the private sector in that low-interest, long-term financing is available. This submarket consumes over 18% of the commercial energy in the Region. The visibility factor of solar demonstrations in public buildings is important to public awareness.

Schools and educational buildings consume 19% of the energy in the commercial sector. Load profiles of most educational buildings indicate an excellent match between energy demand and insolation availability. The investment decision criteria which make solar attractive in this submarket are that it can accept long payback periods; it is sensitive to a certain degree of community and political pressure; and capital outlays are now being stressed which use life-cycle costing to evaluate operating expenses. In addition, the roof area to floor space ratio is more favorable in this submarket than in any other.

Another submarket sector in which there are opportunities for solar contributions is the hospitals and health care facilities subsector. Buildings of this type comprise about 3% of the total inventory, tend to have high energy consumption per building, and consume 12% of the commercial energy total in the MASEC Region. Fifty-five percent of all energy is used for space heating and cooling, and another 8% for hot water.[13] There are ample opportunities for solar contributions in this submarket sector.

The wholesale trade services component also affords an opportunity for solar contributions, with warehouses being good targets of opportunity.

The hotel-motel component of the buildings inventory is by far the fastest growing segment of the commercial sector, expanding at an average annual rate of 7% of the existing stock. Many motels have good roof area to floor space ratios, increasing the technical suitability and market potential for active solar systems.

Thus, several targets of opportunity exist within the submarkets of the buildings sector. Estimates from the American Institute of Architects show that with aggressive solar and energy conservation programs, the amount of energy saved in this sector alone could range from 30 to 50%.[14]

3. INDUSTRY CHARACTERIZATION

The MASEC Region will play a crucial role in the future commercialization of solar energy systems. In order for solar energy applications to make a large impact in the national energy budget, successful commercialization must be geared to regionally specific characterizations as noted in the previous section.

In 1978, there were at least 222 solar equipment manufacturers operating within the MASEC Region, with the majority being based in Ohio and Illinois (see Table 4).

State	Number of Manufacturers	Percentage of Region Manufacturers
Illinois	45	20.3
Indiana	11	5.0
Iowa	12	5.4
Kansas	8	3.6
Michigan	22	9.9
Minnesota	20	9.0
Missouri	20	9.0
Nebraska	7	3.2
North Dakota	4	1.8
Ohio	52	23.4
South Dakota	5	2.3
Wisconsin	16	7.2
MASEC	222	100.0

Source: Larry Icerman. Solar Technology Inventory for the Mid-American Region. (St. Louis, MO; Center for Development of Technology). April 1978.

SECTION 3

INDUSTRY CHARACTERIZATION

Eighty percent of the solar equipment manufacturers have a national distribution territory, while 20% supplied only Regional markets which did not necessarily correspond to the MASEC Region.[15]

Slightly more than one-half (54%) of the solar equipment manufacturers market integrated solar systems as well as component parts. Seventy-four percent of the manufacturers supply products for residential applications, 55% for commercial installation and 42% for industrial use.[16] Based on a review of product literature, the industrial applications appear to be for water heating and space conditioning rather than for process heat systems.

The Icerman study noted that the level of installation skill required to install the products produced by the solar equipment manufacturers in the MASEC Region varied from do-it-yourself (38%), advanced hobbyist (26%) to professional (36%); however, there was considerable overlap between categories. Nearly 60% of the manufacturers have had some experience with maintenance needs, which indicates that a significant number of manufacturers probably also serve in the capacity of a distributor.

A recent Congressional study noted that nearly three million jobs would be created and the nation's bill for conventional fuels would be slashed by almost $120 billion by 1990 if the United States underwent a massive shift toward the use of solar and away from fossil energy. While there would be significant job dislocations, a net gain would occur in the following areas: 1.7 million additional openings for solar heating and cooling equipment installers; 0.5 million jobs for conservation equipment installers; and 1.9 million positions made possible by reduced spending for fuels and utility bills.[17] Thus, the solar alternative will also help to alleviate unemployment problems.

SECTION 4

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REFERENCES

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SECTION 5

REGIONAL PLANNING MEETINGS

5. REGIONAL PLANNING MEETING

A regional planning meeting was held on April 16-18, 1979, at the MASEC Center, for the purpose of preparing input for the Mid-American section of NPAC Implementation plans. Each of the twelve State Solar Offices was requested by the MASEC Center to select four to five appropriate representatives to attend the planning meeting. Collectively, the attendees had over 300 years of solar and related experience.

A two-cycle iterative process was used to obtain numercial and programmatic results. Participants prepared an initial set of outputs, intermediate results were tallied and tabulated, and a revised set of outputs was prepared. Programmatic working groups were organized by market sector with all attendees participating in the buildings sector and one other market sector, determined by their background and choice. Figure 3 shows a summary of occupations taken from biographical sketches provided by the participants.

Major outputs from the "Boiler Room" session were:

1. Implementation programs in each of four market sectors.
2. Energy Use Questionnaire: detailed projections of energy production and consumption profiles, evaluations of probable solar energy contributions by sector and technology, evaluation of the effectiveness of various types of incentives.
3. Consensus determination of costs and energy contribution of four

"options" scenarios for the Mid-American Region.

4. Position papers entitled, "Creating a Solar Society" and "Utilization/Commercialization/Popularization" (Appendices 2 and 3).

The buildings sector material contained in this document is a part of a final MASEC report on the regional NPAC planning process and results which will be prepared for distribution throughout the region.

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

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

The overall tenor of the program set was an emphasis on what could be termed a "sociological solution" rather than a "technological solution" to the problem of accelerated solar commercialization. Figure 4 shows a summary of the relative weights given to each of the program areas expressed as a product of the number of programs developed in an area times the average percentile score for the programs in the set.

There were more than twice as many non-technical developed as technical programs.

Nearly identical emphasis was given to educational programs (areas 1-2) as to institutional programs (areas 3-4). Taken together, these emphases indicate a belief on the part of the participants that (1) solar "market development" is a long-range process requiring significant changes in attitude and information and (2) the barriers to early solar utilization are more economic and institutional than technological. The content of the program set developed at the regional planning meeting was determined to a large but unquantifiable extent by the make-up of the group with respect to their professional backgrounds. A differently constituted group may have reached different conclusions regarding program content and emphasis. More careful attention should be given to selection of participant for future NPAC planning efforts.

The activity of the April 16-18 meeting resulted in Programs 1 through 20. Programs 21 through 38 were generated by four previous topical conferences attended by 170 experts representing eighteen major solar energy related desciplines. These conferences were focused on the identification of a relevant set of questions relating to the needs, resources, and capabilities of the participating states vis-a-vis the commercialization of solar energy in the Region. The results of the conferences were structured into sets of questionnaires that were then sent to over 850 experts in the Mid-American Region.

The results derived from these responses have served as a critical, informed, and expert - yet cross-section and grass roots - input to the process of implementation program selection.

PROFILE OF BOILER ROOM ATTENDEES

Universities - Colleges - Vo-Tech (Education)	12
Energy Associations and Councils	5
Federal, State, and Local Governments	20
A & E and Mechanical	5
Consultant Firms and Self-employed	10
Solar Manufacturing and Sales	4
	56

PROGRAM CATEGORY	NUMBER OF PROGRAMS	AVERAGE PROGRAM PERCENTILE*	CATEGORY WEIGHT
Public Education/Awareness	12	69.5	834
Education/Training	7	84.5	592
Financial Incentives	10	65.9	659
Legislative/Regulatory	11	69.1	760
Performance/Analysis	8	59.8	478
Design/Planning	6	64.3	386
Demonstrations	5	62.8	314

*Program Percentile =

$$\frac{4(\text{No. "A" Votes}) + 3(\text{No. "B" Votes}) + 2(\text{No. "C" Votes}) + 1(\text{No. "D" Votes})}{4\,(\text{Total Number of Votes})}$$

FIGURE 4.

SECTION 6

PROGRAMS

PUBLIC EDUCATION/AWARENESS

Program 1.0 Solar Information Dissemination:

Objective:

To enhance the general awareness of a broad spectrum of people about solar as a viable energy alternative in the Mid-American Region.

Rationale:

The attitudes among a very large segment of potential buyers of solar equipment are sometimes indifferent ("still in the research stage") or somewhat negative ("costs too much, won't work here"). A demand for solar/conservation can be created across a wide variety of applications and technologies if solar is presented as an understandable, reduced-to-practice technology capable of performing successfully, both technically and economically, in their immediate locale. Probable action will result if the information includes suggested actions for residential applications and identifies sources from which to obtain further information on other solar applications.

Task Statement/Description:

1.1 Technical information packages about solar and conservation measures applied to the Mid-American Region should be prepared. This information should include key technologies (hot water, passive space heating, active space heating) and key applications (residential, commercial, agricultural). The information should be packaged for several media (print, audio, audio/visual).

1.2 Regional solar performance and economics information packages should be prepared as a complement to Item 1 above. Material should include discussions of life-cycle costing, cost analysis of conventional energy (marginal costs, etc.) and availability of incentives for solar and conservation.

1.3 Information packages should be disseminated through regional media including major newspapers, radio and television.

Evaluation Measures:

The effectivity of activities in this task can be measured by opinion research (through subcontractors), count of audience reached by various materials and number of follow-up requests received. It should be noted that it will be difficult to determine the isolated effect on sales of any single activity, especially since the RSECs are hampered by OMB regulations concerning surveys.

Implementor:

MASEC, State Solar Offices, subcontractors.

Program 2.0 Solar Case Studies:

Objective:

To reduce public reservations about solar and create demand for solar systems by publicizing technical and economic information on successful solar projects to potential customers.

Rationale:

Solar energy is perceived by a large segment of potential buyers as an experimental technology which is technically and economically feasible only in certain geographic areas. Demand for solar/conservation can be increased through presentation of solar systems which are in place locally and are performing successfully, both technically and economically. Probable action will result if sufficient detail is provided regarding design, materials, and components, construction methods, costs, maintenance, thermal and economic performance, and owner satisfaction with the system.

Task Statement/Description:

2.1 Solar and energy conservation projects should be identified and a representative subset selected for case study documentation.

2.2 Case studies should be prepared on solar and energy conservation projects. Some of these case studies should document the complete histories of solar projects from design stage through successful operation of the systems for a complete heating season.

2.3 Case studies should be disseminated through several media to general and technical audiences.

Evaluation Measures:

The activities in this task can be evaluated by measures of the number of case studies developed, a count of the audience reached by the materials, the energy savings of the projects documented, and the number of solar systems constructed as a direct result of interest or influence generated by the case study project.

Implementor:

MASEC, State Solar Offices, subcontractors.

Program 3.0 Audio/Visual Library:

Objective:

To provide easy access to prepackaged solar information to interested groups throughout the Region.

Rationale:

There are many kinds of professional, civic and educational groups and institutions throughout the Region with a general or specific interest in solar energy. Personal delivery of information in response to these needs is prohibitively expensive and time-consuming. Provision of prepackaged audio/visual materials allows multiple use of information packages and helps assure consistency and quality of the information presented. Well-produced materials of specific interest to a given group can be delivered much more cheaply and easily in an audio/visual package than by personal ad-hoc presentations.

Task Statement/Description:

3.1 A library of educational and technical audio/visual materials should be assembled from existing DOE, regional and state sources.

3.2 Additional audio/visual materials should be prepared. These materials should include slide presentations and videotapes of selected conferences and workshops.

Evaluation Measures:

This task can be evaluated using the count of audiences reached by the materials, the cost per person viewing the materials, and the number and type of requests for the A/V materials.

Related Programs:

DOE Public Information and Exhibit Brances, DOE Technical Information Center, State Energy Agencies, professional organizations, and other public and private sources for solar audio/visual materials.

Implementor:

MASEC, State Solar Offices, subcontractors.

Program 4.0 Solar Index Program:

Objective:

To use the primary medium of television to make audiences aware of solar performance on a daily basis.

Rationale:

Many people view solar as a technology applicable only in certain areas of very high insolation not including their own locality. Television reaches very large audiences and is a primary source of information for many of its viewers. The DOE Solar Index program presents large local audiences with solar performance calculations for their location and daily weather conditions. Such frequent presentations teach and reinforce the idea that solar energy can contribute significantly in a given locality.

Task Statement/Description:

Assistance should be provided for the expansion of the DOE Solar Index program in the Mid-American Region. Liaisons among media, weather stations and analysis stations should be facilitated.

Related Programs:

DOE Solar Index program.

Evaluation Measures:

Measures suitable for evaluation of this task include the number of additional television stations adopting the Solar Index program, count of additional audiences reached by the Solar Index program, and audience awareness studies (see note in Program 1).

Implementor:

DOE, MASEC, State Solar Offices

Program 5.0 Solar Conferences/Product Shows:

Objective:

To stimulate interest in and demand for solar by providing information and contacts on a local level.

Rationale:

Trade and product shows are a recognized method of increasing sales and sales leads. Product demonstrations attract attendees who can also be provided with solar information (see Program 1) via conference or lecture formats. Local organization of these "events" convey the idea that solar is immediately available and useful and counter the widely held opinion of solar as a futuristic option. The credibility of local suppliers is a strong influence on perspective buyers within their own community.

Task Statement/Description:

Solar conferences and product shows should be organized at the state or local level. Partial funding should be provided for educational and display materials.

Evaluation Measures:

This task can be evaluated using attendance count, follow-up with exhibitors to determine the number of sales leads generated, and opinion research (see note in Program 1). Cost per contact should be documented, especially for the first year.

EDUCATION/TRAINING

Related Programs:

State Energy Offices, regional commissions and industry groups sponsor energy fairs. Materials from DOE exhibits branch may be utilized at these events.

Implementor:

MASEC, State Solar Offices, Solar Resource Advisory Panels, other solar and alternative energy groups.

Program 6.0 Solar Information Resource Centers:

Objective:

To utilize public libraries as resource centers for technical information and public education.

Rationale:

Public libraries can provide community-wide information dissemination services and can serve the specialized needs of community-based conservation and solar organizations in their efforts to effect change in local institutions.

Task Statement/Description:

Libraries should be funded through an RFP mechanism to provide staff to organize, supply, and operate a solar information center within the library and interface with local solar and energy associations to provide for their special information needs.

Evaluation Measures:

Each participating library can provide a count of and descriptive statistics on users of the resource center and documentation of community actions taken as a result of or assisted by the resource center.

Related Programs:

Energy Extension Service, Agricultural Extension Service.

Implementor:

MASEC, public libraries.

EDUCATION/TRAINING

Program 7.0 Educational Institutional Assistance: - K-12 Energy Education Program:

Objective:

Facilitate the introduction of energy curricula into the primary and secondary school programs.

Rationale:

A great deal of the attitude change and factual training necessary for an energy-prudent future can be accomplished through an energy curriculum. Increased legitimacy of the subject matter can be achieved by presentation as part of the standard curriculum. In addition, present-day benefits can be achieved through "ripple effects" on parents, teachers and their associates.

Task Statement/Description:

Energy curriculum materials for grades K-12 should be made available to regional educators through:

7.1 The DOE/HEW Energy Educators pilot project currently in progress in census Region 5 to identify sources of curriculum material, and

7.2 Dissemination of sources of curriculum materials found through above to educators in other parts of the MASEC Region.

Evaluation Measures:

This task can be evaluated using measures of the number of energy courses added to curricula, the number of students enrolled in these courses, the number of courses in which units related to energy have been added, and the number of energy conservation projects undertaken in students' homes.

Related Programs:

DOE projects: Solar Energy Curriculum K-6 (Jet Propulsion Laboratory, University of Southern California) and Solar Energy Education Dissemination (State University of New York).

DOE/HEW Energy Educators Pilot Project (Census Region 5).

Implementor:

MASEC, regional energy educators.

Program 8.0 Vocational-Technical Training:

Objective:

To provide a skilled manpower pool for sale, installation and service of solar and related systems. To stimulate construction of solar homes using local examples constructed as part of a vocational-technical school training program.

Rationale:

House construction is a standard part of the vocational-technical school curriculum at present. By incorporating solar systems into these houses, communities can be provided with low-cost local examples of solar and conservation projects, thus diminishing the notion that solar is a foreign, impractical technology. At the same time, training for installers and service personnel can be provided through addition of solar to related trades-training courses, increasing the likelihood of successful operation and maintenance of solar systems in the locale. Market data as well as cost recovery for the solar increment can be obtained at the time of sale of the houses. The strong community linkages which vocational-technical schools have through their curriculum advisory boards should cause additional private solar construction upon the success of the vocational-technical school project.

Task Statement/Description:

8.1 Training programs in solar energy and conservation sales, installation and maintenance should be provided by supplementing existing training programs in related fields or by separate training programs, as appropriate.

8.2 Architectural and engineering assistance and financial support (for the solar increment) should be provided to vocational-technical schools for construction of solar homes in their building trades programs.

Evaluation Measures:

Measures suitable for evaluation of this task are the number of vocational-technical solar residences constructed, the number of solar energy courses added to curriculum, the number of students enrolled in these courses, the number of courses in which units related to energy have been added, recoverability of the cost of the solar increment and increases in recoverability in subsequent years, success in placement of graduates of solar training programs, and additional construction of solar residences related to vocational-technical school programs.

Related Programs:

Vocational-technical schools building trades programs.

Implementor:

MASEC, vocational-technical schools.

Program 9.0 Organized Labor: - Skills Upgrade:

Objective:

To provide to existing skilled tradespersons the additional skills necessary to install and service solar and energy conservation equipment.

Rationale:

In order that solar systems perform reliably (a necessary condition for their acceptance by a mass market) trained installation and maintenance persons must be provided. A highly-trained work force already exists in related fields such as the sheet metal and plumbing trades. Supplemental instruction for these trades can provide many of the necessary solar skills quickly and at relatively low cost. Use of existing trades rather than an additional trade may also result in cost savings during project construction.

Task Statement/Description:

9.1 Solar energy supplements apprentice for training programs should be developed in conjunction with organized labor.

9.2 Programs should be implemented through instructor training and supplemental or special training workshops for tradespersons.

Evaluation Measures:

This task can be evaluated using numbers of tradespersons trained, increasing financial support of the programs by organized labor, number of solar/energy conservation projects serviced or installed by the participants.

Related Programs:

Existing trades training programs such as the Sheet Metal and Air Conditioning Contractors program. Previously developed installation and maintenance courses supported by DOE.

Implementor:

MASEC, organized labor.

ɔgram 10.0 Financial Community Education:

Objective:

To increase the ease of financing solar systems by educating financial and insurance institutions in the basics of solar energy and providing data and solar energy sensitive analysis and decision techniques.

Rationale:

At present, the level of understanding of solar systems by the financial and insurance community is not sufficient for them to make informed decisions on solar projects. Thus, loan approval processes are not uniform and tend to disfavor many solar projects. The financial community has need for specialized information from existing solar projects which must be assembled and repackaged into familiar formats. If such information can demonstrate solar in a favorable light, then the chances of loan and insurance approvals should increase.

Task Statement/Description:

10.1 Relevant financial and insurance data from existing solar projects should be collected and packaged.

10.2 Information should be disseminated by means of training workshops for financial and insurance personnel.

10.3 Information should be packaged for solar builders and installers for presentation to lenders in the loan application process.

Evaluation Measures:

Suitable evaluation measures for this task may be the number of attendees at workshops, average cost per workshop participant, increase in number of solar loans granted, and improved availability of insurance for solar projects.

Related Programs:

NSHCIC Lender Training Program. Professional organizations' training programs. FHA and VA loan programs applicable to solar.

gram 11.0 Builder and Realtor Education:

Objective:

To increase the number of solar homes through the education of builders and real estate professionals in the technical, economic and marketing advantages of buildings containing solar and energy conservation features.

Rationale:

Builders provide the building stock from which buyers must choose to purchase; real estate agents strongly influence the buyer at the point of sale. To accompany "solar advertising programs: which stimulate interest, solarized housing must be available for choice and the solar choice reinforced at the time of final decision. If available data from existing solar projects is assembled, properly packaged and presented to builders and relators to demonstrate solar as a profitable item with strong customer demand, this can hasten the construction of solar energy conserving buildings and increase the effectiveness of the real estate "salesperson" in promoting solar energy.

Task Statement/Description:

11.1 Data should be assembled from existing solar projects on construction techniques, available equipment performance, maintenance, economics and marketing features of solar energy projects.

11.2 Information should be disseminated to builders and real estate professionals through trade media, specialized educational materials and direct instruction.

Evaluation Measures:

This task can be evaluated using measures of numbers of clients reached by the information, cost per client contact, and information from a selected sample of builders and realtors on sales of solar and energy-conserving buildings.

Related Programs:

DOE project "Development of Transferable Energy Conservation Information Package for Those Who Appraise, Finance, and Market Residential Buildings" Contract EC-77-C-01-8696. Solar Conferences/Product Shows (Program 2).

Implementor:

MASEC, professional organizations.

Program 12.0 Architects and Engineers Education:

Objective:

To produce good quality, cost-effective solar systems through education of the architects and engineers who must design such systems. To enhance the perceived validity of solar energy through its inclusion in professional curricula and certification procedures.

Rationale:

Much of the research on and design of solar systems must be done by engineers and architects. By including solar energy in the required training of these professionals, a basic familiarity with and competency in solar design will be assured. These basic engineering concepts can be extended to research, design and produce newer kinds of solar devices and systems having increased performance at lower cost. Presentation of solar as a standard part of a professional curriculum increases its validity as an engineering or architectural specialty. Inclusion of solar in professional registration procedures further establishes its status as a recognized discipline and furnishes some assurance to clients that the architect or engineer is an experienced solar practitioner. In addition, non-certified professionals are encouraged to obtain certification for competitive reasons.

Task Statement/Description:

12.1 Solar energy should be included in the content of required courses leading to an engineering or architectural degree.

12.2 Separate, in-depth solar energy courses should be developed for inclusion as elective courses in engineering and architecture curricula.

12.3 Material (questions) dealing with solar energy should be included in the professional registration procedures for mechanical and electrical engineers and for architects.

Evaluation Measures:

This task can be evaluated using the number of professional schools which include solar content in required or elective courses, the number of students taking these courses, and the number of states which include solar content in professional registration examinations.

Implementor:

Secondary educational institutions, architect and engineering registration Boards.

LEGISLATIVE/REGULATORY

rogram 13.0 Solar Access Legislation:

Objective:

To define and develop the legal methods and instruments that a solar user can employ to prevent blockage of sunlight which would otherwise be available for his solar structure or system.

Rationale:

At present, there exist some legal measures which seek to secure access to solar energy; however, their effectiveness in achieving this end is uncertain. Solar access regulations will encourage investment in solar systems by assuring freedom from encroachment on the solar supply throughout the lifetime of the system. These legal measures may reduce solar investment uncertainties due to interruption of the energy source.

Task Statement/Description:

13.1 Present and past legislation and judicial interpretations regarding solar access should be investigated.

13.2 Model solar access legislation should be developed and disseminated to legislators via state energy offices.

Evaluation Measures:

Development of solar access procedures within states.

Related Programs:

Prototype solar access legislation prepared by the Environmental Law

Institute for HUD. Studies on legal aspects of solar energy by the American Bar Foundation.

Implementor:

MASEC, State Energy Agencies, attorneys, state legislators.

Program 14.0 Codes and Regulations:

Objective:

To establish nationally accepted solar codes and standards by supporting activities of ANSI (American National Standards Institute), NCSBCS (National Conference of States on Building Codes and Standards, Inc.) and other similar organizations. To coordinate and standardize federal, state and local implementation of solar codes and regulations.

Rationale:

At present, solar energy systems are governed by sets of regulations which are non-uniform by state and by agency. Extensions of related regulations are sometimes inappropriate and solar-specific regulations sometimes do not exist. A unified set of solar regulations will expedite the production and use of solar products and systems by providing a consistent (constant) set of conditions within which they must be constructed and operate. Efficiency and accuracy of application of regulations governing solar systems will be enhanced by providing code enforcement officials with simpler and more explicit application procedures.

Task Statement/Description:

14.1 Existing codes and regulations regionally applicable to solar energy should be reviewed.

14.2 Information on existing solar codes and standards should be disseminated to designers, manufacturers, and inspectors of solar systems and, in simpler form, to solar consumers.

14.3 Regional inputs should be developed for codes applicable to solar technologies not presently covered by existing or model codes (photovoltaic and wind systems, for example).

Evaluation Measures:

Progress on this task can be measured by preparation of national solar codes and an adoption of solar codes by states and localities.

Related Programs:

Codes development by major code writing bodies-National Conference of States on Building Codes and Standards, Inc. (NCSBCS), Council of American Building Officials (CABO), International Conference of Building Officials (ICBO), and Southern Building Code Congress International, Inc. (SBCC). Solar standards development organized by American National Standards Institute Subcommittee on Solar Codes and Standards.

Implementor:

MASEC, national standards-making organizations.

PERFORMANCE/ANALYSIS

ogram 15.0 Performance Monitoring:

Objective:

To develop consumer confidence in solar techniques, especially water heating, by providing measured performance data on existing systems and by documentation of problem-correction on systems.

Rationale:

Reports of solar system performance vary greatly, creating confusion about solar and a reluctance to invest in solar systems. These attitudes can be countered by providing measured performance data on existing solar systems in formats appropriate for general and for technical audiences. These data form a rational base upon which to decide for or against solar. Measurement of successful performance following repair of poorly-performing systems will increase consumer confidence in the reliability of solar and decrease bad publicity about these systems.

Task Statement/Description:

15.1 Solar water heating systems in the Region should be identified and an appropriate subset for monitoring should be selected and documented.

15.2 An instrumentation package which is either owner-operated or automatic, should be assembled.

15.3 Systems performance and weather data should be measured and recorded at the sites.

15.4 Data should be analyzed with respect to system efficiency, maintenance problems and economic performance.

15.5 Results should be disseminated in formats suitable for technical and general audiences.

Related Programs:

DOE/HUD National Solar Data Program.

Evaluation Measures:

This task can be evaluated using measures of the number of systems monitored, the number of systems performance enhanced, and mail-back reports from project participants.

Implementor:

MASEC, subcontractors.

Program 16.0 Performance/Payback Analysis:

Objective:

To provide architects, engineers and mechanical contractors with performance and economic analysis of generic types of solar systems for each major city and sub-region in the Mid-American Region.

Rationale:

To support a recommendation of solar/energy conserving features to clients, architects and engineers need reliable information about the technical and economic performance of typical solar systems, information which can provide back-up data and validity for their solar recommendations. Pre-packaged analysis will lessen their reluctance of undertaking such a study due to its time-consuming nature or their unfamiliarity with the details of analysis. Typical solar conditions should be presented as well as special local effects which can make the solar/conservation systems especially marketable (tax incentives, very expensive conventional fuel).

Task Statement/Description:

16.1 Thermal and economic analysis should be performed on generic and specific combinations of solar systems and building types based on existing analytical models, i.e. DSE-232201, November, 1976ERDA, Division of Solar Energy, "An Economic Analysis", for a range of system costs, fuel escalation rates, applicable tax incentives, and other pertinent regional considerations. The results should be packaged and disseminated through architects' and engineers' associations, related professional organizations and through the MASEC Center.

Evaluation Measures:

Suitable evaluation measures for this task include the number of requests for information, and mail-back response cards for users of the information.

Implementor:

MASEC, subcontractors.

DESIGN/PLANNING

Program 17.0 Tract Home Designs:

Objective:

To develop plans for tract housing incorporating conservation, passive and active solar features and to assist in construction of model homes which indlude these features.

Rationale:

Most new housing is of the "tract" rather than the custom-designed type. Tract house plans including solar/conservation features have a large multiplier effect in that the designs, once developed, can be re-used many times at no additional cost. Inclusion of suitable designs, similar to high-volume conventional plans, greatly increases the likelihood that such residences will be constructed. A complete set of proven plans can be made available to developers and since all design work has been completed, the developers risk is reduced. Plans should be developed on a subregional basis to account for local conditions such as weather and site details.

Task Statement/Description:

17.1 Present tract home design sources should be identified. The tract home market should be characterized and design popularity analyzed by type, locale, and demography.

17.2 Support should be provided for design groups to design solar tract homes. Designs should include information on component availability and selection as well as calculated performance and economic data on designed homes.

17.3 Results should be published and distributed to tract home design sources. If necessary, workshops should be conducted to these groups to promote results.

17.4 Designs should be made available to vocational-technical school building trades programs (See Program 8: Vocational-Technical Training).

17.5 Support should be provided to major tract home builders in the Region for construction and documentation of model homes using the solar designs.

Evaluation Measures:

This task can be evaluated using measures of the number of solar tract designs developed, the number of builders receiving information about the designs, the number of model homes built using the designs, the number of buyers of homes including solar, decreasing subsidy for the solar increment on model homes, and additional construction of solar homes by participating builders.

Related Programs:

Vocational-technical schools' building trades programs (see Program 8).

Tract home design sources.

Implementor:

MASEC, tract home builders, subcontractors.

DEMONSTRATIONS

Program 18.0 Government Buildings Demonstration:

Objective:

To place solar demonstrations on state and local government buildings, including schools and libraries, utilizing cost-sharing and/or revenue-sharing mechanisms where applicable. To demonstrate the viability of solar energy and conservation on a local basis.

Rationale:

This task is designed to increase the public acceptance of solar as a technically and economically sound practice in the community of residence, i.e., to counter the widely held notion that "solar won't work here". A monetary commitment on the part of local government in the form of a cost- or revenue-sharing arrangement will encourage care in the selection and installation of local systems which are practical, operable and cost-effective. Such demonstrations will become centers of community interest and their performance will be a matter of public record. Some types of government buildings are similar in size, construction, and energy use profile; design costs for these types of buildings, particularly for solar systems employed for hot water heating only, may be kept low by adapting a few basic system designs to a large number of similar buildings. For other building types and solar applications unique system designs may be necessary.

Task Statement/Description:

18.1 Suitable existing or planned government buildings should be identified and a subset selected for solar demonstration projects.

18.2 Funds should be provided (on a cost-or revenue-sharing basis, where applicable) to local governments for design, construction and performance monitoring of solar systems.

18.3 Information on design, construction and thermal and economic performance of the projects should be disseminated to general and technical audiences.

18.4 A series of workshops should be conducted for state government budget, planning, public construction and physical plant officials to explain the basics of solar water and space heating applied to each state in the Region.

Evaluation Measures:

This task can be evaluated using measures of the number and quality of systems constructed, the number of requests for information on projects, an additional solarization rate in communities having demonstrations relative to control communities, and positive responses by public officials toward investment in solar projects.

Related Programs:

DOE Commercial Demonstration Program

Schools and hospitals portion of the National Energy Act of 1978

Implementor:

Department of Energy, MASEC, state planning and building officials, subcontractors.

Program 19.0 Urban Retrofit Expositions:

Objective:

To stimulate the urban market for solar and energy conservation products and services by demonstrating the availability and feasibility of solar retrofit systems.

Rationale:

A strong need exists to address the retrofitting of existing buildings since the replacement rate for building stock is only about 2% per year, which represents the maximum rate at which solarization would occur if solar were incorporated into new housing only. A portion of the existing buildings in the Region are suitable for solar retrofit applications and a much larger fraction for energy conservation retrofits. Since so much energy is consumed in this sector, retrofitting a relatively small fraction of total buildings makes possible a large reduction in the use of conventional fuels. It is especially important to incorporate the exposition of retrofit options and their performance into city energy and utility planning during this interim period of significant shifts in energy supply and demand.

Task Statement/Description:

19.1 Funding should be provided on a competitive basis to designer/contractor teams to retrofit urban buildings of several types with solar and energy conserving features and to document system cost, materials and component selection, construction techniques, maintenance, special retrofit problems and first-year performance.

19.2 The technical and economic results of retrofit projects should be published and disseminated to professional and general audiences.

19.3 The projects should be open for tours for one year following completion.

19.4 Workshops which include observation and operation of the systems should by conducted.

Evaluation Measures:

This task can be evaluated by using measures of number and type of projects constructed, energy and dollars saved by the projects, attendence at projects, tours and workshops, systems designed or constructed as a result of the workshops or expositions, and reduction in governmental cost-sharing fraction in projects over time allowing funding of additional projects.

Related Programs:

Federal and state solar demonstration programs

DOE/HUD National Solar Data Program

Implementor:

Department of Energy, MASEC, designers, contractors.

STATE INTERFACE

Program 20.0 State Energy/Planning Agency Interface:

Objective:

To exchange information among state agencies and support state activities in areas related to solar energy and conservation.

Rationale:

There are numerous activities, studies, legislative actions and the like which can be undertaken by State Energy Agencies (SEA) in areas of energy use that directly or indirectly interact with the development of solar in the Mid-American Region in important ways. The State Solar Offices (SSOs) place in each of the twelve MASEC states are a natural mechanism for mutual transfer of information between MASEC and these agencies and for indirect support of legislative and regulatory actions of interest to solar. An example is the state building code relating to energy efficiency. Joint MASEC/SSO/SEA information and legislative programs of immediate interest are delineated below. It is anticipated that the operating connections formed during the implementation of these projects will continue and be extended to additional projects as the need becomes apparent.

Task Statement/Description:

Incentives Activities:

20.1 Information should be compiled on utilization and effectiveness of existing state tax incentives for conservation and solar energy (State Energy Agency). Access to state and federal incentives studies should be made available (MASEC).

20.2 Information should be provided to state legislators on incentives for solar energy and energy conservation, utilization rates, energy saved, and economic effects (State Solar Offices).

20.3 Information should be provided to state legislators regarding federal tax provisions for solar and energy conservation equipment (State Solar Offices). Actions to implement similar changes in state tax provisions should be recommended (State Energy Agencies).

Utility Loan Study:

20.4 An inteagency study team should be formed to investigate the probability and effects of a utility loan program for solar water heater installations. If study results are favorable, a pilot program should be initiated on a voluntary basis with a state utility, and regulatory changes to allow utility lending program should be initiated. (State Solar Offices, State Energy Agencies).

Community Energy Planning:

20.5 Information regarding community energy use and municipal policies which affect optimal community energy use should be assembled and made accessible. Information should be disseminated to appropriate state and regional planning agencies. (State Solar Offices, State Energy Agencies).

Implementor:

Included in task statements.

TECHNOLOGY

Program 21.0 Analysis of Climatic Variables and System Performance:

Objective:

To provide the region with accurate data about climatic variables and typical system performance.

Rationale:

Solar radiation and wind are energy resources of an intermittent and diffuse nature which makes the analysis of their utilization difficult. At present climatic data are presented in the form of time averages of single variables which do not permit the simple calculation of the probable performance of solar installations. This difficulty occurs because the performance of a solar system usually depends on several variables at once so that the correlation of several variables (for example, insolation, temperature, and wind) is required for the proper prediction of total system performance.

Task Statement/Description:

The following tasks should be conducted:

21.1 Assess current climatic data base in region and suggest new data gathering programs as required.

21.2 Establish new data gathering activities as appropriate.

21.3 Develop analytical models for predicting solar thermal, wind, and solar thermal/wind systems performance simply and accurately from regional climatic data.

21.4 Compare and evaluate model calculations with actual performance of solar and wind installations in the region.

21.5 Make recommendations concerning present data gathering and analysis activities. Suggest additional climatic data gathering programs as required for model calculation input.

Evaluation Measures:

Completion of the assessment of regional data.

Establishment of new data gathering activities.

Development of analytical models for predicting the performance of various systems throughout the Region.

Related Programs:

"F" Chart, Solcost.

Implementor:

DOE, MASEC, subcontractors.

Program 22.0 Solar Thermal:

Objective:

To establish the base line in the Region for solar thermal systems which will be effective and economic.

Rationale:

A key program area is solar thermal as applied to the residential/commercial sector. Since 28% of the Region's energy consumption falls into this sector, where conventional energy sources may be displaced by solar, a regional solar thermal program represents a practical opportunity for saving conventional fuel resources.

Beyond this the Mid-American Region is unique in terms of winter space heat requirements which occur together with a resource of abundant sunshine. This correlation between clear weather and cold days, along with a reflective snow cover, provides an ideal match between resource and need for regional space heating. Further out in time, low temperature make-up air systems need to be explored for use in space ventilations, as well as for low temperature industrial and agricultural drying processes. Finally, the use of solar assisted heat pumps needs to be evaluated for the region, particularly with regard to finding the best combination system for the various sections of the region.

Central to the rapid commercialization of solar energy throughout the Region are practical and credible demonstrations (hot water) and experiments (space heating and ventilating) which clearly document the economic, social, and environmental advantages of solar technology. This program is required for the long-term growth of a thriving solar energy market. Over a longer range the use of solar-heated make-up air and solar assisted heat pumps seem to be areas of practical value which require more attention.

Task Statement/Description:

The following tasks should be conducted:

22.1 Establish solar hot water heating system demonstrations in each state of the Region. These systems could be located in private homes open for regular tours or could be placed in public buildings. State park campgrounds should be further explored as good demonstrations sites.

22.2 Survey existing actively heated solar homes in the Region and select two from each state for a five-year monitoring program.

22.3 Select the relevant parameters to be monitored at each site chosen and instrument each installation to measure these parameters. Establish a data gathering program for the output from each installation and provide the information to the climatic variables modeling program.

22.4 Based on data from Task 3 and information from the climatic variables program establish an active space heating program.

22.5 Assess the regional need for make-up warm air for space conditioning and process heat and provide for and monitor experimental installations in the Region.

22.6 Using information from the climatic variables program, evaluate the impact of combining current heat pump and solar technologies. Establish and monitor solar-assisted heat pump installations in the Region.

Evaluation Measures:

Completion of the installation of 24 solar hot water demonstrations in Region.

Report on first year's data from 24 monitored space heat installations.

Report on first year's data from process heat experiment.

Report on first year's data from heat pump experiment.

Related Programs:

DOE and HUD demonstration programs.

Implementor:

DOE, MASEC, subcontractors.

Program 23.0 Passive:

Objective:

To establish passive solar as a regionally viable energy alternative.

Rationale:

Passive design is an area too often overlooked by our society which seems to prefer more technically complicated solutions to its problems. Recent studies at Los Alamos Laboratory, however, have produced preliminary results indicating that passive techniques might be nearly as efficient as more complex active techniques at many locations throughout the United States. This is clearly an exciting result and provides an impetus for examining these results in the Mid-American region. The simplicity of construction, maintenance, and operation of passive designs provides an enticing alternative compared to more complex active systems which provide a greater degree of control.

The large seasonal temperature changes experienced by the states of the Mid-American region present special problems in passive design which need to be addressed. Regional designs for the appropriate amounts of insulation in the shell of the structure as well as special structures such as removable window insulation and massive south walls need to be examined.

Special commercial, industrial, warehouse and farm building space should be examined as potential applications of simple passive techniques, since, depending on their use, these spaces can tolerate the wider temperature variations inherent in the utilization of simple forms of passive space heating.

Task Statement/Description:

The following tasks should be conducted:

23.1 Analyze the potential for passive solar heat in Mid-American region using current analytical models and existing climatic data as a basis for calculation. Develop region specific models for passive heating systems and work with the Climatic Variables program to develop data formats which allow for easy analysis of new structures by the non-specialist.

23.2 Select 24 structures from the region for monitoring as passive energy users. Provide results to the Climatic Variables program and assess value of models used for passive analysis.

23.3 Characterize the regional environment for application to whole building design including insulation, temperature, and wind data. Provide simple design methods and ideas of direct practical value to architects and home owners for using passive techniques such as wind breaks, careful window placement, insulation utilization, design of building ventilation and the reduction of infiltration. Prepare solar oriented land use planning guides as practical aids for civil planners and developers.

23.4 Design and either build or retrofit at least six passively heated structures which can tolerate large temperature variations, such as warehouses or industrial plants. Instrument and monitor these structures for 3 years to evaluate their performance.

23.5 Based on the data and analysis of the previous tasks, perform a life-cycle cost analysis of the various options and determine the optimum passive structure design for each section of the Region.

Evaluation Measures:

Report on analysis of monitored structures including an evaluation of various design principles and the model calculation used to assess their performance.

Publication of a practical passive design handbook for architects and homeowners.

Report on the results from monitoring solar passive structures.

Report on the results of a life-cycle cost analysis of various passive design techniques.

Related Programs:

National Passive Program, RSECs '79 AOP

Implementor:

DOE, MASEC, subcontractors.

Program 24.0 Wind:

Objective:

To support the growing wind industry in the Mid-American Region.

Rationale:

Wind energy, since it can be directly converted into mechanical or electrical energy, represents a high grade form of solar energy which is available throughout the Region. Areas of potential application include residential heating, perhaps combined with heat pumps and other solar techniques; and electrical generation at the residential, community, or conventional power plant scale.

A regional wind survey needs to be done to assess the potential for wind-produced energy. Inexpensive wind instrumentation needs to be provided for the prospective buyer so he can evaluate the worthwhileness of his possible purchase.

The survey would reveal the cost effectiveness and potential of wind power for displacing conventional energy sources throughout the Region and provide a data base for assessing the impact of various wind installations on electric utilities. An analysis of wind-solar thermal hybrid systems needs to be conducted since a combination of these for solar heating may provide a larger fraction of a heating load for a given investment than either system used by itself.

Task Statement/Description:

The following tasks should be conducted:

24.1 Conduct a regional survey of potential wind applications and sites including small scale water pumping, electrical generation, and hybrid wind generation.

24.2 Analyze the potential for wind utilization in the Region and prepare specific suggestions for applications such as large (utility) and small (farm/residential) scale wind electric generation and water pumping.

24.3 Prepare wind application handbook materials, including site-specific data, from the results of the previous analysis.

24.4 Provide (loan) wind measuring equipment for prospective buyers.

24.5 Conduct wind energy demonstrations or experiments in each state for key sites and applications.

Evaluation Measures:

Report on regional wind potential analysis.

Completed materials for users handbook.

Funding of regional wind energy programs.

Loaning of instruments.

Report on results of regional wind energy program.

Related Programs:

DOE wind activity, RSECs 1979 AOPs.

Implementor:

MASEC, subcontractors.

INFORMATION DISSEMINATION

Program 25.0 System and Component Evaluation and Certification:

Objective:

To provide the Region with hard data on the performance and reliability of available equipment and system.

Rationale:

This program in coordination with manufacturing technology programs in the Region will provide manufacturers, developers and users with data that will foster the development of practical, low cost, efficient and reliable solar equipment for use in the region. A strong need exists for valid, credible information on solar equipment performance and reliability. This program will define those activities that shall be carried out at MASEC and through contracted efforts or state programs. It is expected that a basic test facility will be established or identified to serve the region and to serve as support to contracted projects and state programs in the test, evaluation, and certification area.

The evaluation and certification of regionally utilized solar components and systems by independent regional entities not devoted to the promotion or sale of a specific product provides the user, lender, etc., with credible information specific to the needs of their area within the region. In addition, the evaluation of competing systems on a common basis in the region by a non-competing entity provides manufacturers and distributors of solar equipment with an indication of the viability of their products in the region. Such an evaluation of competing equipment and methods will indicate to the manufacturer or developer of solar equipment design changes that, if made to his existing equipment, will open to him new market segments in the region.

A regional source of technology test and evaluation equipment with capable operating personnel is required to support independent contracted testing programs in the region. This capability will minimize capital equipment costs, provide back-up technology support and provide uniform test and equipment standards. Furthermore, a reliable regional authority granting its imprimatur to equipment standards, test procedures and test results will provide a firm basis for application decisions by users and product decisions by manufacturers.

Task Statement/Description:

The following tasks should be conducted:

25.1 Inventory independent laboratory solar equipment test capability in Region.

25.2 Solicit Statements of Qualification for Solar Equipment Test from the Region.

25.3 Define Regional test criteria for classes of solar equipment.

25.4 Define, install, test center equipment and staff the facility.

25.5 Develop procedures for testing and access to test equipment and facilities.

25.6 Carry out tests and publish procedures, standards and results.

Evaluation Measures:

Inventory of Solar Test Capability completed.

Solicitation and analysis of statements of test capability from Region.

Definition of equipment and personnel requirements.

Establishment of regional testing procedures.

Completion of staffing and installation of the test facility.

Definition of assessment procedures and test methods.

Performance of tests and publishing of results on an as needed basis.

Related Programs:

Florida Solar Energy Center equipment test facility.

Certified solar test facilities.

Implementor:

DOE, MASEC, subcontractors.

INFORMATION DISSEMINATION

Program 26.0 <u>Solar Literature and Handbooks</u>:

<u>Objective</u>:

To provide the region with both specific and broad spectrum up to date solar information.

<u>Rationale</u>:

The Regional Center serves as the focal point for collecting, verifying, re-packaging, and disseminating information regarding solar energy technologies to the various publics and audiences in the region. Efforts under this program include the collection, verification and packaging efforts required to generate solar literature and handbooks. Packaging mediums that will be developed under this program include handbooks, brochures, pamphlets, newsletters, public awareness bulletins, guides and solar fact sheets. The dissemination of this material will be through the outreach mechanisms of the Information Dissemination Directorate, the State Solar Offices and direct mailings. The necessary preliminary effort involved in this task is the collection, compilation, and evaluation of existing information. It follows that the information should be assembled in the most expedient manner from the most readily accessible sources, the most pertinent pamphlets, brochures, reports, journal articles, handbooks and such other literature or documentary materials (i.e.,film clips, spoken work materials) as may exist for the general public on solar energy principles and technologies. This material should be evaluated for its quality, validity and reliability and the most useful materials should be indexed and stored in such a way as to be readily identifiable and accessible as referral material for the generation of the publications.

One of the functions to be performed under this project will be the revision of a regional solar handbook. This handbook (the "Solar Yellow Pages") is a reference guide for information services. It includes current awareness information such as current and pending legislation, regional solar manufacturers, distributors and other professionals, and solar education information. The handbook should be updated by current awareness bulletins and an annual revision.

Task Statement/Description:

The following tasks should be conducted:

26.1 Survey Region and collect collateral information for updating the information handbook.

26.2 Develop the retrieval mechanisms by which the information may be indexed and stored so that it is most readily accessible. Process information into the Data Bank and Regional Library, as appropriate.

26.3 Update the regional handbook containing the following information: regional solar development material, current and pending solar legislation, solar-related courses, and current awareness information on regional solar research projects.

26.4 Identify specific user audience categories for the publication of brochures, pamphlets and other handbooks.

26.5 Collect collateral material for the publication of brochures, pamphlets, and handbooks oriented to the specific audience categories.

26.6 Repackage the most useful material into the best medium for each of the targeted audiences.

Evaluation Measures:

Evaluation of the collateral material for its quality, validity, and reliability.

Requests from the region for materials.

Related Programs:

RSEC's 1979 AOP.

NSHCIC brochures and literature (not regional).

Implementor:

MASEC, State Solar Offices

Program 27.0 Solar Energy and Conservation Workshops:

Objective:

To give the Region practical up-to-date solar information and to provide synergisim throughout the varied parts of the industry.

Rationale:

Many technological advances in American society have come under scrutiny as an increasingly sophisticated public has become aware of negative as well as positive implications. Nuclear technology, recombinant DNA research, and automobile safety are examples of technological issues abristle with ethical ramifications. If solar energy is to be served as a realistic alternative energy source, two conditions must be met. First, a wide segment of American society must become familiar with solar energy alternatives and comfortable with their implications. Second, the American public must develop a feeling of confidence in the agencies that promote the commercialization of solar energy. Promoting public knowledge of solar alternatives and increasing public awareness of energy issues thus becomes a very important task of the overall solar commercialization program. Two initial and ongoing needs have been identified. First, is the need at a general level for guidelines and priorities for "what works now in solar energy." Second, is a specific, targeted program to carry this message forward with continuous feedback from solar technology developments.

Task Statement/Description:

27.1 A series of conferences should be convened at both the national and regional levels to explore issues on the ethics of solar energy commercialization and the limits to solar technology. The regional conferences should fill in the limits of existing solar technologies within the regions, construct regionally-relevant policies within the broad category of issues, and plan dissemination of solar energy technology information to institutions and to the general public.

27.2 A series of targeted workshops for architects, builders, designers, and solar technologists should be held in each state. These workshops should determine the local acceptability of solar to building buyers and should produce designs which are acceptable, economic, and integrate well with "current" solar equipment and technology in the Region. The initial or first year emphasis should be on passive solar systems.

27.3 Meeting results, analyses, evaluation and feedback should be disseminated to the Region, SERI, and the Department of Energy.

Evaluation Measures:

Requests for workshops

Workshop documentation

Requests for workshop output and reports

Related Programs:

Workshops organizations (professional groups), continuing education activities of universities.

Implementor:

MASEC, subcontractors

Program 28.0 Information and Education Services:

Objective:

To provide the region with a central source for solar information. To provide information services to regional organizations and individuals on a request-for-service basis.

Rationale:

Information dissemination plays a critical role in promoting the widespread commercialization and utilization of solar energy. As the general consciousness of solar energy has spread, solar information requests are coming into special regional libraries from the public and professionals. Such requests are for general as well as specific information on solar energy and indicate the need for localized library dissemination points from a regional focal point. This program will provide for the central and regional source for solar information and information services. By focusing on this specialized goal, the Regional Library should become the best single source of solar information in the Region. As such it should serve a resource function to other special and general libraries in the region. It should also collect, process and disseminate information on a request-for-service basis to the professional, technical, manufacturing and general consumer audiences of the region in a thorough and timely manner.

Task Statement/Description:

28.1 An Information Services function should be provided in order to disseminate general and technical information on a request-for-service basis. Information specialists should provide information services to and handle unique information requests from the regional solar community. In addition, the information specialists should do customized searches, perform research tasks, material review, and findings reporting, and should make referrals to appropriate researchers and technical experts in response to consulting requests. Computer access to regional and national data bank files, DOE's RECON files, and other energy related government files should be provided.

28.2 A Technical Library and Document Center should be provided as a regional information focal point to support the request-for-service solar energy information needs of the professional and general public communities of the region. The Library should compile and organize a specialized collection of materials and should provide information, reference, and research services on a request basis. Referral information on all aspects of solar including general public, technical, marketing, finance, standards, and legislation information should be disseminated. The Library should package and disseminate current awareness material including public awareness bulletins, current awareness brochures on legislation, energy research abstracts, current awareness bulletins on ongoing research solar projects and current awareness bulletins on recently awarded patents. As funding allows, the Regional Library should establish subsidiary branches such as have already been proposed by several major universities in the region.

28.3 Development of the Solar Energy Information Data Bank (SEIDB) should continue and expand. The SEIDB will contain a wide range of technical and general information on all aspects of solar including regional/national manufacturing, distributor, installer and professional contact lists, regional/national energy supply and demand, natural, institutional, and human resources, solar technical data, research inventories, demonstration inventories, and solar industry activity. The information should be accessible via a time-shared computer network capability between the Regional Centers, the State Solar Offices, and SERI.

28.4 The Computing Service function should be maintained and expanded. It should provide for the procurement, installation, and maintenance of all hardware and software data processing capabilities needed to support the activities of MASEC Center, the State Solar Offices and regional audiences on a request-for-service basis. Access should be provided to the SEIDB and other contracted time-sharing computer networks via a system of remote terminals throughout the region.

28.5 Publication services for the preparation of information and educational materials. Its activities should include document editing, handbook editing, printing, and production, word processing, typing and composition, art and illustrating, viewgraph and slide production, audio and video tape production, movie production, photo production, printing and binding.

Evaluation Measures:

Numbers and types of requestors of solar information.

Growth in these numbers over time.

Related Programs:

NSHCIC, DOE Technical Information Center, SERI Information Services, SEIDB, special libraries within the region (universities, energy collections), public and private solar information sources.

Implementor:

MASEC, State Solar Offices, subcontractors.

Program 29.0 Public Affairs:

Objective:

To create and heighten public awareness of energy issues, and to provide factual solar technology responses to their issues or questions.

Rationale:

A strong predisposition appears to exist at all levels of society toward accepting the concept of solar energy as a good thing. Unfortunately, most individuals remain unaware of either the potentials or the difficulties of the practical application solar energy technologies and interests. At the same time, changes in the total energy picture have encouraged many citizens, both public and private, to realize intuitively that alternative energy resources must be explored. Thus a need has already been created for alternatives (solar in this sense), satisfying the primary consideration which forms this basis of conventional promotional practices. It follows that any effort aimed at creating the conditions in which solar energy utilization materials may be commercialized must endeavor to heighten that perceived need by advancing solar energy from the position of a vaguely good idea to that of a good idea whose time can be made to arrive. As technology identifies, refines, and makes feasible specific applications and systems, the general perception may then be heightened further to the point where solar energy is perceived as having arrived.

The timing and precise phasing of this process will prove to be critical. It is possible, at the present moment, to embark on a promotional program of public affairs which (given sufficient creativity, capital and access to media) could promote solar energy and quickly make it outstrip all other energy sources in terms of its general popularity. It might be a grievous error to do so, however, if the technology and industrial infrastructure has not prepared itself to keep pace with demand and performance necessary to match promotional claims. Poor timing of promotion and marketing can, indeed, create an unfavorable image that would subsequently retard acceptance of the solar energy alternative. With this caveat in mind, this program of public affairs has been designed.

Task Statement/Description:

29.1 Public information contact sessions should be held and assistance in coordination and staffing provided as appropriate. These public affair events should include such activities as lectures, forums, panel discussions, seminars and symposia, practical demonstrations, personal contact work before groups of governmental, professional corporate, entrepreneurial and private persons.

29.2 A Speaker's Bureau should be organized and maintained, drawing expert or informed opinion leaders from government, industrial, commercial, professional, technical, scientific and mechanical fields. The activities of this bureau should be coordinated in relationship to the public encounter activities. A source of funds should be provided to underwrite per diem, expenses and the honoraria that may be required to support this activity.

29.3 A solar energy show should be prepared, coordinated and conducted in order to demonstrate solar energy systems and technologies and to promote public awareness of solar energy and its potential economic and social benefits. The show should be duplicated as a series of local events to be staged in conspicuous, accessible public places on days and during hours which would be conductive to broad public attendance.

29.4 A series of prime time, consecutive, live information and question-and-answer video programs should be prepared and aired simultaneously on public and/or commercial television stations in the 12-state region coupled with a toll-free number for audience call-in during each program.

29.5 Collateral materials suitable for use at these and other public events should be prepared and disseminated.

Evaluation Measures:

Count of audiences reached by the public affairs programs.

Feedback mechanisms such as call-in's or mail-back cards from attendees.

Number and type of requestors for information.

Sales leads generated and/or systems sold by exhibitors at public affairs events.

Related Programs:

Many typical media and public events programs exist.

Implementor:

MASEC, subcontractors.

Program 30.0 Displays and Exhibits (Fixed and Mobile):

Objective:

To provide the Region with hand-on hardware and with systems information.

Rationale:

Public awareness of solar energy utilization should be advanced, to the extent possible, by demonstrative or promotional installations that would be installed in high-traffic public places where exposure would be maximal. Displays should be constructed several ways to serve various purposes, but a mixture of displays, static and mobile, unitized and modular, would be most desirable. These display devices should serve the function, in some situations, of first-hand, practical learning systems and otherwise as information dissemination facilitators. They should be directed in the main at the general public and to a great extent at younger persons.

Task Statement/Description:

The following tasks should be conducted:

30.1 Design, construct and operate a Solar Energy and Conservation Van, a mobile display unit that would demonstrate the principles of solar energy technology. While several such units exist under either public or private ownership, it seems likely that none of them would be available on a continuous basis that would be needed for a Region covering 12 states, at least 16 major metropolitan areas, and 28 percent of the nation's population. Furthermore, existing units that provide demonstrations of various forms of energy resources probably would be too broad in scope to provide sufficient focus on solar energy and regional needs. It is anticipated that these traveling units would be operated and maintained by two full-time persons and one full-time advance person to coordinate scheduling and on-site arrangements. Ideally, the display should be solar powered (where and when practicable) and should include hands-on display or demonstration media that would permit participation in the demonstration process. The demonstration component also should include an automatically repeated audio-visual display of solar energy utilization principles. Visits of one day to perhaps a week should be scheduled at schools, colleges, conventions, state fairs, home shows, builder shows, trade fairs, large shopping centers and almost any other locale that attracts large numbers of people. Construction of this vehicle should be done by a regional subcontractor.

30.2 Schedule and operate a modular display booth for the purpose of serving major solar energy and related events. This display booth should be modular and portable so that it could be carried or shipped from point to point for use.

30.3 Operate, maintain and update state-specific solar information booths for use by the MASEC State Solar Offices and other regional clients.

30.4 Develop or assemble printed solar and conservation information for use with the fixed and mobile displays.

Evaluation Measures:

Number and type of clients attending the displays.

Regional requests for displays and exhibits.

Related Programs:

DOE/Honeywell Transportable Solar Laboratory, DOE Exhibits Branch, DOE Technical Information Center, National Solar Heating and Cooling Information

Center, display and exhibits available from solar manufacturers.

Implementor:

DOE, MASEC, State Solar Offices, subcontractors.

LEGAL AND REGULATORY

Program 31.0 Warranties:

Objective:

To assure financial protection of consumers and lenders and to establish manufacturers' product responsibilities through development of warranties for solar equipment and systems.

Rationale:

The issue of warranties is important in encouraging the public use of solar equipment. Consumers hesitate to invest in equipment not covered by warranties because they want to be assured that the solar equipment will deliver the expected energy and cost savings. Lenders want to make certain that equipment which they have financed will work - at least until paid for. Manufacturers want to be aware of their potential liabilities before they establish product cost - or decide whether to enter the market at all.

At present, the establishment of warranties for solar systems is difficult because not enough equipment has been in use for a sufficient length of time to properly evaluate its performance. Nowhere are there adequate or proven test and performance standards to form a basis for the establishment of solar warranties. The problem has become further complicated by governmental warranty requirements for manufacturers' participation in demonstration and incentive programs.

Clearly, the area of warranties is one which will take some time to be resolved and will require much study and close coordination among the several interests involved.

Task Statement/Description:

31.1 A full and continuing study of the warranty issue should be conducted.

31.2 Formal liaison should be established among all groups participating in the development of warranties, including solar testing centers, standards making organizations, and federal and state officials.

31.3 Model warranties should be developed which are uniform in provisions and acceptable to all parties.

31.4 State consumer protection agencies should be informed about solar warranties and assisted in their efforts to enforce them. Information should be collected from these agencies to provide a data base from which to evaluate the performance of solar equipment and revise solar warranties appropriately.

Evaluation Measures:

Development of uniform solar warranties.

Their acceptance by industry and government.

Manufacturers' honoring of the warranties.

Decrease in consumer complaints to state consumer protection agencies.

Favorable responses by lenders to the existance of solar warranties.

Increased sales of warranted solar systems.

Related Programs:

Performance standards development for solar equipment. (See Program 14: Codes and Regulations.)

Warranty requirements by the HUD solar demonstration program.

State warranty requirements for participation in the HUD water heater initiative and in state incentives programs for solar.

Federal Trade Commission solar warranties activities under the Magnuson-Moss Warranty Act.

Implementor:

DOE, HUD, MASEC, solar manufacturers, solar test centers, standards-makers, state consumer protection agencies.

Program 32.0 Certification Studies:

Objective:

To assure proper solar system performance and installation, to protect the consumer and to assist manufacturers through increased product acceptance and marketability.

Rationale:

The introduction of new technical applications in the field of solar energy along with growing public interest in using solar equipment raises concerns about performance. A need has been demonstrated for certification of equipment to meet performance criteria and of tradesmen to meet installation and operational requirements. Consumers, lenders and developers, among others, are concerned with equipment performance and proper equipment installation. Certification can assure that equipment in use actually delivers what it was designed to deliver and give consumers sufficient confidence in the systems to purchase them.

Task Statement/Description:

32.1 Certification issues applicable to both equipment manufacturers and installers should be studied. Problems in certification of solar equipment or installation should be identified.

32.2 Certification processes and mechanisms should be developed for solar equipment and installation.

Evaluation Measures:

This task can be evaluated through an analysis of the impact of certification on the sales of solar systems and on consumer attitudes toward solar energy. (See note in Program 1 regarding opinion research).

Related Programs:

Solar testing centers' ratings for solar components. Installer training and certification programs (see Programs 8: Vocational Technical Training, and 9: Organized Labor Skills Upgrade.) Certification programs by independent laboratories or professional organizations.

Implementor:

DOE, SERI, MASEC, solar testing centers, certification laboratories or organizations.

ANALYSIS AND ASSESSMENT

Program 33.0 Production Distribution Study:

Objective:

To increase the ease of distribution of solar products through existing distribution networks for related products.

Rationale:

The conventional regional distribution network used by the construction industry presently distributes HVAC systems more highly integrated than most solar systems. Solar components and systems exhibit, at present, higher first costs than conventional systems. Thus, the regional distribution and user network is apparently faced with two new problems areas. To allow rapid, immediate diffusion of solar technology, methods must be developed to allow the existing user-distributor-manufacturer network to accommodate itself to these new requirements.

Task Statement/Description:

33.1 The economic and technical impacts of solar technology on manufacturers, distributors, and members of the construction industry in the Region should be evaluated.

33.2 Plans should be developed for integrated solar systems suitable for distribution through the existing HVAC supplier-purchaser network.

33.3 Integrated solar systems should be produced and distributed through selected distributors to evaluate the products' suitability.

Evaluation Measures:

Successful design and production of integrated solar systems.

Acceptance of such systems by HVAC distributors as part of their product line.

Sales of the integrated solar systems.

Related Programs:

Integrated solar system development by private solar manufacturers.

Implementor:

SERI, MASEC, HVAC distributors, subcontractors.

Program 34.0 Regional Needs and Resources:

Objective:

To identify opportunities and directions for regional solar commercialization through assessment of regional energy supply and demand profiles, the extent of solar utilization and the results of commercialization activities.

Rationale:

Comprehensive regional surveys and assessments need to be a continuing effort, and temporal projection of regional scenarios must be provided if solar commercialization is to be effectively carried out.

Other pertinent surveys such as a survey of solar installations and those which measure commercialization results need to be conducted within the region as an ongoing process.

Total regional energy usage and sources need in-depth assessment. In particular those usages which offer a potential for solar substitution need to be documented and costed before applications can be recommended.

Task Statement/Description:

34.1 A regional survey on solar installations should be designed and performed.

34.2 Continuing analyses of all energy sources utilized by regional consumers should be undertaken. The analysis should embrace not only the type of fuel source and its origin, but also the nature of the energy used (process heat, electric power, transportation fuel) and the possible conditions of substitutability of solar derived energy by type of solar process.

34.3 A regional solar insolation and wind energy resource data collection system should be designed that will provide a reliable and usable data base for the entire Region. The system should be tested and evaluated for at least one year following initial implementation.

Evaluation Measures:

Increased solar utilization

Development of energy use data collection methods.

Development and client usage of the insolation and wind data collection program.

Implementor:

DOE, MASEC, subcontractors.

ANALYSIS AND ASSESSMENT

Program 35.0 Market Analysis:

Objective:

To determine the energy market segments open to development by solar energy technologies, using a variety of regional, as well as national, input parameters, and including future conventional energy costs and availability, levels of conservation in the Region, national policy, system life cycle costs, etc.

Rationale:

In order that the solar commercialization process can be effectively carried out, a continuing program directed toward forecasting the size and type of the solar energy market in the Region is needed.

The forecasts developed through this activity will serve to identify sub-regional needs in specific technology areas and will act as an information source for state energy needs.

Data on emerging systems will be used as input data for market forecasting. and information on market size and type developed in this program will be useful in identification of needs for development programs.

The data developed will also provide further input to manufacturers, developers, and the construction industry on changing market requirements. Finally, since the results of this program will define new market segments, the program will serve to define the characteristics required for new delivery mechanisms.

Task Statement/Description:

35.1 Market segments available for short-term development with available technologies should be identified.

35.2 Long-term market and system requirements should be identified.

35.3 Markets for selected technologies should be projected through analysis of such parameters as predicted conventional energy costs and normalized system cost.

Evaluation Measures:

Preparation of general and technology-specific market forecasts.

Number of users of the market analysis.

Accuracy of the market forecasts.

Related Programs:

DOE commercialization plans for solar technologies. Market analyses prepared by public and private institutions, including SERI.

Implementor:

SERI, MASEC, subcontractors.

Program 36.0 Materials Development:

Objective:

To monitor the development of new materials for use in solar systems. To identify needs and characteristics for new materials.

Rationale:

New materials for use in solar systems can impact their cost, reliability and efficiency. The component manufacturer and the system builder can make effective use of such new materials only if information about their characteristics and availability is communicated to them. In turn, the development of new materials appropriate for use in such systems requires that materials research laboratories be aware of the needs of the component and systems builders.

Task Statement/Description:

36.1 A materials survey should be compiled and a materials reference document prepared.

36.2 A solar product needs-analysis should be performed and the results reported to research and development organizations, including SERI.

Evaluation Measures:

Usage of materials information by regional clients.

Action by researchers or manufacturers on product development ideas.

Usage of the newly-developed materials and products.

Implementor:

MASEC, SERI, subcontractors.

Program 37.0 Small Business Financing Study:

Objective:

To support small businesses entering the solar energy field by providing access to existing financing resources. To provide the lender with realistic data describing the market potential in the Region and the financial and technical requirements for businesses entering the market.

Rationale:

New solar energy technologies appear to be a high risk investment to both the lender and the potential manufacturer. At the same time, the technology does offer an energy resource for the Region. The risks and potential benefits are not completely understood by either party. The lender can use an independent assessment of the future value of solar technologies and the new business can use assistance in finding venture capital to begin its activity.

Task Statement/Description:

37.1 The financing needs of lenders and small businesses in the Region should be surveyed.

37.2 Results should be disseminated through joint workshops to lenders and small business.

37.3 A regional business development plan should be prepared.

Evaluation Measures:

Number of lenders and businesses reached by the material.

Additional entry of small business in the Region into solar energy.

Implementor:

MASEC, financial and small business advisory groups.

REGIONAL COORDINATION

Program 38.0 Regional Planning and Coordination:

Objective:

To provide the program planning and coordination necessary to effectively move the region toward solar commercialization.

Rationale:

The region is composed of a complex interrelated set of players. Each of these should be helped to understand the total picture so he can decide the role he desires to play. These players at present are the best source of specific information and therefore extremely important to both the national and regional and planning process. This program is intended to coordinate the knowledge and efforts of the solar community in the Mid-American region and to organize their ideas and energies to provide the DOE with regionally desired planning and program support from all interested levels.

Task Statement/Description:

38.1 Coordination mechanisms should be provided so that the industry can develop in an open knowledgeable environment. These will take many forms: workshops, phone, computer links, etc.

38.2 The MASEC Program Review and Planning Board (PRPB) should be maintained to link MASEC planning with state activity and the activity, needs, and desires of the "grass roots" solar community.

38.3 The independent state solar organizations who serve the Solar Resource Advisory Panel (SRAP) function should be encouraged and supported. From this group comes solar ideas, manufacturing, distribution, advertising, utilizing and other key industry elements.

38.4 The State Solar Offices (SSO'S) should be maintained or improved to better serve their functions of information collection, information dissemination, needs identification, planning and program development.

38.5 Planning tasks should be conducted on an ongoing basis. Three examples are NPAC, the regional annual operating plans, and special planning for emerging technologies or arising business problems.

Evaluation Measures:

All the activity under this program has strong reporting and publishable output which will be used to evaluate coordination and planning effectiveness.

Related Programs:

The Ag-extension service and the ESS both have strong board involvement. All major companies (and the U.S. Government) have extension coordination and planning activities.

Implementor:

MASEC, PRPB, SRAP, SSO'S.

APPENDIX 2

POLICY STATEMENT #1

POLICY STATEMENT ON CREATING A SOLAR SOCIETY

Creating a solar society requires more than merely substituting energy from solar sources for energy from fossil fuels. Creating a solar society is a process of redesigning our homes, farms, industry, communities, and life styles into new and more meaningful forms which use less energy in more humane, efficient, and integrated approaches.

Our goal in developing programs for a sound and practical solar future is to facilitate the widest possible use of solar energy. In the United States, solar programs must be coupled with strong energy conservation programs.

Energy conservation and solar programs should be matched in importance, kind, and quality to known and documented present energy end uses. Present end uses documented regionally and locally can lead to sensibly prioritized solar and energy conservation programs.

Energy conservation and solar programs matched to known and documented present energy end uses will lead to the most sensible and expedient overall reduction in energy use in the United States and allow for rapid success of the solar contribution to human energy needs.

Appendix 2.

APPENDIX 3

POLICY STATEMENT #2

UTILIZATION/COMMERCIALIZATION/POPULARIZATION

*Utilize: To put to use for a certain purpose. See Synonymus at use. [French *utiliser*, from Italian *utilizzare*, from *utile*, useful, from Latin *utilis*. See utility.] -u'til˙iz'a˙ble adj. -u'til˙i˙za'tion n. -u'til˙iz'er n.

*Commercialization: 1. To make commercial; apply methods of business to. 2. a. To exploit, do, or make mainly for financial gain. b. To sacrifice the quality of for profit. -com˙mer'cial˙i˙za'tion n.

*Popularize: To make popular; especially, to cause to become readily intelligible to the layman. -pop'u˙lar˙iz'er n.

Objective: To recommend the expansion of the "commercialization" to encompass and include the concepts of "utilization" and "popularization" in the plan for the advancement of solar energy.

UTILIZATION

Developing strategies to insure solar utilization in addition to solar commercialization implies the spending of the resources of DOE, MASEC, state and local organizations, including grass roots, to make available to a larger segment of the populace solar energy technology in all its viable forms.

Informed customers that are economically able to respond to the marketing of solar systems represent a large part of the people we must reach. However, equal consideration must be given to planning to make solar technology available to the economically subsidized and deprived sectors of the population.

The systematic distribution of our resources and opportunities to insure the effective use of solar energy should be part of an overall plan that includes developing solar energy technology for profit and not-for-profit. These two strategies must go hand-in-hand and complement each other toward the common good.

Greater sensitivity to energy-related individual, human needs, not just the mechanics of the energy crisis as related to the greater socio-industrial complex, is needed by those who plan and make decisions.

COMMERCIALIZATION

Solar, almost by definition, is a slow growing industry. From the first M.I.T. solar house in 1939, to the present state-of-the-art, there has been

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*The American Heritage Dictionary of The English Language, Published by Houghton Mifflin Company, Copyright 1976.

no great quantum leap in its acceptance and general public use.

The causes for the depressed growth of the industry are many, but more important is what can be done to effect a rapid commercialization in the light of our present energy crisis.

Due to the nature of free enterprise where a waiting market exists, a willing industry will grow to feed it. Therefore, the obvious step is to increase the public appetite for alternate energy sources. The ways to achieve this are outlined below.

Public Awareness

Make the public aware of the need to reduce our dependence on foreign imports. Stress alternate energy capabilities and include educational programs on the little understood technical aspects associated with them.

An educated public will be a public willing to try a new idea. The basic fact that alternate technologies are new to most people is a large restraint to their acceptance. The magical quality associated with most of the solar applications must be dispelled through familiarity with their operating principles. By educating we can erase fear of the unknown.

Government Financial Assistance

While present energy conservation and alternative energy legislation is mightily beneficial, more of the same would be more beneficial. Combined local, state, and federal tax incentives, in those areas where they are available, still are not capable of artificially lowering most alternate energy (systems) costs to make them competitive with conventional fuels. An increase in the tax credit incentives is warranted to stimulate demand, and, as demand increases, alternate energy production costs will decrease.

Grants and aids-in-kind from such agencies as HUD, HEW, and DOE should not have the limited target groups now used. A broad based, wide ranging grant program aimed at the average man on the street is necessary to make these monies more than just bonuses to contractors and builders. Once such a program is available, it should be loudly and extensively promoted to ensure its effective use by the public.

The amount of low interest money available for lending institutions to loan out for alternate energy loans must be increased. The loans should not be limited to low income or poverty level people only. All lending institutions should be required to handle these loans and to advertise them. The entire loan program should receive wide promotion on the national and local level.

Conservation & Solar Push Legislation

Development of solar access laws is imperative, especially for urban areas. (See note.)

Editor's Note: In the state of Minnesota, for example, the two parties negotiate and agree on remuneration and easement wording and the law requires the regestration of the easement so that it is not misunderstood and is passed on to the next owners.

Mandatory conservation standards should be required in all new public buildings.

All of these ideas will enhance solar commercialization, but the push should not be limited to these few parameters. The limit of alternate energy development is only defined by the desire for it to succeed.

Popularization

The dominant mental mode of the coming of solar is one of commercialization. While this is certainly a true model, there are other forces at work, other points of view.

The people of the Region are well-tooled and manually capable. They run the highly industrialized world and can do what they want to it. If they want to change the energy efficiency of the small building stock, they can.

In the early 50's Detroit was producing only a single model of cars. People began to change them, to modify the manufactured product to improve looks, speed, handling and to change functions. By the end of the 50's the auto industry had begun to internalize the process and the history of the industry thru the 60's and 70's has been one of continual diversification into rec vehicles, FWD, compacts, sub compacts, sports cars, vans, sno-fitter pickups, snowmobiles, etc. in an explosion of mechanical diversity, all in response to the newly discovered diversity of the market.

Housing is as much a manufacturing endeavor as auto making. Not as centralized, perhaps, but as much influenced by the standardization as the old auto industry was before the hot rodders shaped it up.

The crisis in energy is as much an architectural crisis as it is a crisis in transportation. The Volkswagen of housing has not showed up yet -- though it quite possibly will be a series of versions of passive/earth integrated buildings. The popular interest in changing the present stock's style is beginning to get hot.

One model of how to stimulate the whole market is to get information to the people already tending the housing stock, the people in the pick ups and vans. Small business people who are already looking toward solar can be picked up by energy audit/conservation courses which teach them the rudiments of thermodyamics, eg. they can do heat gain/loss calculations. Once they can analyze the energy 'motors' of the small building stock, they will begin to be the first on their blocks to hot rod their housing. "Popular Science" and like magazines have had articles for years on how to do this, the subject is almost as popular as automobiles.

The change in the housing stock to energy efficient/producing buildings will come fastest if the demand model is kept uppermost in people's minds. If it becomes the popular thing to do, it will be done.

APPENDICES

APPENDIX 1

TASK (PROGRAM) SHEETS

TASK SUMMARY OF MEDIA PROGRAMMING 93% ile (Title)

Market Sector: Primarily Residential	Task Implementor: Contracted Task Force
Task Technology: Primarily Space & Water Heating	Task Category: Market Development

Objective:

To maximize general public awareness of solar technologies presently available for application using media programming, particularly television.

Rationale:

Commercialization of available solar technologies, such as space and water heating and industrial and agricultural process heat, requires consumer demand. This demand will occur after public awareness, understnading, and acceptance of these solar technologies increases. Media programming can accelerate this process.

Unique Opportunity:

This task can stress that there are solar technologies suitable for the northern half of the U.S. Much currently available media programming stresses solar energy in the southern half of the U.S., and may not seem relevant to many persons in the MASEC states.

Task Description:

To develop educational materials primarily for television.

Task Implementation (Subtasks):

1. Identify leading solar technologists to prepare about passive solar residential heating for northern states.
2. Identify and cover (by videotape or film) conferences & workshops to build up a library of useful audiovisual materials of various types for future use.
3. Develop programming including half-hour shows, newsclips, spot announcements, news releases, tape series, videotapes & films for loan to schools and groups, etc.
4. Provide these materials to newspapers, TV & radio stations, schools, groups, etc, using as many avenues as possible.

Subjects:

1. Passive solar residential heating in northern climates.
2. Home-built solar systems.

(cont. on separate sheet)

Implementation Subtasks	Proposed Schedule Milestones							
	1979	1980	1981	1982	1983	1984	1985	2000
1.								
2.								
3.								
4.								
5.								
6.								
7. Manpower in Man-Months								
Materials								
TOTAL Dollars								

TASK SUMMARY OF LOCAL ENERGY INFORMATION CENTER NO RANKING (Title)

Market Sector: ALL	Task Implementor: State Energy Offices
Task Technology: ALL	Task Category: Market Development

Objective: Provide an ENERGY INFORMATION CENTER in each county.

Rationale: LOCALIZED energy information should be made readily available to match local needs with available services, products and information.

Unique Opportunity: Almost every county has an agency or organization with interest and expertise in solar technologies. Each state energy office should develop guidelines on gathering and organizing listing of designers, installers, suppliers, and sources of all types of energy materials. The energy office should contract with an organization in each county.

Task Description: State energy offices contract with a local government, regional government, or private organization in each county to develop an energy directory and a solar telephone question-answering service.

Task Implementation (Subtasks):

1. Develop directory guidance and contract procedures.
   a) Monitor activities and provide national and state information to the county coodinator.
2. Gather and organize energy directory information.
3. Update energy directory information.
4. Staff energy hot line.
5. Organize and/or provide staff support to local energy organizations.

Implementation Subtasks	Proposed Schedule Milestones 1979	1980	1981	1982	1983	1984	1985	2000
1. Per state (Wisconsin as example)								
2. 2.								
3. 3.								
4. 4. NOTE: WI has 72 counties, $3000/man month								
5. 5.								
6.								
7. Manpower in Man-Months	12	876						
Materials local support								
TOTAL Dollars	36,000	$\$2.5 \times 10^6$						

TASK SUMMARY OF ENERGY FAIRS

Market Sector: All	Task Implementor: SRAPs/State Energy Office
Task Technology: All	Task Category: Market Development

Objective: Promote and provide solar energy information to a broad segment of society in an upbeat, festive setting.

Rationale: The infant solar industry does not have sufficient capital to undertake and financially support energy fairs. Competing established industries have huge resources to promote their products in trade shows and otherwise.

Unique Opportunity: Many energy fairs have been organized and run over the last three years. These fairs lack adequate resources to effectively promote solar energy in all segments of society.

Task Description: Provide funding for several annual energy fairs in each state (average three festivals per year per state through 1985).

Task Implementation (Subtasks):

1. Festival coordination.
2. Festival acceptance survey.

Implementation Subtasks	Proposed Schedule Milestones							
	1979	1980	1981	1982	1983	1984	1985	2000
1. per state	├──┤	├──┤						
2.	├──┤	├──┤	etc.	..	..	..	end	
3.								
4 assume $5,000/man month								
5.								
6.					Total	Total/year =$150,000 thru 1985 =$1 x10[6]		
7. Manpower in Man-Months	6	6	6	..	..			
Materials	--	--	--					
TOTAL Dollars	$30,000	$30,000	$30,000					

TASK SUMMARY OF AWARDS PROGRAM NO RANKING (Title)

Market Sector: All	Task Implementor: MASEC
Task Technology: All	Task Category: Market Development

Objective: To promote information transfer on outstanding projects and activities and to re-inforce efforts to accelerate commercialization.

Rationale: The combination of surveys of projects and activities in the MASEC Region with an awards program would enhance MASEC's information dissemination role.

Unique Opportunity: To obtain slides and/or audiovisuals and prepare looseleaf project descriptionson all new MASEC generated surveys as they are undertaken, and to incorporate evaluation and ranking as an element of new MASEC generated surveys where appropriate.

Task Description:

1. Identify high performance buildings, agricultural, utility, industrial process heat projects and outstanding programs, activities, and induviduals.

Task Implementation (Subtasks):

2. Obtain slides, photographs and/or other audio visuals during surveys. Summerize in looseleaf project descriptions.

3. Rank projects and activities where appropriate.

4. Provide annual wards for outstanding performance in several building categories, e.g, residential, hospitals, schools, etc.

Implementation Subtasks	Proposed Schedule Milestones							
	1979	1980	1981	1982	1983	1984	1985	2000
1.								
2.								
3.								
4.								
5.								
6.								
7. Manpower in Man-Months	12	36	36	36				
Materials								
TOTAL Dollars	$40,000	$350,000	$350,000					

MID-AMERICAN SOLAR ENERGY COMPLEX

TASK SUMMARY OF K-12 ENERGY PRINCIPLES WORKSHOPS 93% ile (Title)

Market Sector: Buildings	Task Implementor: DOE/State Energy Office/Local School District
Task Technology: Solar Energy Principles	Task Category: Institutional & legal barriers

Objective: Facilitate K-12 educational program development through workshop information dissemination.

Rationale: In spite of increasingly available energy curriculum materials, the implementation at each school district level is spotty and there is a short-run need to improve teacher effectiveness, training and incentive.

Unique Opportunity: We have teachers, schools and curriculum materials. We need to get them together.

Task Description: Develop incentive programs for teachers to implement energy understanding at the classroom level.

Task Implementation (Subtasks):

1. Organize state task force on energy curriculum development to develop appropriate strategies for the respective state's situation.
2. Carry out program, generally through workshops (see degree-granting institutions, continuing education, and so on, for certification at state-wide teacher gatherings and summer conferences).
3. Provide appropriate information packets for teacher and school use from state energy office.

Implementation Subtasks	Proposed Schedule Milestones							
	1979	1980	1981	1982	1983	1984	1985	2000
1. Task Force								
2. Program								
3. Information Packets								
4.								
5.								
6.								
7. Manpower in Man-Months	1 man yr per state	.5 man yr per state						
Materials								
TOTAL Dollars	$500,000	$250,000						

TASK SUMMARY OF ALTERNATIVE ENERGY HIGHER EDUCATION ACT 92% ile (Title)

Market Sector: All	Task Implementor: Congress, DOE, Institutions of Higher Education
Task Technology: All	Task Category: All

Objective: Support all aspects of higher education relating to research and development in alternative energy and the training of alternative energy scientists, technologists, engineers and economists.

Rationale: Technical and economic expertise must precede the social development for an alternative energy-based society. An effort, like the defense education act of 1960, is needed to prepare technical manpower to meet the needs of a future energy self-sufficient American society.

Unique Opportunity: Alternative energy higher education on a broadscale scope is almost non-existent; yet a present small cadre of committed educators exists, who from their R&D efforts, can offer new curricula in energy technical design and new programs in energy economics.

Task Description: Develop and implement a coordinated alternative energy national educational plan with full and sufficient funding to make possible the delivery of required numbers of energy technologists and economists in accordance with required timetables.

Task Implementation (Subtasks):

1. Set national goals, and timetables regarding types and numbers of solar engineers, economists, scientists, and technologists to be delivered.
2. Pass legislation, secure funding.
3. Provide grants to institutions for development of curricula, instructional manpower, equipment, facilities and necessary supportive R&D efforts.
4. Initiate recruiting and enrollment of ompetent students.
5. Implement, evaluate and refine programs relating to this act.
6. Implement, evaluate and refine educational curricula.

Implementation Subtasks	Proposed Schedule Milestones							
	1979	1980	1981	1982	1983	1984	1985	2000
1. Goals, timetables	|———|							
2. Legislation, funding	....	Congress						
3. Proposals and granting			|———|	....	Etc.			
4. Recruiting				|———|	....	Etc.		
5. Act implementation			Implement Act		....	Etc.		
6. Program implementation & Recycling					Implement Program			Recycle ....
7. Manpower in Man-Months	400	60	600	600	50	50	50 + 50	
Materials		Incl. Grants	$50M		(National Program)			
TOTAL Dollars	$3 M	$.5M	$55.5M	$5.5M	$.5M	$.5M	$1M	0

TASK SUMMARY OF UPDATING SOLAR SKILLS OF EXISTING JOURNEYMEN AND APPRETICES 88%ile (Title)

Market Sector: Installers	Task Implementor: DOE, states, vocational schools community colleges
Task Technology:	Task Category:

Objective: The goal is to provide additional skills needed to service and install solar and energy conservation equipment.

Rationale: The existing manpower pool can be quickly trained to provide manpower for solar installation.

Unique Opportunity: Adding of additional skills will provide the full utilization of craft skills on each job without bringing in another crew.

Task Description: Short seminars or adult evening school, short supplemental instructional programs can add skills as a supplement to existing trades.

Task Implementation (Subtasks):

	PRIORITY
(1) Curriculum development and selection	Building designers
(2) Curriculum review and revisions	Sheet Metal Workers
(3) Pilot programs	Plumbers
(4) Staff workshops	Carpenters
(5) Training implementation	Builders
(6) Program evaluation	Electricians

Implementation Subtasks	Proposed Schedule Milestones							
	1979	1980	1981	1982	1983	1984	1985	2000
1.								
2. Per State (MN Base)								
3.								
4.								
5.								
6.								
7. Manpower in Man-Months	72	84	200	240	240	240	240	240
Materials	600,000	840,000	2,000,000	2,400,000				
TOTAL Dollars								

TASK SUMMARY OF SOLAR HANDBOOK FOR FINANCIAL AND INSURANCE INSTITUTIONS 86% ile (Title)

Market Sector: Buildings	Task Implementor: DOE, Financial/Insurance Institutions
Task Technology: Space Heating & Cooling	Task Category: Institutional

Objective: Provide baseline information to financial and insurance institutions.

Rationale: It appears, at present, the financial/insurance institutions decision process for approval (i.e. mortgage rate, structure) is not uniform. Some do not understand solar energy systems. Some do not have data other than criteria, which would allow them to make decisions.

Unique Opportunity:

Task Description: Provide prototype information based on demonstration and/or on-line systems. Show catagories of financial and taxation issues and insurance liability. Summarize experience/problems/resolutions, current activities and future concerns with each prototype.

Task Implementation (Subtasks):

1. Identify on-line systems.
2. Identify current financial/insurance state-of-art understanding, decision process/ experience.
3. Investigate financial/insurance issues through primary data collection.
4. Develop prototypical systems with issue identification/resolution.
5. Hold regional workshops/dissemination/feedback.
6. Distribute to insurance/financial with supportive follow-up mechanism.

Implementation Subtasks	Proposed Schedule Milestones 1979	1980	1981	1982	1983	1984	1985	2000
1. On-line								
2. State-of-art								
3. Ins-Fin Issues								
4. Prototype								
5. Workshop								
6. Distribute/Follow-up								
7. Manpower in Man-Months	6	24	6					
Materials	15k	30k	12k					
TOTAL Dollars	42k	175k	48k					

TASK SUMMARY OF SOLAR ENERGY TRAINING PROGRAM FOR LENDING OFFICERS 83% ile (Title)

Market Sector: Building	Task Implementor: DOE, State Energy, Lending Institutions, Associations
Task Technology: Space H/C	Task Category: Institutional & Legal Barriers

Objective: Provide higher level of competency in lending institution decision-making with regard to solar energy performance, opportunities, and evaluation techniques (life-cycle costing, etc.)

Rationale: Lending institutions have large say in rate and method of development but little expertise in solar or energy-sensitive analysis techniques.

Unique Opportunity: In conjunction with improvements in professional (architect/engineer) and consumer energy awareness, it is important to keep the lending institution decision-makers abreast of solar energy issues.

Task Description: To develop energy-sensitive evaluation and decision-making programs for loan officers.

Task Implementation (Subtasks):

1. Develop training programs and aids with regional task force.
2. Carry out lending officer training sessions on a regular basis.
3. Follow-up evaluation on a regular basis by state energy office to insure that lending institutions are not deterrants to solar/passive/energy conserving development.

Implementation Subtasks	Proposed Schedule Milestones							
	1979	1980	1981	1982	1983	1984	1985	2000
1. Regional task force developing programs								
2. State led training programs								
3. Evaluation								
4.								
5.								
6.								
7. Manpower in Man-Months	4 man yrs	.5 man yr/state	=	.1 man yr per state				
Materials								
TOTAL Dollars	500,000	250,000	250,000	100,000	100,000	100,000	100,000	100,000

TASK SUMMARY OF SOLAR ON A/E REGISTRATIONS 70% ile (Title)

Market Sector: All	Task Implementor: State Architect & State P.E. Registration Boards
Task Technology: All	Task Category: Legal

Objective:

To assure competence and place legal responsibility for design of solar installations.

Rationale:

Architects and engineers are required by law to certify designs of all public buildings.

Unique Opportunity:

Only a few architects and engineers have in-depth training and/or experience in solar design, and therefore do not promote solar installations to their fullest potential.

Task Description:

To revise architect and engineer registration rules and test requirements to require and measure competence in solar design and energy management.

Task Implementation (Subtasks):

1. Write model rules for uniform adoption.
2. Determine test requirements.
3. Adopt into existing mechanism.
4. Implement.

Implementation Subtasks	Proposed Schedule Milestones							
	1979	1980	1981	1982	1983	1984	1985	2000
1.	|———							
2.	|———	———|						
3.			|———|					
4.				|———	———	———	———	———|
5.								
6.								
7. Manpower in Man-Months	14	12	12	0	0	0	0	0
Materials								
TOTAL Dollars								

TASK SUMMARY OF VOCATIONAL - TECHNICAL MODEL SOLAR HOMES 80% ile (Title)

Market Sector: Buildings	Task Implementor: State Solar Offices
Task Technology: Passive/Hot Water/Heating & Cooling	Task Category: Market Development

Objective: Stimulate building of solar homes as part of vocational-technical training.

Rationale: Improve training of vocational-technical students in solar building technology, and thereby, improve their employability in a solar future. Provide low cost solar demonstration projects at several locations in each state.

Unique Opportunity:

Vocational-technical students have traditionally constructed a residence each year as a class project. Funding for design, training, and possibly for a solar cost increment is all that is needed in construction. The cost increment should be recoverable when residence is sold.

Task Description:

Provide architectural and engineering assistance to vocational-technical training program to support the construction of solar instead of conventional residences.

Task Implementation (Subtasks):

1. Develop a package of solar heating and cooling information, including both printed and visual materials for classroom use.
2. Fund each State Solar Office to engage professional design assistance.
3. Sell solar building program to the vocational-technical infrastructure.
4. Vocational-technical instructors and class construct residences with consultation assistance from designers.
5. State Solar office monitors progress, performance of solar systems, the sale price of buildings, and publicize the entire program via media and office publications.

Implementation Subtasks	Proposed Schedule Milestones							
	1979	1980	1981	1982	1983	1984	1985	2000
1.								
2.								
3.								
4.								
5.								
6.								
7. Manpower in Man-Months	12	6	2					
Materials	10K	2K	2K					
TOTAL Dollars	40K	17K	7K					

TASK SUMMARY OF DEVELOP MORE PROFICIENT SOLAR TRADESMEN FROM EXISTING APPRENTICESHIP SCHOOLS 69% ile (Title)

Market Sector: Building	Task Implementor: Dept. of Labor, Apprenticeship
Task Technology: Solar Heating/Cooling	Task Category: Institutional & Legal Barriers

Objective: Provide competent solar system installers within the existing trades.

Rationale: Proper performance in a mass market requires trained installers.

Unique Opportunity:

A modest expansion of existing apprenticeship programs will provide qualified installers at a lower cost than creation of entirely new programs.

Task Description:

Improve quality of installations and thereby enhance solar's image and productivity.

Task Implementation (Subtasks):

1. Develop training programs and aids appropriate to respective trade and trainees.
2. Carry out teacher training and certification programs in each state.
3. Do apprentice training and issue certificate.
4. State Energy Office follow-up on program.

Implementation Subtasks	Proposed Schedule Milestones							
	1979	1980	1981	1982	1983	1984	1985	2000
1.								
2.								
3.								
4.								
5.								
6.								
7. Manpower in Man-Months	1)5 man yr task force 2) 1 man yr/state			½ man yr per state	"	"	"	"
Materials	modest							
TOTAL Dollars	$1M	500,000	500,000	250,000	250,000	250,000	250,000	250,000

TASK SUMMARY OF TECHNICAL TRAINING OF SOLAR INSTALLERS AND SERVICE PERSONNEL 65% ile (Title)

Market Sector:	Task Implementor: DOE, States, Vocational Schools
Task Technology: All	Task Category:

Objective: To build a manpower pool to provide skilled or trained persons for sales, installation, and service of solar and energy related skills.

Rationale: If solar systems expand rapidly, additional manpower will be needed to supplement present craftsmen. Employment can result for teenagers, minority, and under-employed persons.

Unique Opportunity: Skills can be developed to meet localized needs for under-employed.

Task Description: Provide training programs of 18 months or less duration for para-professional level persons.

Task Implementation (Subtasks):

(1) Survey needs.
(2) Survey course materials - access materials needed.
(3) Workshops for staff development.
(4) Implement program sites.
(5) Provide training.
(6) Provide placement assistance and student follow up.

Implementation Subtasks	Proposed Schedule Milestones							
	1979	1980	1981	1982	1983	1984	1985	2000
1.								
2.								
3.								
4.								
5.								
6.								
7. Manpower in Man-Months	24	72	240	240	300	320	400	400
Materials	250,000	400,000	950,000	1,000,000	1,000,000	1,000,000	1,500,000	1,500,000
TOTAL Dollars								

TASK SUMMARY OF REDUCED INCOME TAX DEDUCTION FOR NON-RENEW ENERGY SOURCES 88% ile (Title)

Market Sector: Buildings/IPH/AG	Task Implementor: Federal and State IRS
Task Technology: Hot water, space h & C, IPH, electrical	Task Category: Legal and Institutional

Objective: Promote conservation and renewable energy sources development by making non-renewable energy more expensive to consumer. Impact: should affect all tax-paying non-residential energy users.

Rationale: Commercial and industrial energy users receive a tax deduction for energy costs as a "cost of doing business". This tax deduction is tantamount to a tax incentive to consume non-renewanle energy. Eliminate this incentive to waste and provide incentives for solar and conservation with the increased tax revenues.

Unique Opportunity: By increasing the effective cost of non-renewable energies, conservation will be promoted. The elimination of energy tax deduction is administratively simple and uniform to all users.

Task Description: Revise state and dederal internal revenue service codes and rules to elimiante or reduce energy tax deduction.

Task Implementation (Subtasks):

1. Prepare impact study and write bill (legislation).
2. Legislature approves revision to tax laws.
3. Agencies (IRS) revise rules and codes.
4. Publish and distribute revised rules.
5. Implement and enforce.

Implementation Subtasks	Proposed Schedule Milestones							
	1979	1980	1981	1982	1983	1984	1985	2000
1. Prepare								
2. Legislate								
3. Revise								
4. Publish								
5. Implement								
6.								
7. Manpower in Man-Months	12	40	60	10	10	10	10	
Materials								
TOTAL Dollars								

TASK SUMMARY OF INCENTIVE STRATEGY TO PROMOTE PASSIVE APPLICATION 78% ild(Title)

Market Sector: Building	Task Implementor: Federal/State
Task Technology: Passive	Task Category: Legal/Institutional

Objective: Promote the use of passive designs in structures.

Rationale: An incentive measure (i.e. federal income tax credit) is a proven promotional strategy when coupled with adequate public relations activities to inform consumers of the credit.

Unique Opportunity: Since passive is a proven measure, and since the federal energy act includes passive but, since IRS has excluded certain passive designs in rules and regulations of the act, a redefintion of passive by IRS could expand its qualification for the incentives.

Task Description:

1. Expand IRS regulations so as to include passive designs.
2. Provide funding the states withing the region for support and public relations activities to inform the public of the incentives, especially passive incentives

Task Implementation (Subtasks):

1. Have the Congress submit additional intent language to better include passive under the NEA to IRS.
2. Provide funding to the Regional Centers to fund promotional programs on the state level.

NOTE: National in scope. Applies only to passive.

Implementation Subtasks	Proposed Schedule Milestones							
	1979	1980	1981	1982	1983	1984	1985	2000
1.								
2.								
3.								
4.								
5.								
6.								
7. Manpower in Man-Months	24/ 200,000							
Materials	250,000							
TOTAL Dollars	450,000							3,150,000

TASK SUMMARY OF TAX INCENTIVES FOR SMALL SCALE ENERGY PRODUCERS 72% ile (Title)

Market Sector: Buildings/homeowners	Task Implementor: D.O.E./I.R.S.
Task Technology: Solar Utilization	Task Category: Market Developement

Objective: Enable homeowners to receive the same benefits (tax credits, depreceiation schedule) as other energy producers, i.e. oil companies and utilities.

Rationale: In order for solar to survive, anyone converting energy from the sun must have the same incentives and benfits as producers of conventional energy.

Unique Opportunity: For the first time, small scale solar projects would have and equal opportunity in the marketplace. Many people would be encouraged to produce their own energy instead of consuming someone else's energy production.

Task Description: Establish a series of tax laws at both the state and dederal level to eliminate the economic advantage that large conventional energy producers have over homeowners who want to produce their own energy.

Task Implementation (Subtasks):

1. Develop initial tax credit incentives.
2. Develop depreciation shcedules for energy-producing equipment.
3. Develop schedules to allow for defuction for maintenance costs.
4. Upgrade tax incentives on an on-going basis.

Implementation Subtasks	Proposed Schedule Milestones							
	1979	1980	1981	1982	1983	1984	1985	2000
1.								
2.								
3.								
4.								
5.								
6.								
7. Manpower in Man-Months	48	36	24	13				
Materials								
TOTAL Dollars								

TASK SUMMARY OF ACCELERATED DEPRECIATION FOR SOLARIZED RENTAL, COMMERCIAL AND INDUSTRIAL PROPERTY 58% ile (Title

Market Sector: Building	Task Implementor: Congress & IRS
Task Technology: All	Task Category: Institutional & legal barriers

Objective:

Accelerate use of solar energy systems on depreciable real estate property.

Rationale: Real estate, being a margin-sensitive sector, is very sensitive to tax incentives. A postive solar tax incentive will make solar projects feasible and non-solar projects not feasible in many cases.

Unique Opportunity: Tax law changes are easily and directly implemented at almost no cost.

Task Description: Enact individual and corporate federal income tax incentives through business accelerated depreciation (tax sheltering for energy conscious real property investments.

Task Implementation (Subtasks):

1. Establish tax incentive goals and objectives.
2. Define qualifying projects and technologies.
3. Define extent of tax sheltering desired (after input from RSECS SSO's).
4. Pass through congress.
5. Establish tax rate mechanics.
6. Implement.

Implementation Subtasks	Proposed Schedule Milestones 1979	1980	1981	1982	1983	1984	1985	2000
1. Establish goals & objectives								
2. Define qualifying project types and technologies								
3. Define extent of tax sheltering desired								
4. Pass through Congress								
5. Establish tax rate mechanics								
6. Implement								
7. Manpower in Man-Months	160	60	60	IRS				
Materials								
TOTAL Dollars $2.25M	$1.25M	$.5M	$.5M	(National Basis)				

TASK SUMMARY OF SOLAR BANK NO RANKING (Title)

Market Sector: Ag., Industrial, Utility	Task Implementor: DOE/National Solar Bank
Task Technology: All	Task Category: Market Development

Objective: To stimulate market development through a $25 billion capitalization of a national solar bank.

Rationale: By offering no (low) interest loans to the residential and business community through a well-capitalized revolving loan program, a sufficient solar market will be guaranteed. This in turn will provide manufacturers with a clear economic signal to begin production and installation of solar technologies.

Unique Opportunity: Some solar technologies are now marginally competitive; others are nearly so. To offset the economic advantage enjoyed by conventional energy systems and to provide up-front money to residential and business sectors, a solar bank should be created. Lending requirements, paperwork and other restrictions should be minimized.

Task Description: (1) Publish and publicize present opportunities available with solar technologies; (2) Make $15-20 billion available in loans within a 5-year period with 5 or more billion available thereafter depending upon rate of payback of early loans.

Task Implementation (Subtasks):

Implementation Subtasks	Proposed Schedule Milestones							
	1979	1980	1981	1982	1983	1984	1985	2000
1. Publicize, promote, organize.								
2. Process loans ($15-20 billion)								
3. First paybacks.								
4. Second round of loans ($5-10 B-plus paybacks)								
5.								
6.								
7. Manpower in Man-Months								
Materials								
TOTAL Dollars								

TASK SUMMARY OF HOT WATER HEATERS NO RANKING (Title)

Market Sector: Buildings	Task Implementor: Utilities
Task Technology: Hot Water	Task Category: Market Development

Objective: To provide low interest loans for 1.1 (10^6) solar water heater installations on residential property by 1995 through utility companies.

Rationale: Cost to finance and administer this program is less than the cost of building and operating new energy supply facilities. Further, this program can make large sums of money available as loans through the private sector.

Unique Opportunity: To provide a strong economic incentive which would stimulate a rapid increase in the manufacture and installation of solar systems; to familiarize large population sectors with solar concepts generally; to avoid construction of additional energy facilities and depletion of conventional fuels.

Task Description:

1. Raise approximately \$3.1 x10^9 to finance program 1.1 x10^6 collectors; 80 sq, ft collector per system; \$25/ft^2 installation costs; \$10/ft^2 administrative/overhead costs.
2. Increase manufacturing and installation capacity.

Task Implementation (Subtasks):

Implementation Subtasks	Proposed Schedule Milestones							
	1979	1980	1981	1982	1983	1984	1985	2000
1.								
2.								
3.								
4.								
5.								
6.								
7. Manpower in Man-Months								
Materials								
TOTAL Dollars								

TASK SUMMARY OF ESTABLISH A NATIONAL SOLAR ENERGY VENTURE CAPITAL CORPORATION 47% ile(Title)

Market Sector: All	Task Implementor: A public corporation
Task Technology: All	Task Category: Industry Infrastructure Development

Objective: To provide a source of capital funding for solar energy businesses.

Rationale: A publicall held stock company to invest in solar businesses will provide a central source for venture capital in a capital short industry. Will provide solar investors wide dissemination of risk.

Unique Opportunity: By providing this mechanism the American people can invest, on a shared risk basis, in the solar industry.

Task Description: Requires legislation for establishment of corporation and wide distribution of its existence and potential.

Task Implementation (Subtasks):

1. Legislation.
2. Structure design.
3. Set up organization and systems.
4. Public offering.
5. Institute methods.
6. Invest in businesses.
7. Provide management and financial support services.

Implementation Subtasks	Proposed Schedule Milestones							
	1979	1980	1981	1982	1983	1984	1985	2000
1. Legislation								
2. Structure Design								
3. Organized Corporation								
4. Offering								
5. Methods								
6. Investment								
7. Support Services								
7. Manpower in Man-Months	10	3000	3000	2000	1000	300		
Materials	40K	500K	500K	400K	200K	100K		
TOTAL Dollars	750K							

TASK SUMMARY OF ENERGY BLOCK GRANTS TO LOCAL GOVERNMENT 40% ile (Title)

Market Sector: All	Task Implementor: Local Government Units
Task Technology: All	Task Category: All

Objective: To use the community development block grant (CDBG) mechanism to establish local priorities for solarization and conservation, contract to meet those needs, and provide local oversight of projects.

Rationale: CDBG review teams have knowledge of local needs and resources, can exercise effective oversight of projects, will have incentive if continued funding is based on effectiveness, and can involve the public directly in process.

Unique Opportunity: Brings local governments into solarization effort, using established mechanisms. Can be an excellent educational process for governments and citizens involved in review process. Maximum impact on low income sector.

Task Description: Provide DOE funding through Regional Solar Energy Centers to local communities with CDBG programs. RSEC's establish guidelines and approve local plans. Initial funding on basis of population; continued funding determined by effectiveness in reducing conventional fuel consumption.

Task Implementation (Subtasks):

1. Enact legislation, appropriate funds.
2. Promulgate rules for program.
3. Conduct orientation sessions for local CDBG staff.
4. Local units conduct CDBG review process.
5. Plans approved and projects implemented.
6. Evaluation of impact on conventional fuel consumption.

Implementation Subtasks	Proposed Schedule Milestones							
	1979	1980	1981	1982	1983	1984	1985	2000
1. Legislation								
2. Promulgate rules								
3. Orient CDBG staff								
4. CDBG review								
5. Projects implemented								
6. Evaluation								
7. Manpower in Man-Months								
Materials								
TOTAL Dollars		$25 million for Midwest Region						

TASK SUMMARY OF ISSUANCE OF SOLAR INDUSTRY POSTAGE STAMP 31% ile (Title)

Market Sector: All	Task Implementor: U.S. Postal Service
Task Technology: All	Task Category: Industry Infrastructure Develpment

Objective: To subsidize solar energy organizations and businesses through reduction of postage expense.

Rationale: The only possible method for implementation is through the U.S. Postal Service.

Unique Opportunity: Simple and fast method to subsidize a young industry.

Task Description: Provide legislation for implementation and qualification of participants to use stamp(s).

Task Implementation (Subtasks):

(1) Pass legislation.

(2) Design system for qualification.

(3) Design artwork.

(4) Issue stamps.

Implementation Subtasks	Proposed Schedule Milestones							
	1979	1980	1981	1982	1983	1984	1985	2000
1. Pass Public law								
2. Qualification								
3. Artwork								
4. Issuance								
5.								
6.								
7. Manpower in Man-Months	12	15						
Materials	5,000	20,000 000	40,000 000	40,000 000	30,000 000	20,000 000		
TOTAL Dollars	80,000	21,000,000	"	"	"	"		

TASK SUMMARY OF SOLAR ACCESS LEGISLATION 86% ile (Title)

Market Sector: All	Task Implementor: Federal & State
Task Technology: All	Task Category: Legal

Objective: To define the rights of the individual to utilize the sun's energy over a given area, to which he has legal jurisdiction, without encroachment, of and to, others.

Rationale: To eliminate uncertainties in solar supply.

Unique Opportunity:

To encourage and guarantee investment protection.

Task Description:

Research develop legislation.

Task Implementation (Subtasks):

Research old laws.
Coordination of states with each other.

Implementation Subtasks	Proposed Schedule Milestones							
	1979	1980	1981	1982	1983	1984	1985	2000
1.								
2.								
3.								
4.								
5.								
6.								
7. Manpower in Man-Months								
Materials								
TOTAL Dollars								

TASK SUMMARY OF PASSIVE DESIGN FOR STATE AND LOCAL GOVERNMENT BUILDINGS 78% ile (Title)

Market Sector: Buildings	Task Implementor: State & Local Governments
Task Technology: Passive	Task Category: Industrial Infrastructure

Objective: Increase the number of facilities using passive solar design and demonstrate their effectiveness.

Rationale: To get the maximum effectiveness from building materials, and to demonstrate the usefulness of passive design.

Unique Opportunity:

Federal buildings have served as a showplace for solar systems, active and passive. State and local government buildings are a natural extension of this category.

Task Description:

Require the consideration of passive solar design in all state and local government buildings and mandate the use thereof if cost effective.

Task Implementation (Subtasks):

1. Define "cost effective" as repayment of additional construction costs over building lifetime by passive systems, using life-cycle costing.
2. Develop a form relating additional labor costs, material costs, labor costs, energy savings, assumed fuel escalation rate, and interest rates.
3. Require filing of such form with appropriate official to obtain permit.
4. State energy director sets the fuel escalation rate yearly.
5. If effective, a passive design shall be mandatory.
6. Set a time limit (less than 15 years) on such legislation.

Implementation Subtasks	Proposed Schedule Milestones							
	1979	1980	1981	1982	1983	1984	1985	2000
1.								
2.								
3.								
4.								
5.								
6.								
7. Manpower in Man-Months								
Materials								
TOTAL Dollars								

TASK SUMMARY OF OPEN SECONDARY MORTGAGE MARKET FOR ALTERNATIVE ENERGY PROJECTS 78% ile (Title

Market Sector: Buildings	Task Implementor: Federal National Mortgage Assurance Corporation
Task Technology: All	Task Category: Legal & Institutional

Objective: To eliminate financing barriers for alternative energy residences, especially earth-shelters.

Rationale: People cannot build energy-efficient houses if they cannot finance them.

Unique Opportunity:
The secondary mortgage market, where prime lender's paper is bought up by government controlled financial sources, is very susceptible to directive and also directly sets tone for acceptable loan markets.

Task Description:
Direct secondary mortgage sources to buy bulk paper on alternative energy residences (new and retrofit).

Task Implementation (Subtasks):

1. Identify loan sectors needing support.
2. Determine ranges and quantities of loans involved (quotas).
3. Set objectives.
4. Pass act through government.
5. Issues directives to primary lenders.
6. Review and evaluate.
7. Set subsequent period quotas.

Implementation Subtasks	Proposed Schedule Milestones 1979	1980	1981	1982	1983	1984	1985	2000
1. Identify	├──┤							
2. Determine	├──┤							
3. Set	├──┤							
4. Pass act		├──┤						
5. Issue			├┤					
6. Renew and Recycle			├──	────	──┤			
7. Manpower in Man-Months	20	20	20	20				
Materials								
TOTAL Dollars	150K	150K	150K	150K				

73% ile

TASK SUMMARY OF MANDATORY ENERGY EFFICIENCY PERFORMANCE STANDARDS FOR NEW CONSTRUCTION (Title)

Market Sector: Building	Task Implementor: Congress, State and Local Government
Task Technology: Passive (Conservation)	Task Category: Legal & Institutional Barriers

Objective: The building sector consumes approximately 20% of our energy budget for space heating and cooling, most of which is wasted. We must prevent this continued inefficiency by requiring that all new construction be as energy efficient as practicable.

Rationale: Mandatory compliance will force everyone to work within the same guidelines toward the same goal. This will give solar strategies a fighting chance.

Unique Opportunity:
We have a chance to attempt to "solve" our energy problems by seeking to <u>prevent</u> those problems rather than always trying to <u>cure</u> them after the fact.

Task Description:
Develop: 1) Goals and 2) Guidelines and then determine the best means to 3) Implement and 4) Enforce this compliance, i.e., through issuance or denial of building permits.

Task Implementation (Subtasks):

1.
2. (as above)
3.
4.

Implementation Subtasks	Proposed Schedule Milestones							
	1979	1980	1981	1982	1983	1984	1985	2000
1. Develop program.	├──┤							
2. Implement		├──	──	──	──	──	──	──┤
3.								
4.								
5.								
6.								
7. Manpower in Man-Months	80							
Materials								
TOTAL Dollars	600,000							

TASK SUMMARY OF ESTABLISH MARGINAL COST RATES FOR CONVENTIONAL ENERGY 70% ile (Title)

Market Sector: All	Task Implementor: DOE, State Energy Offices
Task Technology: All	Task Category: Legal & Institutional

Objective: To encourage use of renewable (solar) energy by providing basis to compare solar versus new conventional energy sources (i.e., North Slope oil, new electrical generating plants, etc.)

Rationale: To provide a fair cost comparison in life-cycle costing and cash flow analysis between solar energy and non-renewable energy sources.

Unique Opportunity:

At present solar energy is compared in cost analysis to the "rolled in" or average cost of conventional energy sources. Solar should be compared to the cost of developing new conventional energy sources.

Task Description:

Develop method for determining and promulgating marginal costs.

Task Implementation (Subtasks):

1. Prepare marginal costs of conventional energy sources by DOE and state energy offices.
2. Promulgate marginal costs.
3. Require marginal cost analysis on state and federal building projects.
4. Update costs quarterly.

Implementation Subtasks	Proposed Schedule Milestones							
	1979	1980	1981	1982	1983	1984	1985	2000
1. Prepare								
2. Promulgate								
3. Require								
4. Update								
5.								
6.								
7. Manpower in Man-Months	120	120	80*	80	80	80 . .	. . . . . .	. . .
Materials	* could be variable							
TOTAL Dollars								

TASK SUMMARY OF MANDATING ENERGY PERFORMANCE IN BUILDINGS 65% ile (Title)

Market Sector: Building	Task Implementor: State & Local Government
Task Technology: Solar Heating & Cooling	Task Category: Institutional & Legal Barriers

Objective: Require designers, builders and owners to incorporate energy conservation measures and use of solar in all buildings.

Rationale: To obtain maximum savings of fossil fuel and electricity.

Unique Opportunity:

Technology is available at cost effective prices, and it is imperative to reduce petroleum imports and improve balance of payments.

Task Description:

Promulgate design criteria to all building professions and trades. Develop and implement an enforcement method.

Task Implementation (Subtasks):

1. Develop design tools for implementation of this task.
2. Develop design manuals for determining cost effectiveness of building and solar performance on a life cycle basis.
3. Publicize programs to all sectors of society.
4. Implementation. Passive or active is optional, designer must obtain permit to build and not use.

Implementation Subtasks	Proposed Schedule Milestones							
	1979	1980	1981	1982	1983	1984	1985	2000
1.								
2.								
3.								
4.								
5.								
6.								
7. Manpower in Man-Months	48	72	72	60	48	24	24	24
Materials	10,000	10,000	10,000					
TOTAL Dollars								

TASK SUMMARY OF CODE UNIFICATIONS 62% ile (Title)

Market Sector: All	Task Implementor: State Government
Task Technology: All	Task Category: All

Objective:

To unify all existing solar codes and regulations into one unified national solar energy code.

Rationale:

To stabilize solar installations and assure the most efficient operation.

Unique Opportunity:

Solar being an "infant" industry, the codes and governing agencies across the nation are being abridged.

Task Description:

Establish working relationship with ALL state and federal agencies for the unification and standardization of solar installations.

Task Implementation (Subtasks):

1. Conference of state code officials nationwide.
2. Resolution of code differences and/or contradictions.
3. Adoption of a unified national code.
4. Inspections, monitoring and enforcement of code by governing authorities.

Implementation Subtasks	Proposed Schedule Milestones							
	1979	1980	1981	1982	1983	1984	1985	2000
1. State agency meetings	10							
2. Secretarial	10							
3. Printing & adoption	10							
4. Administration	10							
5. Enforcement	10							
6. at 8,000/M.M.	400,000							
7. Manpower in Man-Months	50	50						
Materials	100,000	100,000						
TOTAL Dollars	500,000							

TASK SUMMARY OF LOCAL CODE AND REGULATION UPDATING No Ranking (Title)

Market Sector: Local Government	Task Implementor: State Energy Offices
Task Technology: Laws	Task Category: Institutional Barriers

Objective: To assist local building officials, zoning officials and planning officials in revising and enacting codes and regulations pertaining to the health, safety and well-being of the community in the matter of future solar installations.

Rationale: The local administrators are dependent upon experts in various fields for information and guidance in making decisions in their fields. The federal and state officials are dependent upon the local officials to carry out their policies.

Unique Opportunity:
Solar is a new field and there are very few regulations regarding its utilization. The use and application of solar technology is known to only a few people at this time so outside guidance is imperative.

Task Description:

Establish a working relationship between the above designated government officials.

Task Implementation (Subtasks):

1. Contact the appropriate officials.

2. Discuss the present regulations that might need to be revised.

3. Provide technical information and availability of resource material.

4. Be solar resource person for group meetings of local officials.

Implementation Subtasks	Proposed Schedule Milestones							
	1979	1980	1981	1982	1983	1984	1985	2000
1.								
2.								
3.								
4.								
5.								
6.								
7. Manpower in Man-Months								
Materials								
TOTAL Dollars								

MID-AMERICAN SOLAR ENERGY COMPLEX

TASK SUMMARY OF LOCAL GOVERNMENTS SOLAR DEMONSTRATION PROGRAM 59% 11c (Title)

Market Sector: Buildings	Task Implementor: Local Government
Task Technology: Domestic Hot Water & Space Heating	Task Category: Market Development

Objective:

To demonstrate to city and village populations across the nation that solar heating systems are viable.

Rationale:

Will provide an in-place structure for broad solar feasibility demonstration and assure a national commonality of approach. Also, it's politically expedient for the Administration and Congress.

Unique Opportunity:

With a central demonstration program aimed at a wide diversification of location, with proper monitoring and tests of appropriateness, this program can be a tremendous vehicle for proving to the people of the U. S. that solar does/will work in the community in which they live.

Task Description:

Obtain Congressional approval and U. S. Department of Energy support to establish funding and criteria for direct funding to local units of government on a revenue sharing basis.

Task Implementation (Subtasks):

1. DOE support.
2. Local government interest groups support (NACO/USCM/NLC, State Associations).
3. Enabling legislation.
4. Administrative rules.
5. Appropriation for planning monies.
6. Local government (cities, villages, counties, town & township) planning.
7. Appropriation for construction.
8. Local government submission of plans.
9. Funding of local government projects.
10. Construction, operation, dissemination of resul s to community.

Implementation Subtasks	Proposed Schedule Milestones							
	1979	1980	1981	1982	1983	1984	1985	2000
1. (1)								
(2)								
2. (3)								
(4)								
3. (5)								
(6)								
4. (7)								
(8)								
5. (9)								
(10)								
6.								
7. Manpower in Man-Months								
Materials								
TOTAL Dollars			$2.5 B					

TASK SUMMARY OF COORDINATED REGULATORY AGENCIES 32% ile (Title)

Market Sector: All	Task Implementor: Local, State, Federal Govts.
Task Technology: All	Task Category: Institutional/Legal Barriers

Objective: To coordinate all agencies of local, state and federal governments to simplify governing regulations.

Rationale: To expedite the implementation of solar products and installations.

Unique Opportunity:
To dissolve contradictions in existing codes and regulations.

Task Description:
Advise different agencies where contradictions exist.

Task Implementation (Subtasks):

1. Point out definite areas of conflict
2. Conference committee between contradictory agencies.
3. Resolution of conflicts between agencies.
4. Mandatory conferences bi-annually.
5. Necessary legislation for agency code revisions.
6. Reports to all personnel involved concerning said regulations.

Implementation Subtasks	Proposed Schedule Milestones							
	1979	1980	1981	1982	1983	1984	1985	2000
1.								
2.								
3.								
4.								
5.								
6.								
7. Manpower in Man-Months	30	30	30	30	30	30	30	30
Materials	10,000							
TOTAL Dollars	372,000/YR. + Escalation.							

TASK SUMMARY OF MANDATORY SOLAR ENERGY FOR PUBLICLY OWNED BUILDINGS No Ranking (Title)

Market Sector: Building	Task Implementor: Congress, State and Local Government, DOE, RSECs
Task Technology: Hot Water, Space Heating, Energy Conservation, Make-up air heating Passive	Task Category: Market Development

Objective:

To generate 2 Quads annually by 2000 for commercial and public buildings.

Rationale:

To provide examples and experiences of passive, active and energy conservation designs for all commercial and public buildings.

Unique Opportunity:

Widely displaced demonstrations, good visibility, industrial infrastructure development, market development, provide basis for development of appropriate codes and laws for implementation of energy efficient buildings.

Task Description:

Congress mandate that all publicly owned buildings incorporate passive/active solar and energy efficient design. For federal buildings no cost-sharing; cost-sharing available to state and local governments who comply.

Task Implementation (Subtasks):

1. Prepare impact studies - (cost vs. savings).
2. Present to appropriate congressmen and congressional committees.
3. Get law passed; get federal buildings built with solar, energy conservation and passive.
4. Get state support and state buildings incorporating these features.
5. Educate public.
6. Get support for local cost sharing.

Implementation Subtasks	Proposed Schedule Milestones							
	1979	1980	1981	1982	1983	1984	1985	2000
1. Impact study								
2. Presentations (Congress)								
3. Law Passed								
4. State Support								
5. Educate Public								
6. Local Government								
7. Manpower in Man-Months		36	72	72	36	18	12	
Materials		0.1	0.1	0.1	0.1	0.1	0.1	
TOTAL Dollars		1.9	3.7	3.7	1.9	1.0	0.7	

TASK SUMMARY OF SYSTEM PERFORMANCE/PAYBACK ANALYSIS OF SOLAR IN MAJOR CITIES IN REGION(Title)

Market Sector: Building	Task Implementor: Successor to ERDA, Div 4, Solar Energy-DSE-2322-1
Task Technology: Solar DHW & Space Heating	Task Category:

Objective: Motivate architects and engineers by providing them with payback information to support recommendation of solar to clients.

Rationale: Architects and engineers are conservative, don't want to risk their reputation on experimentation without proof that their recommendations are backed by reliable information.

Unique Opportunity: So many architect-engieers' buildings are still being designed and constructed as they were before the energy crises. Architects and engineers tend to be conservative and negative about solar. If designed, contractor will install.

Task Description: Distribute this performance/payback information through architects' associations and limiting the analysis tomajor cities in that state. Also distribute to mechanical contractors associations in respective states.

Task Implementation (Subtasks):

1. Use same analysis procedure and methodology used in DSE-2322-1, Nov. 1976, ERDA, Div. of Solar Energy, "An Economic Analysis".
2. Performance/payback based on F-chart, cost of conventional energy, individuals income tax bracket, etc.
3. Analyze based on $20, 30, 40/sq. ft. installed collector price.
4. Analyze based on increasing electricity, gas, oil costs.
5. Analyze based on using tax incentives available-locally.

Implementation Subtasks	Proposed Schedule Milestones							
	1979	1980	1981	1982	1983	1984	1985	2000
1. Reference DSE-2322-1	Nov. 1976							
2. Distribute architects and engineers.								
3. Distribute to mechanical contractors associations in states and major citites in MASEC area.								
4.								
5.								
6.	'Analysis: 1st yr. MASEC Distribution-by Associations' requests.							
7. Manpower in Man-Months	?	¼	.1	.1	.1	.1	.1	.1
Materials								
TOTAL Dollars		1,650	660	660	660	660	660	660

TASK SUMMARY OF ENERGY LABELS FOR BUILDINGS 62% ile (Title)

Market Sector: Buildings	Task Implementor: Federal and State Government
Task Technology: All	Task Category: Legal and Institutional

Objective: Tp provide prospective buyers or renters of new and existing buildings information on the amount and cost of energy consumed for the building.

Rationale: In order for people to choose energy efficient buildings, people must have information on the building's energy consumption--similar to EPA mileage labels on new cars.

Unique Opportunity: Energy effiecent passive solar buildings use 1/3rd or less energy than conventional buildings. REquiring disclosure of energy consumption will provice a powerful market incentive to make buildings more energy efficient.

Task Description: Pass federal and state laws requiring all buildings to be labeled describing their energy consumption and its cost. The annual energy cost would have to be disclosed whenever the sale price or rent was stated. For existing buildings the utility bills would be disclosed for the last two years. For new buildings the calculated amount of energy consumption and its cost would be disclosed.

Task Implementation (Subtasks):

(1) Prepare impact study and write legislation.
(2) Secure passage of act.
(3) Write rules.
(4) Publicize requirement.
(5) Implement and enforce.

Implementation Subtasks	Proposed Schedule Milestones							
	1979	1980	1981	1982	1983	1984	1985	2000
1. Prepare	├──┤							
2. Legislate	├──	──┤						
3. Rules	├──	──┤						
4. Pulbicize		├──	──	──┤				
5. Implentment/Enforce		├──	──	──	──	──	──	──
6.								
7. Manpower in Man-Months								
Materials								
TOTAL Dollars								

TASK SUMMARY OF MONITORING AND REPORTING ON INSTALLED SOLAR H_2O SYSTEMS 60% ile (Title)

Market Sector: Buildings	Task Implementor: RSEC
Task Technology: Hot Water	Task Category: Market Development

Objective: To prove to the consumer that solar hot water heating is a viable and economic energy option.

Rationale: To displace a substantial dependence on conventional fuels with solar utilization.

Unique Opportunity: Many good and bad systems exist and, with conflicting claims, the consumer is confused and reluctant to invest.

Task Description: Monitor long term (at least 2 months of normal use) performance of existing solar H_2O systems in region, evaluate and publicize.

Task Implementation (Subtasks):

1. Develop basic instrument and recording package for monitoring solar domestic water heating systems performance.
2. Canvass region for installed systems seeking volunteers for monitoring.
3. Install monitoring equipment on approximately 50 installations geographically distributed in region and monitor for at 2 months of normal use.
4. Evaluate long term performance in terms of system efficiency, maintenance problems cost effectiveness (life-cycle), others.
5. Develop rating figure.
6. Disseminate results to public.

Implementation Subtasks	Proposed Schedule Milestones							
	1979	1980	1981	1982	1983	1984	1985	2000
1.								
2.								
3.								
4.								
5.								
6.								
7. Manpower in Man-Months	50	100	40					
Materials	30K	10K	5K					
TOTAL Dollars								

TASK SUMMARY OF ENERGY UNIT COST LABELING 58% ile (Title)

Market Sector: Commercial/Industrial/Buildings	Task Implementor: Government/Private Industry
Task Technology: Administrative	Task Category: Legal/Information

Objective: To reduce energy use and shift energy use patterns to be more consistent with energy type.

Rationale: Consumer understands dollar amounts and the capability of different energy forms.

Unique Opportunity: Program is based upon the common denominator of the society, the dollar; such a program does not exist at the present time.

Task Description: Massive labeling and administrative effort to obtain regional/local values by private industries. In this plan all energy forms and devices that are used by various sectors would be costed on a regional basis in terms of price per unit energy delivered to that sector (customer).

Task Implementation (Subtasks):

1. Determinatinon of sectors/and devices.
2. Rating ($/BTU) done by private industries.
3. Government review of ratings.
4. Private industry publishes costs to each sector.

Implementation Subtasks	Proposed Schedule Milestones							
	1979	1980	1981	1982	1983	1984	1985	2000
1.								
2. Sector device ID	12MM							
3. Rating	18	36		24		24		
4. Review		6			6			
5. Publish			7		6			
6.								
7. Manpower in Man-Months	30	39	10	24	12	24	12	24
Materials	30K	30K	40K	40K	50K	50K	60K	60K
TOTAL Dollars	325	293	75	180	90	180	90	180

TASK SUMMARY OF ON-SITE PERFORMANCE MONITORING EQUIPMENT 55% ile (Title)

Market Sector: Buildings	Task Implementor: DOE/Contractor
Task Technology: Space Heating/Cooling/DHW	Task Category: Product Development

Objective: Provide standard electronic package for portable on-site monitoring of completed active solar systems.

Rationale: Design of microprocessor based system is expensive; return on development costs is poor due to lack of market.

Unique Opportunity:

Stimulate on-site monitoring by making a relatively low cost package available.

Task Description:

Develop a portable data acquisition system to monitor the performance of active solar systems.

Task Implementation (Subtasks):

1. Study ASTM on-site monitoring test criteria (E44.06).
2. Identify parameters to be monitored.
3. Select appropriate sensors and design system.
4. Test and de-bug system.
5. Compile documentation.
6. Correlate short term test vs. accumulated data base.

Implementation Subtasks	Proposed Schedule Milestones							
	1979	1980	1981	1982	1983	1984	1985	2000
1.								
2.								
3.								
4.								
5.								
6.								
7. Manpower in Man-Months	4	4	3					
Materials	$100	includes 1 completed system						
TOTAL Dollars K	30.	130	22.5				TOTAL	$182,500

TASK SUMMARY OF PLANNING AN ENERGY EFFICIENT COMMUNITY 55% ile (Title)

Market Sector: ALL	Task Implementor: Local Government, State Solar Association, Community Org's.
Task Technology: Conservation; All	Task Category: All; Legal and Institutional Barriers

Objective: To provide funds for planning to make communities more energy efficient by identifying policies which must be adopted to encourage energy conservation and to eliminate barriers to energy efficiency.

Rationale: Our communities must be redesigned to allow and encourage energy efficiency.

Unique Opportunity: Our energy shortage and high energy prices have created an awareness that every community must be redesigned to consume less energy.

Task Description: Analyze how energy is now used in the community and how the people's need for energy could be minimized in the future.

Task Implementation (Subtasks):

(1) Identify current energy uses.

(2) Identify city policies which prohibit or discourage conservation.

Implementation Subtasks	Proposed Schedule Milestones							
	1979	1980	1981	1982	1983	1984	1985	2000
1.								
2.								
3.								
4.								
5.								
6.								
7. Manpower in Man-Months								
Materials								
TOTAL Dollars								

TASK SUMMARY OF URBAN RETROFIT DEMONSTRATIONS - I 52% ile (Title)

Market Sector: Buildings, Utilities, Agriculture	Task Implementor: Non-Profit Groups/Assns.
Task Technology: All (Integrated)	Task Category: Mkt. Dev. & Legal/Inst. Barriers

Objective: Provide local examples of workable and affordable solar technologies. Integrate conservation and solar into city planning.

Rationale: To save maximum amount of fossil fuels and electricity and move toward a solar society in as cheap and efficient a manner as possible.

Unique Opportunity:
The technologies are available but need to be worked into the unique settings of each urban area.

Task Description:
Demonstrations and workshops for retrofitting city houses and buildings with integrated solar technologies. Use findings for planning recommendations on a city level.

Task Implementation (Subtasks):

1. Establish place for demonstrations.
2. Run demonstrations and workshops in as many solar systems as are applicable in the city/area.
3. Set up task forces to integrate findings and conversions into city planning.
4. Implement conversion plans.
5. Recycle house.

Implementation Subtasks	Proposed Schedule Milestones							
	1979	1980	1981	1982	1983	1984	1985	2000
1.	├──┤							
2.	├────	────	──┤					
3.		├────	────	────	──┤			
4.		├────	────	────	────	────	────	──┤
5.							├──	──┤
6.								
7. Manpower in Man-Months	48	72	60	60	60	60	48	24
Materials	10,000	20,000	15,000	10,000	10,000	10,000	10,000	5,000
TOTAL Dollars								

TASK SUMMARY OF URBAN RETROFIT DEMONSTRATIONS - II 52% ile (Title)

Market Sector: Buildings	Task Implementor: Doe/Hud/Grass-Roots/MASEC
Task Technology: Active,-Passive, Hot Water	Task Category: Market Development

Objective: To stimulate market for goods and services by demonstrating feasibility, reliability, availability of solar retrofit systems.

Rationale:

Many large cities have large potential customer base, subsidized and unsubsidized, for retrofit. Pay-off for both buyer and seller.

Unique Opportunity:

Same as above.

Task Description:

Support and fund appropriate, economically sound demonstrations of retrofits and R & D on retrofit applications.

Task Implementation (Subtasks):

1. Compile designs.
2. Identify contractors and educate.
3. Refrofit buildings.
4. Open buildings to public.

Implementation Subtasks	Proposed Schedule Milestones							
	1979	1980	1981	1982	1983	1984	1985	2000
1. This program would run for a full year, in chosen location, until demonstration sites are functioning. It should then be re-evaluated and updated.								
2.								
3.								
4.								
5.								
6.								
7. Manpower in Man-Months	24							
Materials								
TOTAL Dollars	80,000							

TASK SUMMARY OF PHOTOVOLTAIC SYSTEMS FOR FARMS AND HOMES 45% ile (Title)

Market Sector: Buildings and Agricultural	Task Implementor: RSEC's/Industry
Task Technology: Solar Cells	Task Category: Market Development

Objective: Develop and demonstrate photovoltaic technologies on homes and farms.

Rationale: To start a transformation from non-renewable electrical energy production.

Unique Opportunity:
Solar cells are commercially available and can be used in small systems to obtain experience at low cost.

Task Description:

Install a variety of systems for varying applications at a large number of locations.

Task Implementation (Subtasks):

1) Identify and publicize small-scale photovoltaic opportunities.
2) Develop regional grants program for small-scale photovoltaic applications.
3) Conduct a design-only and a design/build competition.
4) Farm and home owners install and operate systems.
5) Survey system performance and economics as well as owners' attitudes about solar cell systems.

Implementation Subtasks	Proposed Schedule Milestones							
	1979	1980	1981	1982	1983	1984	1985	2000
1.								
2.								
3.								
4.								
5.								
6.								
7. Manpower in Man-Months	48	48	12	12	12			
Materials	12k	12k	12k	12k	12k			
TOTAL Dollars	212k	212k	62k	62k	62k			

TASK SUMMARY OF PUBLIC ECONOMICS/SOLAR EDUCATION

Market Sector: All Sectors	Task Implementor: MASEC - Local Government
Task Technology: All	Task Category: Market Development

Objective:

Consumer awareness and education of life-cycle economics, solar practicality, and their iterrelationship.

Rationale:

Increase public acceptance of solar energy.

Unique Opportunity:

1) Technology is available at cost-sffective prices

2) Use and application of solar technology is limited; external guidance is necessary.

Task Description:

Use of various media by local governments to educate public.

Task Implementation (Subtasks):

1. Establish, isolate, and obtain pertinent information
   a) Education
   b) Economics
   c) Solar system technology
2. Information source and material organization
3. Develop presentation and information dissemination programs
   a) National
   b) Regional
   c) Local
4. Local "disseminator" education.
5. Implement presentation and information dissemination programs through various media

Implementation Subtasks	Proposed Schedule Milestones							
	1979	1980	1981	1982	1983	1984	1985	2000
1. Establish inforamtion sources								
2. Material organization								
3. Develop presentation program								
4. Local "disseminator" education								
5. Implement presentation & information dissemination								
6.								
7. Manpower in Man-Months		18	36	36	18	12	6	
Materials								
TOTAL Dollars								

IMPLEMENTATION PLANS FOR THE INDUSTRIAL PROCESS HEAT MARKET SECTOR

PREPARED BY:

THE
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TABLE OF CONTENTS

TABLE OF CONTENTS

PROGRAMS

Program Number	Program Title
8.0	IPH Executive Awareness Program
8.1	IPH Industry Program Development
8.2	IPH Industry Advisory Council
8.3	IPH Solar Energy Industry Speaker Bureau
9.0	IPH Consumer and Economic Research Program
9.1	IPH Economic Analysis
9.2	IPH Consumer Survey
9.3	IPH Consumer Analysis
10.0	IPH Target Market Program
10.1	IPH Market Survey
10.2	IPH Solar Energy Feasibility Workshops
10.3	IPH Energy Audit and Preliminary Design
10.4	IPH Marketing Information Dissemination
11.0	IPH Consumer Financial Assistance Program
11.1	IPH Financier/Consumer Needs Analysis
11.2	IPH Financial Package Development
11.3	IPH Consumer Information Dissemination
11.4	IPH Lender Assistance
11.5	IPH Consumer Financial Assistance
12.0	IPH Industry Solar Promotion and Customer Assistance Program
12.1	IPH Consumer Assistance
12.2	IPH Solar Promotion
	INSTITUTIONAL AND LEGAL BARRIERS
13.0	IPH Government Coordination Program
13.1	IPH Government Coordination
14.0	IPH Tax Program
14.1	IPH Tax Study
14.2	IPH Model Tax Legislation
14.3	IPH Solar Tax Council
14.4	IPH Tax Information Dissemination
15.0	IPH Legislation Program
15.1	IPH Legislation Study and Model Legislation
15.2	IPH Industrial Fuel Allocation Legislation
16.0	IPH Legal and Regulatory Program
16.1	IPH Legal and Regulatory Assessment
16.2	IPH Model Code and Regulation
16.3	IPH Legal and Regulatory Information Dissemination

Program Number	Program Title
17.0	IPH State and Local Government Interface Program
17.1	IPH State Government Information Transfer
17.2	IPH Local Government Information Transfer
18.0	IPH Federal Government Interface Program
18.1	IPH Federal Government Information Transfer
	PRODUCT DEFINITION
19.0	IPH Technology Development Coordination Program
19.1	IPH Technical Program Coordination
20.0	IPH Target Industry Design Program
20.1	IPH Industry Generic Systems Analysis
20.2	IPH Target Industry Design Model
20.3	IPH Target Site Design Competition
21.0	IPH Demonstration Program
21.1	IPH Demonstration Management
21.2	IPH Demonstration Installation Analysis
21.3	IPH Demonstration Promotion
22.0	IPH Demonstration and Data Support Program
22.1	IPH Installation, Data Acquisition, Monitoring and Performance Analysis
22.2	IPH Industry Technical Information Transfer
22.3	IPH Component Testing and Recommendation
23.0	IPH Industrial Product/Process Restructuring Program
23.1	Product/Process Redesign Development
23.2	Product/Process Redesign Analysis
23.3	Product/Process Redesign Marketing
24.0	IPH Woody Biomass Program
24.1	IPH Woody Biomass Industry Survey
24.2	IPH Woody Biomass Design and Analysis Team

INTRODUCTION:

Industrial Process Heat (IPH) has been identified as one of the highest priority areas for near-term solar energy commercialization. It is estimated that on an annual basis 0.6×10^{15} Btus of energy could be saved by solar by 1985 and 7.0×10^{15} Btus could be provided annually by the year 2000.

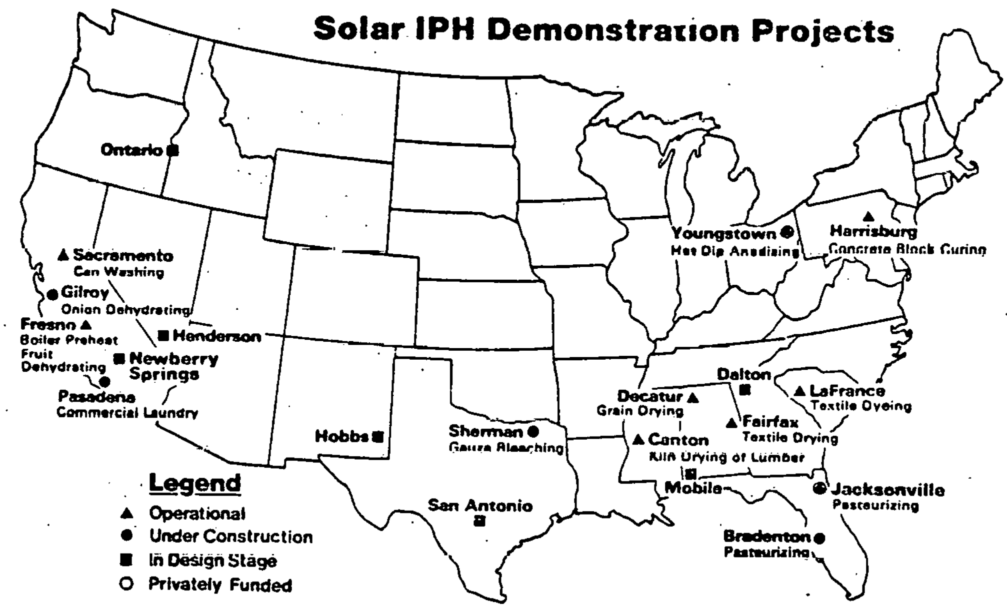
The industrial process heat market has several advantages which include:

- o The relatively large size of the market in energy-savings potential provides a broad base for a solar energy industry.
- o The potential users can be easily identified allowing inexpensive marketing.
- o The large size of each installation allows significant impact on energy by even a relatively few installations.
- o The relatively stable year-around industrial energy demand allows high solar system utilization factors resulting in low costs for solar-supplied energy.
- o The large size of each solar installation allows lower system costs due to economics of scale.
- o Qualified operation and maintenance people can be trained from existing plant personnel, reducing operating expenses.
- o Collector systems can often be put on flat roofs available at many plant sites.
- o The aesthetics of solar energy systems are usually not important to industrial users.

- o News of successful installations travels fast in the industrial sector; potentially fast market penetration can be provided given product viability.
- o Industry communication means are inexpensive and efficient which allows for a low cost marketing program.

The Mid-American Region accounted for 29% of all industrial energy consumption in the United States. The Region is sensitive to fuel shortages; it was severely affected by natural gas cut-offs in 1977 and in 1978, for example. The Region has a concentration of high-energy industries containing over 40% of the primary metals and 34% of the stone, clay, and glass industry. The Region contains 42.5% of the food processing industry which, is the most single promising industry for solar energy applications.

The Department of Energy has over 20 IPH demonstration projects in the United States, but only one in the Mid-American Region. These demonstration projects include textile drying, pasturizing, can washing, laundering, bleaching, kiln drying, concrete block curing, food dehydrating, and anodizing. The projects are shown on the following map. A more complete list can be found in the Appendix.



MARKET CHARACTERIZATION

Usage

The industrial sector uses about 40% of the national energy production compared with 20% used by the residential sector, 15% by the commercial sector, and 25% by the transportation sector. In the industrial sector, the breakdown of energy end uses is as follows

Energy Use	Percentage
Process Steam	40.6
Electric Drive	19.2
Electrolytic Processes	2.8
Direct Process Heat	27.8
Feedstock for Chemicals	8.8
Other	0.8
	100%

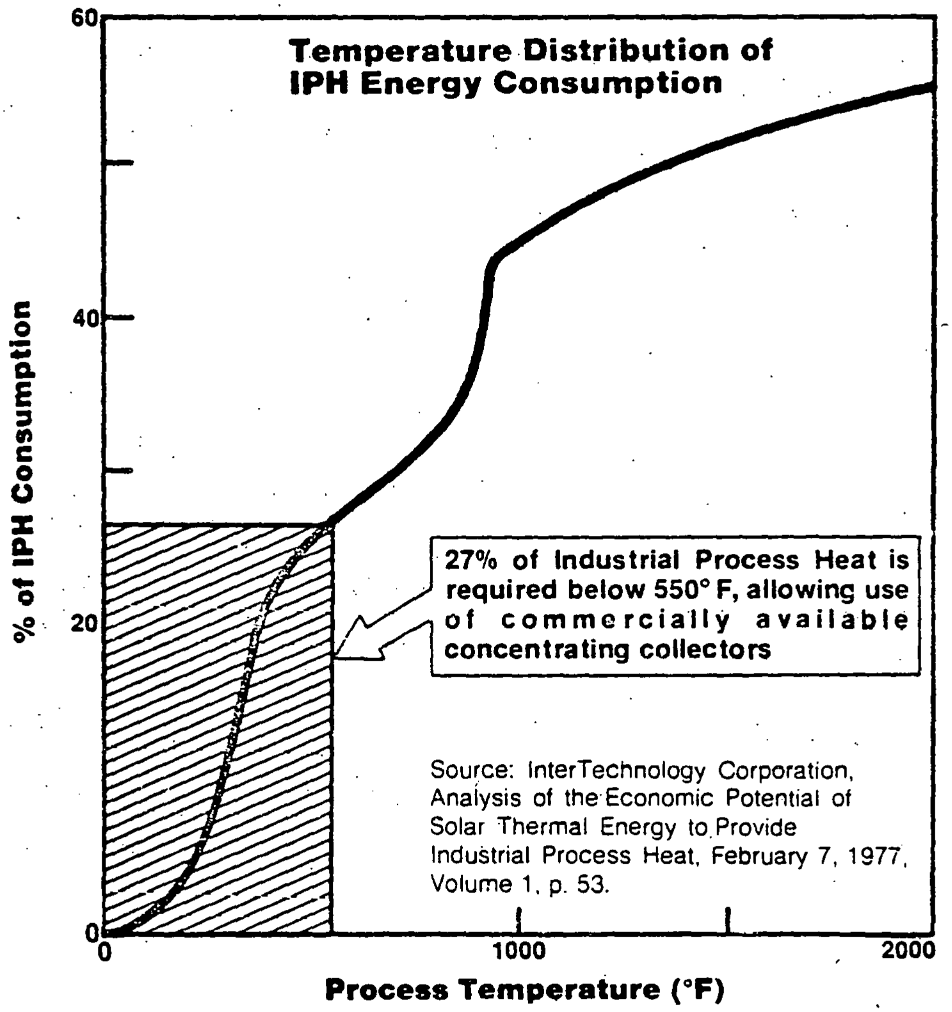
Process steam and direct heat together account for more than 67% of the total demand.

The Mid-American Region is characterized by a large usage of coal and a low usage of oil compared to other regions. The regional demand by fuel type in the MASEC Region is broken down as follows:

	10^{12} Btu Primary Fuel Consumption	Percentage (1974)
Coal	1636	32.4%
Oil	432	8.6%
Natural Gas	1789	35.9%
Petroleum	322	6.6%
Electricity	572	11.3%
Other	264	5.2%
	5045	100%

Temperature

The temperature requirements of industrial process heat span a range of $100^{o}F$ to $4000^{o}F$. Direct heating requirements ($T < 550^{0}F$) represent 37% of the energy used. This is the maximum temperature range which is economically attainable using commercially available solar technology. If preheating from $60^{o}F$ is included, then over 55% of the total demand could theoretically be provided by solar energy systems. The following graph shows industrial energy used by temperature range.



Top Energy Markets

Industrial utilization of IPH is concentrated in only six industries which make up over 80% of the industrial demand. These top industrial users are:

Industry	Service Demand (10^{12} Btu)	Percent of U.S. IPH Energy Usage	MASEC Region % of National
Primary Metals	4876	27.5%	40.3%
Petroleum Refining	3052	17.2%	18.8%
Chemicals	2867	16.2%	12.5%
Paper and Allied Products	2220	12.5%	13.6%
Stone, Clay, Glass	1299	7.3%	34.3%
Food Processing	940	5.3%	42.5%

From the preceeding table it is evident that the MASEC Region has a high concentration in the primary metal industry; the stone, clay, and glass industry; and the food processing industry.

When combining the factors of total energy usage and temperature range of energy usage within an industry, the picture changes significantly. Most of the process heat used in the primary metals industry and in the stone, clay and glass industry is used at high temperatures (exceeding 350°F). The target industries in the MASEC Region having large energy demands at temperatures potentially achievable by solar collectors are chemicals, paper and food industries. The following table shows the market potential for direct heating applications under 350° F.

Target Industries

Industry	Service Demand 10^{12} Btus	% Under 350°F Direct	Direct Btu Available Under 350°F	Mid-American Region as % of U.S.	Region Service Demand <350°F 10^{12} Btus
Primary Metals	3071	4.8	174	43.9	76
Petroleum	1848	5.9	109	9.7	11
Chemicals	1447	82.6	1195	17.9	214
Paper	1083	93	1007	21.9	221
Food	429	78.7	338	42.3	143
Stone, Clay, Glass	355	6.8	24	33.2	8
Textiles	121	94.3	114	2.0	2

To capture the near term markets, low temperature applications which use energy at less than 250°F are more cost effective than higher temperature applications. Further analysis and comparison of the chemical, paper, and food industries in the MASEC Region reveals that the food industry has by far the most energy demand in low temperature ranges.

	Energy Usage (MASEC Region 10^{12} Btu)	% Demand 217°F	Total Required Demand 212° F 10^{12} Btu
Paper & Allied Products	302	< .2	< .6
Chemicals	464	< .1	< .5
Food & Kindred Products	398	67%	267

From the table, it is evident that in the MASEC Region the food processing industry is the best near term market.

IPH Demonstration Selection Criteria:

The applicability of solar energy to industrial process heat varies widely with the specific industry, process and even plant site. A marketing program in IPH must be very specific in its direction and the specific criteria must be very selective. However, for maximizing the impact of a demonstration, the site selected must be widely applicable. A summary list of selection criteria is as follows:

Industry Selection Criteria:

1) Industry uses large amounts of energy.
2) Industry can use energy at temperatures which can be delivered by a solar energy system.
3) The industry should not expend significant usable waste heat at solar energy system deliverable temperatures since such waste heat could be used in place of solar heat.

Plant Site Selection Criteria:

1) The area available for the solar system at the site should be sufficiently large.
2) If located on existing structures, the collector site should not require excessive reinforcement of structure to support the solar system.
3) The cost of land should be low.
4) The plant fuel could should be high.

Process Selection Criteria:

1) For a demonstration, the application of solar to a particular proess shall be easily adaptable to other processes.
2) The process should not be so inefficient that changing or altering the process or its components would make solar energy uneconomic.
3) The process temperature should be as low as possible.
4) Ideally, the process should be able to handle changes in temperature of the delivered energy.
5) The demand for energy should be as constant as possible throughout the year.

Selected Markets in the MASEC Region

A review of existing literature identifies the industries and processes described below as having the maximum potential for conversion to solar energy in the Mid-American Region. This selection is based on the temperature and form of the process heat inputs which are primarily hot water at 212°F and hot air at 212°F. A few applications also use steam 212-350°F.

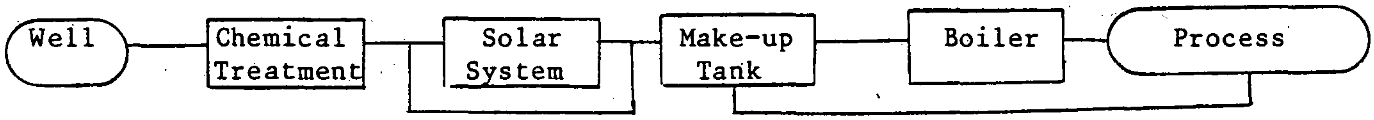
Target Industries and Processes

1) Processes in the automobile and truck manufacturing industry including preparation for paint, paint-make-up air, solder make-up, oven baking and washing.
2) Rinsing and washing applications in the glass industry.
3) Processes in the lumber industry including low temperature air for kiln drying and hot water for log conditioning (pre-cutting).
4) Stock preparation and paper making applications in the paper and pulp industry in plant which do not have on-site electric generation.
5) Processes in the food industry including hog slaughtering, pork processing, wet corn milling, soybean oil manufacturing, milk and whey drying, and rendering plants.
6) Special high temperature applications which have potential for energy savings by using solar to meet energy requirements at the lower end of the temperature scale, such as in preheating of boiler feed water.
7) Sugar processing low grade steam, pulp drying and pulp press heating.
8) Mineral drying such as asphalt rock aggregate.

Market Example: Make-Up Water Preheat for Boilers in Meat Rendering Plant:

Meat rendering plants often use huge amounts of water, usually at a constant rate of demand. The meat rendering process is characterized by (1) water-heating in a boiler and (2) the resulting steam being used directly in the rendering process. If the make-up water is well water at 60°F and the percentage of the water (condensate) returned to the boiler is low, the process is an ideal application for solar energy. The process also has extremely wide applicability as boilers are used in most industries. In some cases, well water could be pumped directly to the boiler from the solar collectors making a heat exchanger unnecessary.

Boiler Water Preheat Without Heat Exchanger



As an application for solar energy, boiler water preheating has several advantageous characteristics:

1) Low water temperatures results in high collector efficiency because of very low heat loss in the piping system and in the collectors.
2) Low pressure requirements (make-up water tank can be vented) resulting in reduced piping costs.
3) High percentage of water used directly in the process requiring a high percentage of low temperature make-up water.
4) Constant heat demand of operation producing a smooth load and increased collector efficiency.
5) A direct heating system eliminating heat exchanger thermal losses and extra equipment costs.
6) Little or no extra storage due to the constant load.
7) Low collector costs because of the low temperature and pressure requirements.

Concerns

As noted in the table on decision makers, the major concerns of industrial management are financial as measured by return-on-investment criteria; reliability as measured by downtime, operating and maintenance costs; and equipment life. As important as the reasons for purchasing are, the reasons for not purchasing are as important even though they are more subtle. These reasons include: insufficient capital, too much time and personnel to be used during the system acquisition and installation period, and insufficient importance of the project compared with other concerns. Fear of being first and making a serious mistake with a technology new to an industry, as would be solar energy, is a major unspoken factor which delays the utilization of solar energy systems. The net result is that, in the initial stages at least, solar energy must have benefits over and above a sufficient payback to be installed at any particular plant. For some, the public relations benefits are sufficient to overcome these fears, but for others, in fact the majority, solar energy will come only when their sister plant or competitor has it.

Method of Contact

In the proceeding table, the methods of contact included mass media, trade associations, trade magazines, shows, conferences, seminars, and direct contact. Because the advantages of IPH are industry sensitive, the most cost-effective means of communication in terms of numbers of potential customers contacted per dollar are those associated with a particular target industry. The most effective intra-industry communication links are trade associations, magazines, shows, and conferences in which the presentations can be tailored to the users. As with most purchases involved large dollar amounts, direct contact is necessary to make things happen. However, when an installation does occur news travels fast within an industry.

IPH BUYER PROFILE:

People

Commercialization involves marketing and a prerequisite for any marketing program is an understanding of the needs of the buyer. The actual purchase may involve several levels in a corporation, from the chairman of the board to the purchasing agent. Each member of management, depending on his/her level or responsibilities, views solar energy from a different perspective. To promote solar energy, each buyer's perspective must be taken into account. The concerns of the individuals which are in the approval process are listed in the following table:

TYPICAL INDUSTRIAL DECISION MAKERS

CONTACT	CONCERNS	POSITIVE TYPE DECISIONS	METHODS OF CONTACT
BOARD OF DIRECTORS	IMAGE, PROFITABILITY	INVESTIGATE SOLAR	MASS MEDIA
PRESIDENT	PROFITABILITY, RISK	ENERGY HAS HIGH PRIORITY, ASSURE FUEL SUPPLY	DIRECT GOVERNMENT CONTACT
FINANCE COMMITTEE	PROFITABILITY	"LIFE CYCLE" COSTING IS ACCEPTABLE	FINACIAL SEMINAR
DIVISIONAL MANAGER	PRODUCTION, PROFITABILITY	PAYBACK IS SUFFICIENT	INDUSTRY ASSOCI-ATIONS, TRADE SHOWS
ENGINEERING MANAGER	RELIABILITY	SOLAR IS RELIABLE	ENGINEERING ASSOCI-ATIONS, SEMINARS, CONFERENCES
ENGINEER	WORKABILITY	SOLAR WORKS	DIRECT MAIL SALESMEN
PURCHASING AGENT	VENDOR VIABILITY	VENDOR IS ACCEPTABLE	SALESMEN RATING SERVICES

METHODOLOGY OF PROGRAMMING:

Many functions must be performed on a regional basis to aid the commercialization of solar energy. However, because the need for energy is pervasive, the effects on the entire socio-economic system must be taken into consideration before a major governmental action can be made. The first step in making a change is to identify the problems. This step often requires a survey. If a zoning law is deemed to be restrictive, the effects of its removal should be considered. First, it is necessary to know why the law was originally passed; second, it is necessary to know what the effects of the change will be. The second step, assessment of the implications of the alternatives to questions such as these, requires that an impact study be made. The third step involves answering these questions, or, if no definitive answer exists, then the recommendation of alternatives. The fourth step is to promote the recommendations to the people who can make the changes. In this example, it is a zoning commission. The fifth step is to promote the results, a favorable ruling, for example, to the people who will act on the knowledge. In this case, it is the owners of homes, businesses or factories located in the zone.

This step by step process of making changes is the underlying methodology of the core Industrial Process Heat programs which follow. In some cases, it is assumed that the problem is known or the solution is known or the change has been made and all that is left to be done is to promote these facts. If the program description contains names like the data gathering, needs survey, or information acquisition, then <u>determination of the problem</u> is the program. If the words are analyzed, assessed, determined or the like, <u>the solution or alternatives generation</u> is the program. If the name is state, local or federal government marketing, the program is promotion of changes and if the names are information dissemination or buyer marketing the program is promotion of results. The sixth step is to see if the required results happened. This step goes by the name Evaluation Measures in this paper.

PROGRAM ORGANIZATION:

The Mitre/Metrek program organization of NPAC classifies programs into four categories: Industrial Infrastructure Development, Market Development, Institutional and Legal Barriers, and Product Definition. This structure, which organizes programs around function, was slightly modified to the present organization with programs organized around marketing and product development.

Organization by market allows programs to be directed towards a single type of constituency. A normal marketing organization has one constituency, the consumer, towards which to direct its marketing and advocate its products. The Regional Centers have three constituencies: the consumer, the government and the solar industry. Using this tripartite marketing organization, each category of programs can be directed toward the same types of individuals allowing an easily managed approach in terms of contacts, position on issues, and advocacy of solar energy. As an example, an individual marketing to a solar manufacturer is an advocate who can supply the manufacturer with designs, training programs, financial assistance, and other benefits. He is an advocate for the manufacturer to the government and to the consumer. On the other hand, in consumer marketing, the advocacy is for the consumer. In some cases, the consumer advocate must recommend a second manufacturer for the purchase. The difficulty of playing both roles is evident.

<u>Industrial Infrastructure Development</u> (Solar Industry Marketing) This category includes programs directed toward the means of production and distribution of solar energy systems. The major actors in this group are manufacturers, distributors, architects, design engineers, contractors and installers. Lenders to any of these actors are included in this category.

Market Development (Consumer Marketing): The programs in this category are concerned with aiding the end users or potential buyer. The actors in this group are industrial executives, plant engineers, operating engineers, maintenance engineers, and the lenders to the buyer.

Institutional and Legal Barriers (Government Marketing): The programs in this category are directed toward the state, local, or federal government. The government actors include DOE, SERI, national laboratories, Congress, federal regulatory agencies, state energy agencies, state legislators, state planners, municipal boards, mayors, and other government officials impacting solar energy utilization.

Product Definition (Technology Development): The programs in this category are directed toward improving the knowledge or the technology of industrial process heat solar energy systems. Demonstration programs for sales purposes are included in this category because the technology is presently available and every demonstration is expected to provide much performance, reliability and economic data.

Program Coordination:

Since all solar Industrial Process Heat programs have a similar objective, to accelerate commercialization, they must be performed using an organized and coordinated management system. Overall program management must ensure a minimum of duplication and a maximum of synergism between programs. Information, technical data, skills, design tools, and instructional materials must be freely transmitted between programs. Design of this exchange forms an integral part of the program coordination function.

The first program of each major section is a coordination program which has the objective of managing the inter-relationships of the several programs within the single category. The program may be considered a management function; however, program coordination is a major function of a Regional Center. Coordination between each category is also a management function and is summarized as follows:

Solar Industry/Consumer Program Interface:

The solar industry program must closely interface with the consumer programs. For example, data collected in the consumer analysis programs would be useful to solar manufacturers in designing products and promotional activities. The market analysis and advertising and promotion programs would also be useful to manufacturers and distributors and should be performed with their knowledge and support. In return the solar industry should provide detailed information on available equipment so that valid design recommendations can be made.

Solar Industry/Government Program Interface:

The solar industry should be made aware of existing and proposed tax incentives, regulations and funding availability for solar IPH projects. Periodic program status reports should be made to manufacturers, distributors, and architects' and engineers' professional associations.

Solar Industry/Technology Program Interface:

The technical programs must provide information and data directly to industry in order to assist in product improvement. Demonstrations should be designed to help generate sales. For this reason interaction with industry is essential in planning, constructing and evaluation IPH demonstrations.

Consumer/Government Program Interface:

Implications of existing and proposed legislation affecting solar IPH should be disseminated to industry executives and trade associations. The financial advisory council must have extensive government contacts in order that it be continuously aware of regulatory actions and decisions affecting the financing and economics of solar IPH applications.

Consumer/Technology Program Interface:

Potential buyers should be aware of demonstration programs and contacts among present and prospective installation owners should be facilitated. Demonstrations should be advertised and promoted to maximize their impact on the industrial community.

Promoting Sales in Industrial Process Heat

The goal of increasing utilization of solar energy requires the adoption of a marketing philosophy. IPH marketing should not only include advertising and promotion, it should include assistance in making sales. The ultimate measure of program effectiveness involves the amount of energy saved and such savings require the purchase and use of solar energy systems. The most effective means of increasing solar purchases is direct sales assistance. The IPH programs are designed with the combined purpose of not only providing technical information but also of making the buying and selling of solar energy systems easier. The objective of these programs is to motivate people to act.

An actual IPH solar equipment sale involves the following five steps: attention, interest, desire, conviction, and close. Each step must be completed before the succeeding step is started and each step applies to solar energy as follows:

1) Attention--Getting the buyers attention can be accomplished by many methods; however, trade shows, magazines and other mass media are normally used.
2) Interest--Gaining interest involves more intimate contact and usually requires trade shows and conferences or even word of mouth.
3) Desire--At this point, generalized meetings cannot be used. Desire must be accomplished with personal contact. Obtaining desire requires advocacy of a particular system for a specific plant. The IPH marketing programs are designed to reach this point in a sale.
4) Conviction--To get conviction, all fears must be overcome, all points answered and all objectives satisfied. For this reason, many programs must be run simultaneously as the neglect of a single barrier will stop the sale.
5) Close--The close will come easily and quickly if the proceeding points are completed and a programmatic objective will be reached.

Program Content - Regional Input

Concepts for programs presented in the industrial process heat section included inputs from many regional sources and in particular, the regional planning meeting held on April 16-18, 1979 at the MASEC Center. This regional planning meeting, termed the "boiler room", is described in the buildings sector of the NPAC document submitted by MASEC.

During this meeting, two groups were formed to generate program concepts for the industrial process heat market sector. The groups of approximately 15 people each were organized into a morning and afternoon session. The two sessions produced 40 program titles from which 21 program concepts were written.

The program concepts were ranked on a scale of 0% to 100% of the total possible number of points. Each program was scored by each group member according to the following weighting system: A (4 points); B (2 points); C (1 point); and D (0 points). Following this ranking procedure, the programs were grouped according to the activity type, the number of programs, the average program percentile, and the product of the latter two categories.

The group consensus is that the tax, education, and legal programs need to be emphasized in furthering the commercialization of solar energy in the industrial process heat sector of the economy. This does not necessarily follow for the other sectors of the economy.

Specific problems of industrial process heat were addressed by programs designed to alleviate the problems. Those programs which could conceivably be implemented by a regional solar center are integrated with the following programs. The entire set of program concepts and titles is included in the Appendix. The following table summarizes the results of the regional meeting.

Program Summary Ranking

Activity	Examples	No. of Programs	Average Program Percentile	Program Percentile No. of Programs
Tax	Incentives Depreciation Leasing write-off	8	59	472
Education	Information Training Programs Continuing Educ.	4	78	312
Legal (non-tax)	Fuel Allocation Efficiency standards	3	62.5	187
Baseline Data	Actual Use Characteristics	2	63.8	128
Technical Development	Storage system	1	80	80
Demonstration	Actual Installation	1	75	75

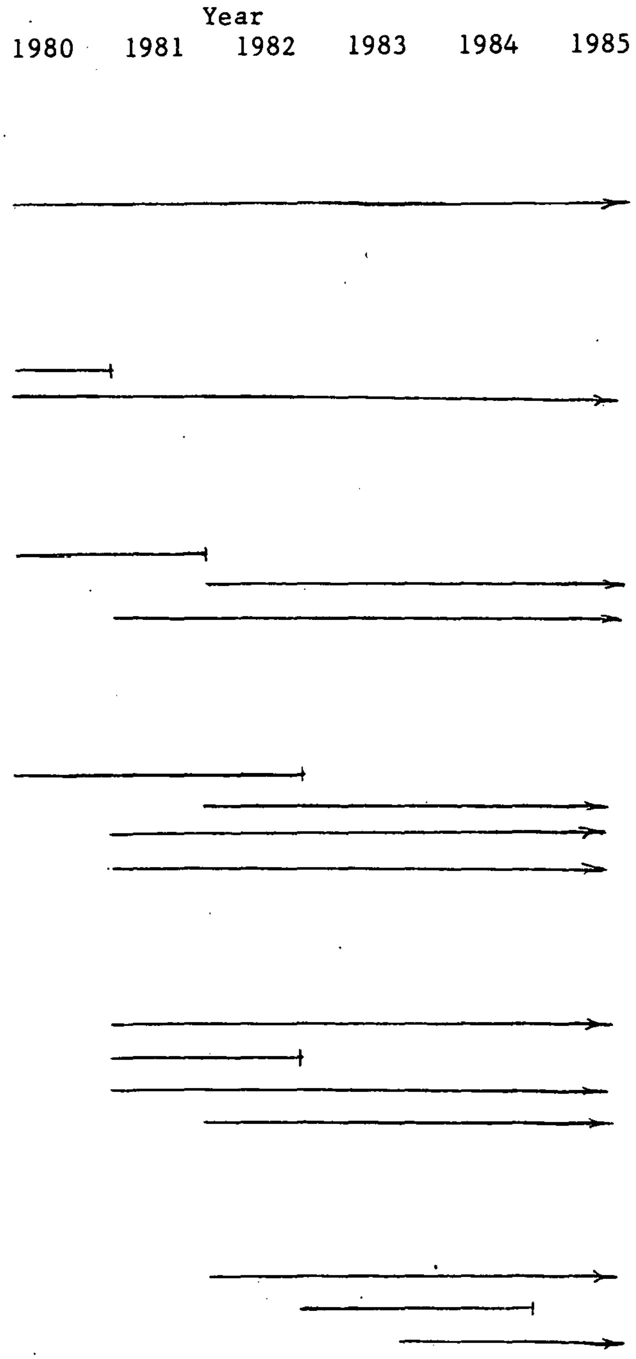
SOLAR INDUSTRIAL PROCESS HEAT

SUMMARY OF RESULTS

PROBLEM	PROGRAM
Initial High Cost	- Tax credit - Subsidy
Low Return on Investment	- Tax shelter - Accelerated Depreciation - Fossil Fuel Tax Disallowance
Better Alternative Use of Capital	- Leasing Program
Lack of Knowledge	- General Information Dissemination Executive Awareness
Applicability Plant Specific	- "Target of Opportunity" Survey
Major Concern with Availability - Not Cost	- Guidelines for Priority Fuel Usage Import Quota on Fuels
Lack of Operating Knowledge	- Maintenance/Plant Engineer Training
Lack of Construction Knowledge	- Professional Engineer/Architect Training
Lack of Buyer Confidence	- Industrial Process Heat Demo.
Avoidance of "New" Technology	- Non-taxable Dividend for Solar Company Stockholders
High Fossil Fuel Energy Usage by Industry	- Industrial Product/Product Re-structuring

PROGRAM PHASING

Industrial Infrastructure Development



1.0 COORDINATION

1.1 Solar Industry

2.0 INDUSTRY MARKETING

2.1 Research
2.2 Information Dissemination

3.0 FINANCIAL

3.1 Financial Analysis
3.2 Venture Capital Corp.
3.3 Financial Report

4.0 ARCHITECT & ENGINEERING

4.1 Data Acquisition
4.2 Design Tool Development
4.3 Information Dissemination
4.4 A&E Marketing

5.0 CONTRACTOR & INSTALLER

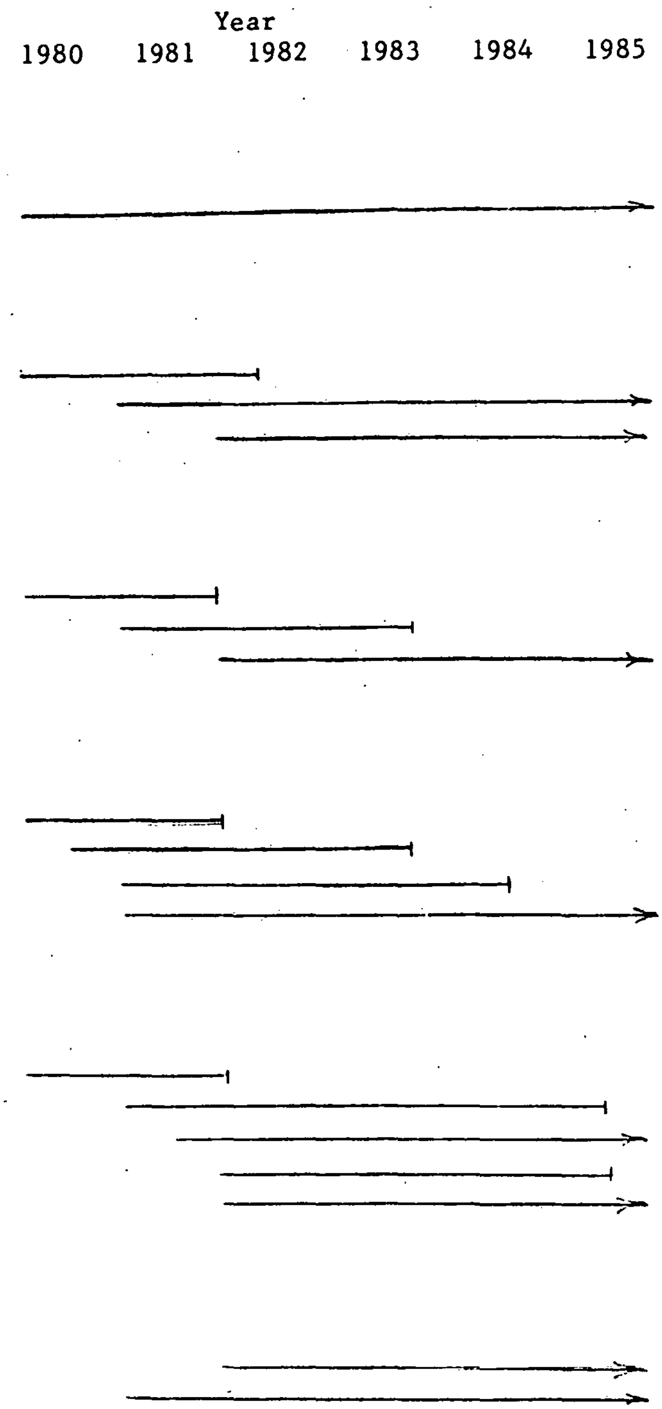
5.1 Data Acquisition
5.2 Manual Development
5.3 Information Dissemination
5.4 Workshops & Assistance

6.0 OPERATION & MAINTENANCE

6.1 Data Acquisition & Analysis
6.2 Program Development
6.3 Workshops

PROGRAM PHASING

Market Development



7.0 COORDINATION

7.1 Consumer Marketing

8.0 EXECUTIVE AWARENESS

8.1 Program Development
8.2 Advisory Council
8.3 Industry Speaker

9.0 CONSUMER AND ECONOMICS

9.1 Economic Analysis
9.2 Consumer Survey
9.3 Consumer Analysis

10.0 TARGET MARKET

10.1 Market Survey
10.2 Feasibility Workshops
10.3 Audit and Design
10.4 Information Dissemination

11.0 FINANCIAL ASSISTANCE

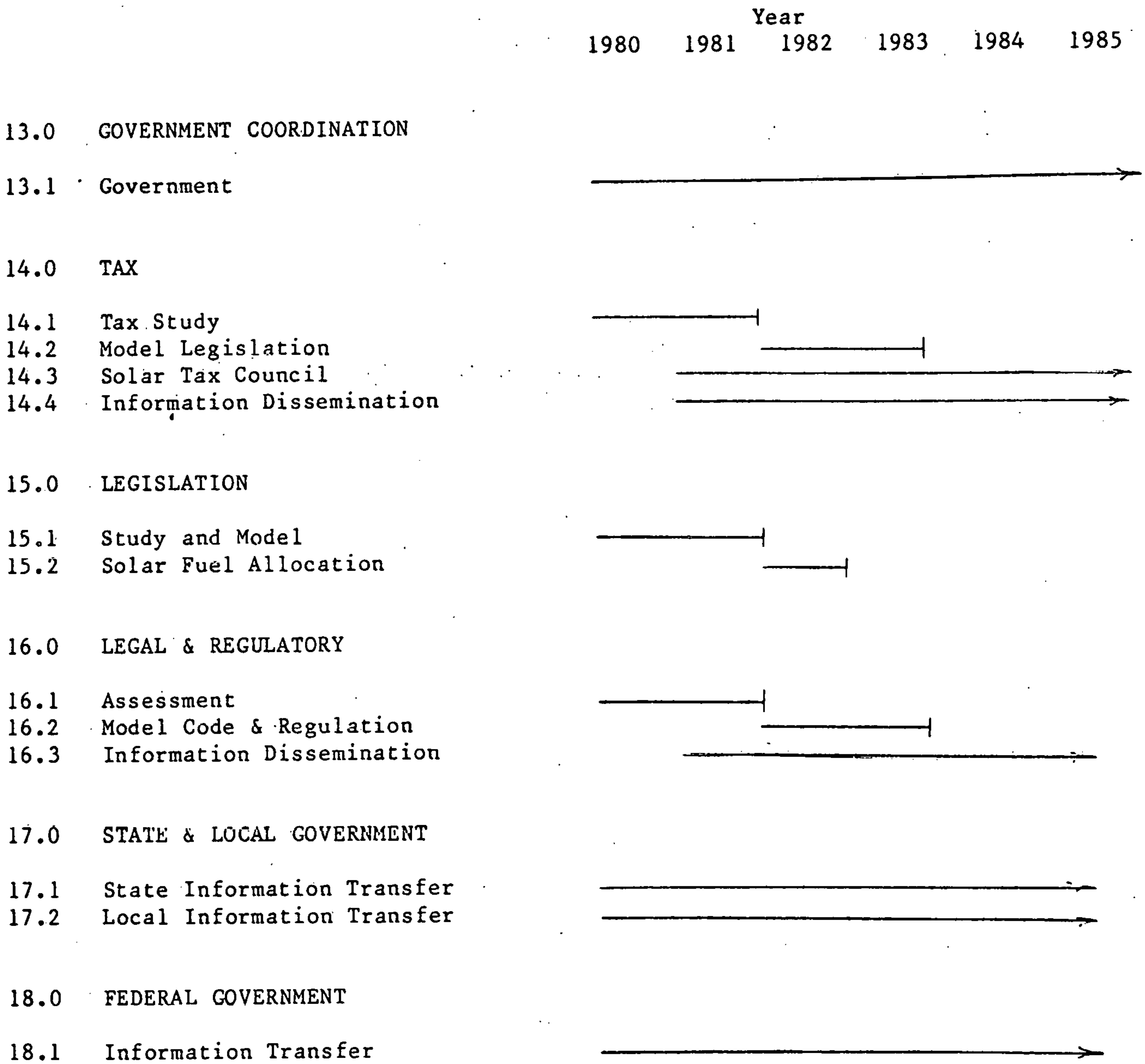
11.1 Needs Analysis
11.2 Package Development
11.3 Information Dissemination
11.4 Lender Assistance
11.5 Consumer Assistance

12.0 PROMOTION AND ASSISTANCE

12.1 Consumer Assistance
12.2 Solar Promotion

PROGRAM PHASING

Legal and Institutional Barriers



PROGRAM PHASING

Product Definition

Year: 1980 1981 1982 1983 1984 1985

19.0	COORDINATION
19.1	Technology Development
20.0	TARGET INDUSTRY DESIGN
20.1	System Analysis
20.2	Design Model
20.3	Site Design Competition
21.0	DEMONSTRATION
21.1	Management
21.2	Installation Analysis
21.3	Promotion
22.0	INSTALLATION DATA SUPPORT
22.1	Analysis
22.2	Information Transfer
22.3	Testing & Recommendation
23.0	PROCESS/PRODUCT REDESIGN
23.1	Design Development
23.2	Analysis
23.3	Marketing
24.0	WOODY BIOMASS
24.1	Industry Survey
24.2	Design and Analysis Team

PROGRAMS

INDUSTRIAL INFRASTRUCTURE DEVELOPMENT PROGRAMS

INDUSTRIAL INFRASTRUCTURE DEVELOPMENT

The IPH Programs described in this section relate to development of the solar industry. Because of the high capital investment in each IPH project, it is expected that the industry distribution channel serving the IPH market will be unique from that serving the other markets considered by NPAC. The programs described here are often of general applicability and during actual implementation may be adapted to the changing needs of the industry or incorporated into programs of other market sectors.

Program 1.0 IPH Solar Industry Coordination and Sales Assistance

Objective:

To maximize the total effect of all IPH programs directed towards the solar industry.

Rationale:

Solar industry-related programs must be approached in a consistent, logical manner to provide a unity of approach. Duplication of programs must be avoided and information exchange between programs must be promoted. The information directed toward one solar industry participant should be made known to other types of participants in order to increase understanding and cooperation. For example, a consumer survey performed in the consumer marketing/program would provide very beneficial marketing information for manufacturers and distributors of solar equipment.

Task Statement/Description:

1.1 IPH Solar Industry Coordination:

Industry analysis and financial programs should be made available to members of the solar community. Financial programs should take into account the needs of individual industries.

Training programs for architects, design engineers, and operating and maintenance engineers must be interrelated as each program contains much of the same information. Feedback from workshops and seminars should be transferred to the appropriate performer. Material from each program should be freely available to other performers in order to understand the approach taken by each.

Evaluation Measures:

The IPH solar industry coordination program manages other IPH programs; therefore the measures of success are subjective. Some subjective evaluation measures include: the degree of cooperation among programs; the amount of interchange of information between programs; the amount of duplication, consistency of approach, and overall evaluation of IPH solar industry program success as compared to its goals.

Related Programs:

- o IPH Consumer Coordination Program
- o IPH Government Coordination Program
- o IPH Technial Coordination Program
- o Commercial/Residential Market Programs

Implementor:

MASEC

Program 2.0 IPH Solar Industry Marketing Program:

Objective:

To assist the solar industry in market research, marketing, and management. To monitor and assess the solar market.

Rationale:

The solar industry is new and has little experience and relatively few resources to research the market or make informed management decisions. With limited capital, individual companies can ill afford marketing or management mistakes and therefore good, timely information is critical to their success. The Regional Center can maintain information gathering capabilities and provide assistance based on the experienced companies.

Task Statement/Description:

2.1 IPH Solar Industry Research:

From a marketing viewpoint, an on-going program of surveying and assessing the solar manufacturer, distributors, and installers should be implemented. Products, service functions, component and system specifications as well as a description of services available, should be included.

2.2 IPH Solar Industry Information Dissemination:

Data collected on individual companies will be reported together with the products and services available. Analyses of business conditions relevant to solar will be published periodically.

Evaluation Measures:

The following methods may be used to evaluate the programs: number of contacts in the solar industry, number of new businesses, growth of the solar industry, survey of manufacturers, contractors, installers, etc.

Related Programs:

- Financial Services
- Consumer Analysis
- Market Analysis

Implementor:

MASEC

Program 3.0 Industrial Financial Assistance Program:

Objective:

To assist the solar industry in obtaining financing and maintaining corporate financial health.

Rationale:

The solar industry includes many new small firms which have difficulty obtaining financing. In addition, industrial process heat installations are large and complex and require large amounts of capital which may not be easily available even to established companies. Moreover, to obtain federal funding requires both knowledge of government rules, regulations, and procedures, and the capabilities of implementing the procedures. Many companies, large and small, do not have the existing capability to deal with the government; and learning to do so would require excessive manpower and capital to submit profitable yet competitive bids. The Region has the resources to aid the individual manufacturer, distributor, or architectural and engineering firm submit bids by helping each company learn what it needs to be successful

Task Statement/Description:

3.1 Financial Analysis Development:

A study must be made in order to provide individual companies with industry financial data. Industry information and requirements of financial institutions will be issued in an industry report which should be continuously updated to reflect changes in the financial situation of the industry. Data will be collected on corporate functions and will include sales, production, distribution, inventory, employment, and financial condition, if such data is available.

3.2 Venture Capital Corporation:

A venture capital corporation program should be set up to fund solar energy companies which cannot gain funding through normal channels. Such a corporation may be formed as a Small Business Investment Corporation (SBIC) in order to obtain government funding.

3.3 Industry Financial Report:

An industry financial report will be printed and updated. Model financial packages will be published and disseminated. Lists of financing institutions who have expressed interest in solar will be disseminated.

Evaluation Measures:

Financing programs can be evaluated by the number of loans granted, amount loaned, and replayment history of participants. Financial assistance programs can be evaluated on the changes in financial health of participating organizations. The proposal assistance programs can be evaluated on the number and amount of contract awards.

Related Programs:

- IPH Consumer Financing
- IPH Federal Government Marketing

Implementor:

MASEC, SBA, SBIC's, financial institutions, etc.

Program 4.0 IPH Architect and Engineering Training and Assistance Program:

Objective:

To train architects and engineers in the planning, engineering and design of solar energy systems and to increase the industry confidence in the solar energy system design capabilities of these professionals.

Rationale:

Solar potential being heavily dependent on site specific characteristics requires specialized capabilities of architects and engineers. The novelty of solar industrial energy systems makes industry skeptical of the capabilities of architects and engineers who are uncertified in solar. A program to train and certify representatives of A&E firms would increase their professional credibility with industrial firms. In addition, confidence in solar energy in general would increase as fewer errors in engineering would occur. Awareness of requirements for economical solar installatins may cause architects and engineers to make recommendations for immediate modifications to non-solarized firms of which they have knowledge.

Task Statement/Description:

4.1 IPH Design Data Acquisition:

Designs of existing solar IPH installations should be collectively acquired and catalogued.

4.2 IPH Design Tool Development:

Design tools for component selection, engineering, and/or components integration should be developed. Such design tools should be utilized with climatic data, solar insolation and other geographically specific factors in order to provide complete design tool packages.

4.3 IPH Architect and Engineering Information Dissemination:

A comprehensive catalog of system and component designs should be developed. This data bank should include information necessary to implement the engineering of such designs Courses should be assembled and curricula written for solar IPH applications; energy courses should be provided in architect and engineering professional education programs.

Design literature such as graphs and tables should be published and disseminated to A&E firms. Design calculators, computer programs, slide rules, and other hardware should be reproduced and disseminated to A&E firms. A program to dispense these design tools to libraries and to the SEIDB program should be instituted.

4.4 IPH Architect and Engineering Marketing:

Seminars and conferences should be held to explain the value and availability of the design data bank and accompanying design tools. Speakers and guest lecturers should be provided to architect and engineering colleges. Continuing education curricula and courses should be established for local chapters of architects' and engineers' societies.

Evaluation Measures:

The completion of A&E programs, the number of courses, and the number of graduates of solar A&E courses are measurements of success. The adoption of design tool standards by the professions are also yardsticks of success. In the long run, the number and size of installations utilizing techniques and standards learned in solar courses would be a significant measure of success.

Related Programs:

- Architects and engineers programs in Building Sector

Implementor:

MASEC, colleges, universities, A&E societies

Program 5.0 IPH Contractor and Installer Training Program:

Objective:

To improve the quality and number of solar installers and to reduce costs of installation.

Rationale:

By increasing the capabilities of the contractors in estimating costs and by increasing the knowledge of installers in installation methods, the learning time and the risks of doing busness should be reduced. In this manner, the costs of installing solar equipment should be reduced and the savings passed on to the customers. Without a program of this type, it may take years for individual contractors to obtain sufficient experience to reduce costs on their own. Also, by increasing the number of experienced contractors, competition will help keep prices down. In addition, more solar IPH installers can provide industry with sufficient personnel to meet future increases in solar demand.

Task Statement/Description:

5.1 IPH Contractor and Installer Data Acquisition:

A study is necessary to determine the most cost-effective methods of installation. A cost analysis of the effects of site, geographical, and system factors on installation cost is necessary. An on-going survey will provide updated costs and changes in construction techniques. New equipment on the market may require new analyses.

5.2 IPH Contractors and Installers Information Dissemination:

Installation data and costs should be organized and published. The contractors and installers manual should be updated every year. The publication should handle regional or state differences and program should be coordinated with other regional contractor and installer programs to minimize cost.

5.3 IPH Contractor and Installer Workshops and Assistance:

Installers should be provided with hands-on experience in costing, planning, purchasing, and managing the installation of a solar energy IPH installation. Individual contractors should be aided in quoting installation costs and submitting proposals for federal assistance.

Evaluation Measures:

The number of people attending workshops and requesting manuals will be the first measure of evaluation. A second measure will be surveys of the knowledge gained and the methods of installation used. A future measure will be estimating the reduction in the installation costs.

Related Programs:

- o IPH Programs: Financial Assistance, Program Coordination

Implementor:

MASEC, SEIDB

Program 6.0 <u>IPH Operation and Maintenance Training Program:</u>

Objective:

To provide trained personnel for the operation and maintenance of solar energy systems. To increase the confidence of present industrial operation- and maintenance personnel in the operability and reliability of solar systems.

Rationale:

One of the major barriers to the widespread use of IPH solar energy systems is the novelty of the system and the ensuing lack of confidence that such systems are reliable and can easily be operated and maintained.

One of the key advantages of solar in the industrial sector is the fact that most industrial plants have internal maintenance personnel. However, since most operating engineers do not have experience in solar, they are skeptical about its operation and maintenance. In addition, industrial management acknowledging the lack of qualified O&M personnel to run the solar equipment, have reduced confidence that the systems will continue to operate properly. If the company which installed the system had to train each individual operator for each installation, costs would prohibitive.

Task Statement/Description:

6.1 IPH Operation and Maintenance Data Acquisition and Analysis:

Operation and maintenance procedures must be developed to optimize the cost-effectiveness of solar IPH systems. Methods of operating the system including knowledge of each component and operating limitations as well as operating parameters for every mode of operation must be determined.

As much as possible, data should be acquired from actual installations. Developing information not presently available will be the objective of new testing or monitoring programs. Maintenance information should include component reliability and failure data. Data to determine the entire system overhaul schedule for preventative maintenance should be obtained.

6.2 IPH Operation and Maintenance Program Development:

Curricula for operation and maintenance programs should be developed. Operation and troubleshooting manuals for standardized systems should be developed and printed. Audio-visual and collateral materials for training should be prepared and these materials should be disseminated to libraries and other institutions. Operational models for practicing operation and control of solar IPH installations should be constructed.

6.3 IPH Operation and Maintenance Workshops:

Workshops and training sessions should be given to potential solar buyers. Operation and maintenance curricula should be provided to educational institutions, labor unions and industry associations. Actual practice control simulation should be provided; emergency procedures should be simulated as well.

Related Programs:

o IPH: A&E training program, contractor installer program

Implementor:

MASEC

MARKET DEVELOPMENT

PROGRAMS

MARKET DEVELOPMENT

Program 7.0 IPH Consumer Coordination Program:

Objective:

To coordinate all programs directed toward the IPH buyer; to maintain an interface with the industry and government marketing programs; to maintain knowledge of current state-of-the-art in solar industrial process heat.

Rationale:

Program coordination can minimize duplication of activities and facilitate the exchange of information between programs. Programs such as the operating and maintenance training program may be directed toward either the solar industry to help train instructors or towards the consumer to help train operators and maintenance personnel.

Task Statement/Description:

7.1 IPH Consumer Coordination:

The Consumer Analysis program must utilize feedback information from both the Executive Awareness programs and the Financial Assistance programs. Intimate knowledge of the people who make financial judgments must be included.

Evaluation Measures:

The subjective measures of success in coordination are extent of cooperation and information interchange among programs, and increased use of materials and information due to the coordination function.

Related Programs:

- IPH Solar Industry Coordination Program
- IPH Consumer Coordination Program
- IPH Technical Coordination Program
- Consumer/Residential Building Coordination Program

Implementor:

MASEC

Program 8.0 Executive Awareness Program

Objective:

To create in key executives a positive attitude toward solar energy and to increase their awareness of developments in the solar energy field.

Rationale:

A positive attitude towards solar energy by top company officials who influence the policy of large corporations can provide a major impact on the utilization of solar energy. In the past five years, the corporations having official policies favoring energy conservation have substantially improved their energy efficiency. A favorable policy toward solar energy would make selling solar to those companies easier. Also, IPH solar energy systems are in a price range that may require a presidential approval. The industries which consume most of the industrial energy are large which means that the effect of a top contact is enormous when multiplied over many company divisions with their numerous managers and engineers.

Task Statement/Description:

8.1 IPH Industry Program Development:

Programs and speeches on solar IPH applications must be developed and adapted to various industries. Such programs may include information from individuals who have bought, installed, or operated a solar installation. The program should include audio-visual aids and packages for presentations to both solar energy professionals and company executives.

8.2 IPH Industry Advisory Council:

Councils for corporate executives should be formed in key industries. Programs should be presented showing the technical as well as the economic aspects of solar energy. The programs should be designed to allow executives to make judgments of where in their company's plants potential solar appliations may exist. Council advice should be sought on desired changes in government policies, laws, and regulations which would make solar energy systems more attractive to industries.

8.3 Solar Energy Industry Speakers Bureau:

A speakers bureau must be established to make presentations to interested companies. The program must be capable of adapting presentations to various industrial applications.

Evaluation Measures:

The speaker's program can be evaluated by the number of presentations, number of inquiries and an attitude survey. The industry advisory council program may be evaluated by the number of solar purchases by companies represented on the council and by the implementation of council recommendations.

Related Programs:

- o IPH Industry Marketing Program

Implementor:

MASEC

Program 9.0 Consumer and Economic Research Program:

Objective:

To understand the buying needs, motives and general behavior of IPH buyers; to increase the efficiency of advertising and promotion; to aid development of program plans.

Rationale:

Commercialization is basically marketing, which involves all aspects of moving a product to a purchaser. Understanding the consumer is a prerequisite to making intelligent decisions about how the consumer will react to programs intended to facilitate his purchase. The customer's methods of doing business in areas such as purchasing, economic analysis, engineering analysis and corporate strategy vary by corporate size, type and condition of business. Knowledge of the business conditions as well as their effect on the solar customer is necessary for implementation of programs which are responsive to the needs of the customers. The discovery of shifts in consumer behavior could have a substantial effect on the programs of industry and government and must be taken into account either formally or informally to solar marketing programs.

Task Statement/Description:

9.1 IPH Economic Analysis:

Economic, technological and environmental factors which affect solar energy must be identified and analyzed on an on-going basis. These factors must be translated into policy recommendations for government, technological recommendations to solar users, and business recommendations to the solar industry. These factors should also be transmitted to other solar organizations to integrate into their marketing programs.

9.2 IPH Consumer Survey:

In addition to using information from other programs such as the Consumer Financial Assistance program or Executive Awareness program, an on-going program of interviews of potential buyers should be instituted. Such surveys could be integrated into a national information network which monitor the needs and desires of the prospective consumers. This program should look for attitude shifts and report these changes to government and industry.

9.3 IPH Consumer Analysis:

A methodology should be developed for a consumer analysis program which would invesitgate the industrial consumer attitudes, motivation, and relevant behavior. This program, whether using the phone surveys, in-depth interviews, questionnaires or other methods should indicate the relevant solar purchaser sub-markets or market segments. A market study should determine the most useful segmentation of the solar IPH market; for example, whether geographical location, collector size, collector pressure, collector type, plant size, plant age, and process type as well as standard industrial classifications are useful in describing the market and other pertinent indicators.

Evaluation Measures:

Part of this program is, in fact, an evaluation program in so far as attitudes and intentions of the consumer are measured. Initial methods of evaluating the program itself include number of people interviewed or surveys made. In the long run, the test of the program is how well it predicts behavior and helps increase solar commercialization.

Related Programs:

- Consumer Behavior Studies

Implementor:

MASEC, national market analysis firms

Program 10.0 IPH Target Market Program:

Objective:

To identify opportunities for utilizing solar IPH systems in the most cost-effective manner; to increase the effectiveness of government and industry marketing efforts.

Rationale:

The cost-effectiveness of solar IPH systems varies markedly by industries, geographical location, process, plant site, and numerous other factors. To make the best use of scarce resources in industrial and government labor and capital, the plants and processes which are the most promising individually or have the most impact regionally or nationally should be considered for solar IPH applications. By making a market survey, the best submarkets can be quickly and inexpensively discovered. Solar feasibility workshops can identify good plant sites at a low cost. Finally, an energy audit and preliminary design analysis can identify the best prospects for installations of solar IPH systems.

Task Statement/Description:

10.1 IPH Market Survey

A survey should be made to identify the most promising markets and sub-markets. The survey should examine in depth the most widely applicable and cost-effective applications by process for design surveys. Survey methodology, survey questionnaires and tools should be developed for making a quick, easy and inexpensive survey of energy usage, solar applicability, plant site feasibility, etc.

10.2 IPH Solar Energy Feasibility Workshops:

Workshops should be given to plant engineers, architects, and design engineers in which energy audits and preliminary design analyses are used to determine feasibility of solar energy at an individual plant.

10.3 IPH Energy Audit and Preliminary Design:

Energy audits should be performed in markets identified in the IPH market survey and/or discovered through the use of design workshops. Energy audit methods and standardized models should be developed. Detailed data should be gathered for input into computerized models for preliminary system designs. Such models would be developed in conjunction with the Architect and Engineering training program.

10.4 IPH Marketing Information Dissemination:

The results of market surveys should be compiled, analyzed and published and the findings should be distributed throughout the Region. Energy audit methods and results should be formatted and packaged for mass distribution. Materials for the solar feasibility workshops, including self-instruction manuals should be developed and disseminated in trade journals, trade shows, and other media.

Evaluation Measures:

Surveys can be evaluated by the number of respondants or cost per response. The quality of the survey can be determined by the relative cost-effectiveness of solar IPH at the surveyed plant in comparison to other plants in the industry. The solar energy feasibility workshops could be evaluated by the number of attendees.

Related Programs:

- IPH architectural and engineering programs

Implementor:

MASEC, architectural and engineering firms

Program 11.0 IPH Consumer Financial Assistance Program:

Objective:

To assist the purchaser of solar energy systems by providing financial information.

Rationale:

The purchases of solar IPH systems, costing hundreds of thousands of dollars, often requires the involvement of banks and other lenders. These institutions may not be familiar with solar energy and, hence, may reject loans for these unusual projects. The cost and the economy of a purchase is greatly affected by the method of financing. Should the purchase of a solar system adversely affect cash flow capital availability or profitability, the purchase would be rejected. By using several financing mechanisms corresponding to the needs of various users, the economic benefits of solar energy can be maximized.

Task Statement/Description:

11.1 IPH Financier/Consumer Needs Analysis:

A survey should be made to determine the financial qualifications of both potential consumers and potential lenders. The analysis should take into account the differing financial needs depending on the industry type, corporate size, and financial condition of the consumers. The survey should also determine how those needs could be modified by additional information, marketing or legislative changes.

11.2 IPH Financial Package Development:

Model financial packages should be developed to meet the needs of various kinds of buyers and lenders. Such model financial packages should include information for individual investors, SBIC's, lessors, banks and other institutional lenders. Model package types may include leasing, sale and leaseback, and lease purchase instruments. The models should take into account taxes, rules and regulations analyzed in other IPH programs. Leading financial institutions and consumers should review the model packages for legality and potential effectiveness in facilitating solar system financing.

11.3 IPH Consumer Information Dissemination:

Results of both the consumer and the financial needs surveys should be published. Recommendations for policy changes should be made to the appropriate government offices. Model financial packages should be published and disseminated to lending institutions and individuals. The programs should be published to lenders and potential solar customers. Project financial evaluation material should be developed and disseminated.

11.4 IPH Lender Assistance:

The programs and financial packages developed above should be promoted to lender and user groups through conferences, meetings, and seminars. Individual assistance should be provided. Energy and dollar savings of various types of systems and costs/benefits of a particular installation should be calculated and presented.

11.5 IPH Consumer Financial Assistance:

Financial information should be made available through workshops, conferences and seminars. The relative benefits of various types of financial packages should be explained and methods for calculation of return on investment, cash flow projections, equipment life, and operating and maintenance costs should be projected. In addition, information on subsidies and other available government financial assistance should be disseminated at the conferences.

Evaluation Measures:

A survey of needs can be evaluated by the number of people surveyed and cost per survey response. Financial packages can be evaluated by measuring the reduction in the cost of conventional energy used in a "solarized" industrial plant. The number of companies utilizing the financial packages is also a suitable evaluation measure. Assistance programs can be evaluated by the number of attendees and, ultimately, the number of attendees who buy solar or borrow money for solar applications.

Related Programs:

- IPH Solar Industry Financial Assistance
- IPH Tax Program
- IPH Subsidy Program

Implementor:

MASEC

Program 12.0 IPH Industry Solar Promotion and Customer Assistance Program:

Objective:

To increase user's awareness of solar energy; to increase user's confidence in the probable success of a solar installation.

Rationale:

Through a customer assistance program, the real needs of potential buyers can be met directly. Direct support of the potential buyer in evaluating his solar needs engenders confidence in the buyer and reduces his risk. Decisions favorable to solar can then be made more decisively and quicky. Widespread public awareness can be most cost-effectively achieved by using selected media. For example, industry magazines can directly reach clients who otherwise could not be contacted economically.

Task Statement/Description:

12.1 IPH Consumer Assistance:

Buyers of solar IPH systems should be aided in the selection of solar system hardware. A data book containing hardware and system performance information should be published. Operating and maintenance programs should also be included in the text. Computer programs, developed to aid in the selection of solar IPH systems, should be made available. Operation and maintenance problems of each system should be solved through engineering consultation or site visits.

12.2 IPH Solar Promotion Program:

The consumer assistance programs should be advertised in selectec trade magazines and periodicals. Program material of interest to potential customers should be repackaged and distributed. Design study information should be made available to consumers.

Evaluation Measures:

The number of inquiries made to the consumer assistance program is the first measure of success of the Solar Promotion Program. The Solar Assistance program can be evaluated by the number of companies assisted and the number and size of solar installations made.

Related Programs:

- IPH Financial Assistance Program

Implementor:

MASEC

INSTITUTIONAL AND LEGAL BARRIERS

PROGRAMS

Program 13.0 IPH Government Coordination Program:

Objective:

To maximize the combined effectiveness of programs involving interaction with local, state, and federal governments.

Rationale:

Each type of government, whether federal, state, or local, has similar functions which affect solar commercialization; these functions should be analyzed and assessed in a similar manner by a single program. However, effective marketing of solar energy requires program organization directed towards governmental units so that working relationships can be maintained with the key decision makers. Results of analysis and assessment programs can then be presented effectively to the government officials by the appropriate governmental marketing program.

Task Statement/Description:

13.1 IPH Government Coordination:

Interaction among the various levels of government should be facilitated. Within the federal government, the activities of various federal agencies and contractors should be monitored. Information obtained from the various government agencies and contractors should be transmitted to the tax, legislative, regulatory, and financial analysis programs. In a similar manner results from the analysis programs should be transmitted to the appropriate government.

Evaluation Measures:

Evaluation measures may be the number of laws passed or the number of barriers removed. For a coordination program, cooperation and interchange of information and materials and lack of duplication are measures of effectiveness.

Related Programs:

- IPH Solar Industry Coordination Program
- IPH Market Development Coordination Program
- IPH Government Interface Coordination Program

Implementor:

MASEC

Program 14.0 IPH Tax Program

Objective:

To assist in the preparation, passage, and promotion of tax incentives for solar industrial process heat applications; to monitor and assess the impact of existing taxes on solar IPH.

Rationale:

Existing local, state, and federal tax laws inhibit commercialization of solar energy. Return on investment is highly dependent on the schedule of depreciation since solar energy systems are capitalized and amortized over a period of years. By depreciating as soon after the purchase date or by expensing solar energy costs, the cost to the user becomes substantially less. Property taxes also increase the cost of solar energy; their elimination would substantially change the life-cycle costs of solar energy systems. As much as possible these detrimental taxes on solar should be eliminated.

Task Statement/Description:

14.1 IPH Tax Study:

A survey of the existing laws affecting solar IPH should be made. The effects of these laws, positive or negative, on the utilization of solar energy should be assessed. Taxation methods including accelerated depreciation, special tax credits, and fossil fuel usage taxes should be investigated. A survey should be made of the municipal property taxes in the Region. The feasibility of state tax credits for solar IPH users should be examined. Tax benefits for lenders or investors should be evaluated. Reduction or elimination of taxes on land covered by solar collectors should be examined.

14.2 IPH Model Tax Legislation:

Model tax legislation, which maximizes the benefits for the solar user should be drafted. The legislation should account for differing technologies and differences in local tax codes. Local property tax laws, value-added taxes, state and federal income taxes should be modeled. Proposed legislation to eliminate state and local sales taxes on solar should be drafted. Recommendations of solar tax council should be analyzed (see below).

14.3 IPH Solar Tax Council:

A tax council should be formed to formulate tax policies affecting solar energy. The council membership should include tax lawyers, businessmen, legislators and other affected individuals. The council should make recommendations for tax studies, legislation or regulatory changes to local, state and federal governments.

14.4 IPH Tax Information Dissemination:

Results of tax studies should be published and disseminated to appropriate government officials, tax lawyers and corporations. The tax studies should be included in the industry and customer assistance programs. Model legislation should be published and disseminated to appropriate government agencies.

Local, state, and federal government officials should be contacted using government interface programs.

Evaluation Measures:

The adoption of favorable tax laws is one measure of effectiveness; favorable changes in interpretation of existing tax laws is another.

Related Programs:

- IPH Legislation Program
- IPH Regulation Program

Implementor:

MASEC, Federal, State, and Local Governments

Program 15.0 IPH Legislation Study Program:

Objective:

To develop legislation favorable to the utilization of solar energy.

Rationale:

Legislation can play a key role in commercializing solar energy. For industry, the availability of energy is more important than its price, since energy is only a small part of most industries' operating budget but having no energy available means producing no products. Legislation which favors the use of solar energy would act to increase energy availability to industry creating a most compelling reason for installing solar IPH systems.

Task Statement/Description:

15.1 IPH Legislation Study and Model Legislation:

Legislation concerning solar should be monitored and its effects reported. Recommendations for legislation should be obtained from consumer, industry, engineers and interested parties on an on-going basis. The suggested actions should be assessed and model legislation should be developed from them.

15.2 Solar Related Fuel Allocation Study:

A study should be made to develop legislation which would provide more stable fuel availability for solar users. Incentives which should be studied include plant improvements by solar users, fuel priority classification and fossil fuel allocation increases the proportional amount of energy supplied by solar.

Evaluation Measures:

Passage of proposed legislation would be the first definitive means of program success. The ultimate measure of success would be the impact of the legislation on solar energy use.

Related Programs:

- IPH Regulatory Program

Implementor:

MASEC

Program 16.0 IPH Legal and Regulatory Program:

Objective:

To accelerate commercialization of solar energy by removing legal and regulatory barriers.

Rationale:

Legal and regulatory restrictions on the building and operating of a solar energy system often do more than just make the installation more difficult or less economic. They may also prevent the initiation of a project altogether. Zoning codes, building codes and certain product specifications all represent possible barriers to solar energy systems.

Task Statement/Description:

16.1 IPH Legal and Regulatory Assessment Progam:

A survey should be made of the existing laws and regulations which inhibit the use of solar energy. Codes which restrict the use of land for industrial purposes should be examined. Construction specifications on solar components such as piping, should be studied. A comprehensive report on the regulatory barriers to solar energy should be published and disseminated.

16.2 IPH Legal and Regulatory Information Dissemination Program:

Code and regulatory studies should be published and disseminated to the appropriate governments, the solar industry and special libraries. Opinion leaders and the general public should be made aware of restrictive codes regulations.

Evaluation Measures:

The removal of restrictive codes is evidence of success. The adoption of model codes and regulations is another.

Related Programs:

- IPH Legislation Programs
- IPH Tax Programs
- Building Market Warrantee and Code Programs

Implementor:

MASEC

Program 17.0 State and Local Government Interface Program:

Objective:

To provide information transfer and planning assistance to state legislators, energy officials and other state personnel; to aid in the coordination of solar and related activities among states.

Rationale:

States can greatly influence the utilization of solar energy; the Regional Centers can increase that influence because of their more concentrated resources for solar planning, analysis and assessment, technology transfer and other functions. The combination of the local orientation and contacts of state governments with a regional concentration of analytical and technical capabilities in regional solar energy centers should produce a synergistic effect in accelerating solar IPH commercialization. State governments have a special interest in their state's industries since industry in the Mid-American Region is the primary source of outside capital in the states. Industry is often structured to serve a regional market and often has regional planning and marketing perspectives which allows a regional organization to better understand and assist with industrial problems.

Task Statement/Description:

17.1 IPH State Government Information Transfer Program:

Results of the tax, regulatory and legislative survey programs should be made known state officials. Model legislation, regulations and codes should be developed in conjunction with state legislators. Information about actions of state governments should be transmitted to the solar industry and potential solar buyers; similarly, concerns of the industry should be transmitted to the state.

17.2 IPH Local Government Information Transfer Program

Seminars and conferences should be held to update local officials in solar IPH applications and to transmit information from the tax, legislation and regulation programs. Model codes, regulations and other relevant legislation for local governments should be published and disseminated throughout the Region and nation.

Evaluation Measures:

The degree of cooperation, the acceptance of favorable legislation, taxes and regulations are measures of effectiveness.

Related Programs:

- IPH Federal Government Interface Program
- IPH Tax Program
- IPH Regulatory Program
- Buildings Market: State Energy Planning Agency Interface

Implementor:

MASEC

Program 18.0 Federal Government Interface Program:

Objective:

To track federal legislation and assess its regional impact and to promote regionally effective federal solar legislation. To provide DOE and other government agencies with information on the effectiveness of federal programs and to publicize solar legislation to industry. To aid in receipt of federal funding and subsidies by regional industry.

Rationale:

Many federal government activities impact the Region; therefore, a coordination of federal and regional efforts is essential. Federal funding of solar projects for the Region must be coordinated and duplication avoided. At present, federal government support of the solar IPH industry is necessary for its survival. Similarly, regional federal funding is necessary for a regional IPH industry.

Task Statement/Description:

18.1 IPH Federal Government Information Transfer:

Federal officials should be informed of the results and recommendations of regional solar IPH programs. Model legislation and codes should be promoted towards the appropriate government agencies. The needs and concerns of industries in the Region should be transmitted to the appropriate federal agencies and individuals. Grants and demonstration projects for the Region should be promoted and assistance in making proposals for federal projects should be provided.

Evaluation Measures:

The number of solar grrants and demonstration projects is one measure of success. The enactment of favorable solar legislation is another.

Related Programs:

- o IPH State Government Information Transfer Program
- o IPH Local Government Information Transfer Program

Implementor:

MASEC

PRODUCT DEFINITION PROGRAMS

Program 19.0 Technology Development Coordination Program:

Objective:

To maximize the total effectiveness of all programs directed towards improving solar IPH technology.

Rationale:

Solar IPH design, demonstration, data gathering and monitoring must be inextricably interlinked. The design program must produce designs for use in the demonstration program; in turn, data gathering and analyses are necessary to improve the designs.

Task Statement/Description:

19.1 IPH Technical Coordination:

Target industry studies will provide and assist the candidates for DOE solar IPH demonstration programs. Data gathering and performance analyses programs should provide information to the technology transfer programs. Equipment should be purchased for sharing by the data gathering, monitoring, and testing programs.

19.2 IPH Technical Coordination with Solar Industry Coordination:

The technical programs must provide technical information and data directly to the solar industry and demonstration must be designed to help make sales. The testing program is a direct support of solar industry.

Evaluation Measures:

Measures of effectiveness include the degree of cooperation between programs and the lack of duplication of efforts.

Related Programs:

- IPH Solar Industry Marketing Coordination Program
- IPH Market Development Coordination Program
- IPH Government Marketing Coordination Program

Implementor:

MASEC

Program 20.0 Target Industry Design Program:

Objective:

To provide a range of designs from which to construct successful solar IPH demonstrations; to provide professional design experience in IPH solar systems.

Rationale:

The cost of large industrial process heat solar systems is substantial. Any design errors will be costly and very visible. Formation of several design teams ensures that many engineers and architects obtain solar experience. The best features of alternative designs can be incorporated into winning designs, improving the final design of a demonstration project. In addition, the results of the teams provide many design types and will improve the chances of additional successful installations.

Task Statement/Description:

20.1 Industry Generic System Analysis:

The general design criteria for IPH systems for individual industries and processes should be determined. Design approaches should be worked out for each process and system parameters which affect the designs should be analyzed. An entire solar IPH systems analysis manual should be prepared.

20.2 Target Industry Design Model:

From a systems analysis, computer model should be developed for use in system design. System response to parametric changes should be studied and the results reported. The model should include variable climatic conditions, insolation, process temperatures, pressures, system components and other pertinent factors.

20.3 Target Site Design Competition:

A competition should be held to produce several designs for specific sites. Preliminary designs from many A&E firms should be evaluated and a number of design awards should be given. The performance and economics of designs received should be analyzed by computer simulation. The designs should also be submitted to a technical review panel to determine the awards.

Evaluation Measures:

The number of respondents to the design competition and the quality of designs are two measures of effectiveness. The ultimate measure is the performance of these designs in the field.

Related Progams:

- o DOE IPH Demonstration Program

Implementor:

MASEC

Program 21.0 IPH Demonstration Program:

Objective:

To demonstrate the viability of solar industrial process heat systems on a regional basis and to produce demonstrations applicable to a large number of target industries.

Rationale:

Before making a major purchase, most industry manufacturing personnel want to view the same type of equipment employed in a similar type of operation and plant environment. This operating similarity would include the following factors: similar products, similar equipment, similar size of operation, similar operating conditions such as pressure and temperature and operation, and a similar process within the plant. Viewing a successful operating system creates confidence in the system and makes the purchase decision by a potential buyer much easier. Easier decisions to buy eventually result in increased sales.

Task Statement/Description:

21.1 IPH Demonstration Management:

From the target industry design programs, a demonstration project should be selected and funding for the project obtained from DOE. The process of soliciting and selecting subcontractors, preparing the site and the plant operation must be well managed. Installation, monitoring of the equipment and system checkout procedures must be done properly. Reports on all phases of the project should be compiled. The demonstration program manager should serve as an advisor to the equipment contractor.

21.2 IPH Demonstration Installation Analysis:

The problems encountered in the IPH demonstration project installation should be solved and further analysis should be made to prevent similar problems.

21.3 IPH Demonstration Promotion:

During project construction, site visits by architects and engineers should be promoted in cooperation with the Architects and Engineers Assistance program. After completion of the demonstration, members of the target industry should be contacted and tours of the plant site should be conducted in coordination with Consumer Marketing programs.

Evaluation Measures:

A properly performing installation, with few construction problems, should be a measure of achievement. The number of people visiting the plant is a means of evaluating the demonstration and the number of similar installations made because of the demonstration program should be the ultimate measure.

Related Programs:

- o DOE IPH Demonstration Programs
- o IPH Contractor and Installers Assistance Program
- o IPH Architects and Engineers Assistance Program

Implementor:

MASEC

Program 22.0 IPH Demonstration and Data Support Program

Objective:

To provide technical information transfer from regional users and manufacturers and to provide technical assistance, testing and design improvements for the solar industry.

Rationale:

Existing installations can provide the information necessary to improve the design and manufacture of new equipment as well as to improve the performance of the original installations. Manufacturers need operating data to improve their products and to reduce manufacturing costs. Favorable technical data gathered from existing installations can add to the credibility of the entire solar IPH industry.

Task Statement/Description:

22.1 IPH Installation, Data Acquisition and Monitoring and Performance Analysis:

Existing installations should be monitored and performance data acquired for analysis. This data should be processed through computer models to determine the accuracy of the models in detecting problems in the system.

22.2 Industry Technical Information Transfer:

Data from solar IPH installations and other sources should be disseminated to the solar industry. Technical problems encountered in existing installation and their resultant solutions should be transmitted throughout the industry. A technical advisory board should be formed to provide recommendations to solar manufacturers in the area of production methods, materials, and equipment design.

22.3 Component Testing and Recommendation:

New solar manufacturers should be provided with a means of testing their new products. In conjunction with SERI, Sandia Labs and private testing companies, a testing program should be instituted using regional demonstration projects as a data base. Components found to perform well should be recommended to the public.

Evaluation Measures:

The Performance Analysis program should be deemed effective if it contributes to the improvement of computer design and performance models and ultimately to improvements in system design. The Industry Technical Transfer program can be evaluated by the number of information requests and an opinion survey of the solar industry.

Related Programs:

- o DOE: IPH Demonstration Program
- o MASEC: IPH Demonstration Program
- o MASEC: IPH Design Program

Implementor:

MASEC with SERI, National Laboratories, etc.

Program 23.0 Industrial Product/Process Redesign Program:

Objective:

To reduce energy consumption in industry.

Rationale:

The amount of energy required to produce an end product is largely controlled by the manufacturing process used. By changing the original process, energy requirements may be reduced. By reducing process temperature requirements, solar systems may become applicable in many areas not now feasible for solar energy. Solar energy devices which are integral to the process such as greenhouses and grain dryers, may be appliable to similar technologies such as mineral drying and oil heating. By reduction in process temperature and alteration of other process requirements, future manufacturing processes may be designed to better accommodate solar energy systems.

Task Statement/Description:

23.1 Product/Process Redesign Development:

The methods and requirements of process and product redesign should be examined on industry, process and product basis. Computer models should be developed to simulate production processes for initial solar suitability analyses.

23.2 Product/Process Redesign Analysis:

An analysis of the energy used for several generic product types should be undertaken. In conjunction with SERI and national laboratories, a program should be instituted to study possible changes in existing methods of production and existing product specifications.

23.3 Product/Process Redesign Marketing:

Seminars, workshops and conferences on product/process energy-efficient redesign should be given to appropriate industries. Results of successful programs should be disseminated. The methodology of process or product energy redesigns should be published.

Evaluation Measures:

New product and processes developed by this program and energy savings resulting from implementation of these process and product changes are measures of success.

Related Programs:

Implementor:

MASEC

Program 24.0 IPH Woody Biomass Program

Objective:

To increase the utilization of woody biomass for industrial process heat.

Rationale:

Woody biomass already supplies 45% of the energy used by the paper industry nationally. However, in the Mid-American Region, woody biomass supplies only 19% of the energy used in this industry. With such variation, an examination of the industry is in order. In addition, the amount of energy used by the pulp and paper industry is enormous so that slight changes in utilization of wood provide substantial savings in fossil fuel.

Task Statement/Description:

24.1 IPH Woody Biomass Industry Survey:

The paper industry and the forest products industry should be surveyed to determine their utilization of woody biomass. A conference on woody biomass involving industrial officials, plant engineers, combustion engineers and other plant personnel should be conducted and the proceedings disseminated throughout the industry.

24.2 IPH Woody Biomass and Analysis Team:

Groups of experts should be formed to examine the technical feasibility and the economics of woody biomass in industrial processes. The group should make recommendations for federal programs to increase the utilization of woody biomass in industry.

Evaluation Measures:

The number of people attending conferences is one measure of effectiveness; the production and information of good recommendations for increased biomass utilization from the team of experts is another.

Related Programs:

Implementor:

MASEC

PROGRAMS FROM

THE MASEC REGIONAL MEETING

"BOILER ROOM"

APRIL 18-22, 1979

INDUSTRIAL PROCESS HEAT PROGRAM RANKING

PROGRAM NAME	Percentage of Available Score Intermediate	Percentage of Available Score Final	Ranking First Category
Industrial Infrastructure Development			
1. Executives Training & Awareness	95	72.5	*
2. Continuing Education Programs for Architects and Engineers	86	61.25	*
3. Maintenance/Plant Engineering Training	--	77	*
4. IPH Energy Consumption Performance Guidelines	77	82.5	*
Market Development			
5. Information Dissemination	100	95	*
6. Encouraging Participation of Small Firms in MASEC Demos.	79	44	
7. IPH Demo. Solar Program	67	75	*
8. Regional "Targets of Opportunity" for Solar IPH	77	82.5	*
Institutional and Legal Barriers			
9. Encouragement of Efficient & Productive Enterprises	96	50	*
10. Tax Incentives	96	84.5	*
11. Disallow Non-renewable Energy Sources as Expense for Industry	80	26.75	
12. Solar System User Leasing as Business Expense Deduction	75	73	*
13. Tax Incentives for Industrial Application of Solar Energy	73	64.5	
14. Accelerated Solar Energy System Depreciation Allowance	65	78.75	
15. Tax Shelter for Investing in Solar Systems to be Leased	64	60.25	
16. Fuel Allocations for Energy Conservation	69	71	

IPH PROGRAM RANKING cont.

PROGRAM NAME	Percentage of Available Score Intermediate	Final	Ranking First Category
17. Non-taxable Capital Stock Dividend for Solar Investment	57	30.75	
18. Import Duties on Fuels	31	35	
19. Industrial Process Restructuring	57	46	
20. Storage Systems	--	79	*
21. Proposed Support Program	--	47.75	

FORTY ORIGINAL TITLES

IPH - AFTERNOON SESSION

Written Programs	Total Programs	Percentile
	Awareness	82
	Allocation Priority for Solar Energy Users	61
*	Subsidy-Tax Exemption	73
*	Disallowance for Taxes Nonrenewable Energy Cost	80
*	Accelerated Depreciation	65
*	Solar Utility Leasing	75
*	Solar Tax Shelter	64
	Most Favored Company Status for Solar Users	39
	Products Warranty Liability	43
*	Tax Free Dividend for Solar Company (Stockholder Programs)	57
	MASEC Region Demonstration Direct Underwriting	66
	Proposed Support (MASEC IPH Advance)	70
*	Maintenance-Plant Engineer Training	66
*	Professional Engineer-Architect Continuing Education	86
*	Executive Training Program	95
	Labor Union Negotiation Program	27
	Environmental Credit	75

FORTY ORIGINAL TITLES

IPH - MORNING SESSION

Total Written	Total Programs	Percentile
*	Energy Consumption Performance Guidelines	77
	Energy Audit	25
*	Tax Credit	96
*	Import Quotas	31
*	Provide Front End Funding for Demonstration Projects	79
*	Soil Types	
	Regional State Survey of IPH by Temperature	67
	R & D in Storage Systems	42
*	IPH Demonstration Program	67
	Incentive on Dollar Per BTU Basis	67
*	Information Dissemination	100
*	Preferential Allocation Based Upon Solar	69
	Low Interest Loans	46
*	R & D on Process Restructuring for Conservation	57

IPH

T. Heck

TASK SUMMARY OF EXECUTIVES TRAINING & AWARENESS PROGRAM (Title)

Market Sector: All	Task Implementor: States
Task Technology: All	Task Category: Market Development

Objective:

To provide company executives information about the potentials of the solar technologies.

Rationale:

Most executives are unaware of the various solar options, and make decisions affecting energy on the basis of utilizing only fossil fuels.

Unique Opportunity:

An awareness and training program will provide executives the opportunity to employ the latest solar techniques in their efforts to reduce operating costs, comply with environmental constraints, and conserve fossil fuels.

Task Description:

To develop a training and awareness program for executives and assist the states in implementation.

Task Implementation (Subtasks):

1. Identify target audience.
2. Develop and provide course material.
3. Train/educate instructors.
4. Conduct training/awareness program.
5. Provide a follow-up survey to evaluate effectiveness of training.

Implementation Subtasks	Proposed Schedule Milestones							
	1979	1980	1981	1982	1983	1984	1985	2000
1.								
2.								
3.								
4.								
5.								
6.								
7. Manpower in Man-Months	60	120	120	240	240	50		
Materials (000s)	25	100	100	200	250	50		
TOTAL Dollars	125	300	300	600	650	150		

TASK SUMMARY OF IPH CONTINUING EDUCATION PROGRAMS FOR PROFESSIONAL ARCH & ENGRS. ROM (Title)

Market Sector: All	Task Implementor: States
Task Technology: All	Task Category: All

Objective: To update the awareness and knowledge of professional engineers and architects with respect to solar energy and energy conservation.

Rationale: Professional architects and engineers are required to design energy conservation and solar heating systems. They must be knowledgable to make intelligent cost-effective designs.

Unique Opportunity: Professional architects and Engineers have been a basic obstacle to pronulgation of solar energy. This program gives an opportunity to correct this situation because the individual's licens is in jeopardy.

Task Description:

Assist states in carrying out continuing education program.

Task Implementation (Subtasks):

1. Provide educational material and or instructors to state licensing agencies
2. Set up testing or grading procedures for license endorsement or renewal
3. Work with state to set up scheduling for courses and exams.
4. Carry out course work and testing

Implementation Subtasks	Proposed Schedule Milestones							
	1979	1980	1981	1982	1983	1984	1985	2000
1.								
2.								
3.								
4.								
5.								
6.								
7. Manpower in Man-Months		12	24	12	6	6	6	6 yr.
Materials		0.05	0.05	0.03	.03	.03	.03	.03
TOTAL Dollars		.11	.11	.09	.09	.09	.09	.09

IPH T. Heck

TASK SUMMARY OF MAINTENANCE/PLANT ENGINEER TRAINING (Title)

Market Sector: All	Task Implementor: States
Task Technology: All	Task Category: Market Development

Objective:

To provide maintenance personnel and plant engineers training concerning the application of solar technologies.

Rationale:

The employees who will be required to maintain and integrate solar systems into existing facilities or new facilities must have the necessary expertise.

Unique Opportunity:

The training program will provide in-house expertise to handle maintenance/engineering problems where heretofore much of this was accomplished by outside contractors or utilities.

Task Description:

Develop a training program for maintenance and plant engineers, and assist the states during implementation.

Task Implementation (Subtasks):

1. Identify participants.
2. Develop and provide course material.
3. Train/educate instructors.
4. Conduct training program.
5. Provide follow-up survey for training-evaluation purposes.

Implementation Subtasks	Proposed Schedule Milestones							
	1979	1980	1981	1982	1983	1984	1985	2000
1.								
2.								
3.								
4.								
5.								
6.								
7. Manpower in Man-Months	50	100	100	200	200	50		
Materials ('000)	25	100	100	200	200	25		
TOTAL Dollars	125	300	300	500	500	125		

TASK SUMMARY OF IPH ENERGY CONSUMPTION PERFORMANCE GUIDE LINES — Charles Carey (Title)

Market Sector: IPH	Task Implementor: Appropriate Mfgr's Assoc.
Task Technology: Hot Water/Air/Wind/Biomass/ Passive	Task Category: Market Development

Objective:
Establish level of energy consumption per pound of product.

Rationale: Knowing whether an industry is above or below the norm will make the individual inefficient energy user look for ways to reduce energy consumption in order to be more competitive.

Unique Opportunity:
With rising costs of conventional energy, the profit and difference between competition may be the cost of energy.

Task Description:
Contract with an engineering firm to audit the many different individual firms in order to establish the norm.

Task Implementation (Subtasks):

1. Classify type of industries
2. Work through proper association to get energy consumption per pound of product from the members
3. Distribute this information to manufacturing firms in same classification
4. Individual firms may then call in energy consultant of their choice to decrease energy consumption

Implementation Subtasks	Proposed Schedule Milestones 1979	1980	1981	1982	1983	1984	1985	2000
1. Update & Distribute	"	"	"	"	"	"	"	"
2.								
3.								
4.								
5.								
6.								
7. Manpower in Man-Months	10	3	3	3	3	3	3	3
Materials								
TOTAL Dollars	750,000	45,000	45,000	45,000	45,000	45,000	45,000	45,000

TASK SUMMARY OF INFORMATION DISSIMINATION Fisher & Riemers (Title)

Market Sector: IPH | Task Implementor: MASEC

Task Technology: All | Task Category: Market Development

Objective: To increase knowledge of solar industrial process heat applications to the industrial sector, engineering community, and others within the MASEC region.

Rationale: To insure rapid utilization of solar IPH technology as systems become cost effective.

Unique Opportunity: There is often a significant delay between when a new technology becomes practical and when it is utilized. This delay can be reduced through effective information transfer.

Task Description:

1. Brake available in bulk to the local level, information results of key surveys, studies, demonstrations, and activities performed in the MASEC region, including the following:
   - results of regional/state survey of IPH potential by temperature
   - results of survey performed to develop energy consumption performance guidelines
   - demonstration programs
   - non DOE supported IPH projects of interest
   - research results
   - available MASEC services
2. Insure that future information dissimination is recognized as an important element of surveys, studies, and activities to be performed so that write-ups, slides, and/or other audiovisuals are gathered during their performance.
3. Where appropriate combine purpose of survey or studies with evaluation/ranking and awards for high performance.

Implementation Subtasks	Proposed Schedule Milestones							
	1979	1980	1981	1982	1983	1984	1985	2000
1. Establish program (with info on current and future activities)								
2. Survey & study results								
3. High performance awards program								
4. Demonstration results								
5. Research results								
6. IPH annual program evaluation								
7. Manpower in Man-Years	2	4	4	4	4	4	4	4
Materials								
TOTAL Dollars	.6	3.6	4.8					

L. McQueen

TASK SUMMARY OF ENCOURAGING PARTICIPATION OF SMALL FIRMS IN MASEC IPH DEMOS (Title)

Market Sector: IPH	Task Implementor: DOE/MASEC
Task Technology: IPH	Task Category: Institutional and Legal Barriers

Objective: Provide small design firms with opportunity to become involved in demonstration programs.

Rationale: Token funding allows smaller firms to investigate a program by reducing financial concern.

Unique Opportunity: Under present programs, "front end" money is not permitted. This discourages participation by small firms.

Task Description:

Restructure demonstration programs to allow "small" firms to receive money for preliminary designs, or "front end" money.

Task Implementation (Subtasks):

1. Define small firm by number of employees and dollar volume
2. Rewrite demo to include distribution of "front end" money
3. Set up budget for "front end" money in demonstration budget
4. As IPH demo is announced, allocate money by formula

Implementation Subtasks	Proposed Schedule Milestones							
	1979	1980	1981	1982	1983	1984	1985	2000
1.								
2.								
3.								
4.								
5.								
6.								
7. Manpower in Man-Months								
Materials								
TOTAL Dollars								

TASK SUMMARY OF IPH DEMO SOLAR PROGRAM Thomsen/Smith (Title)

MID-AMERICAN SOLAR ENERGY COMPLEX

Market Sector: IPH	Task Implementor: State & Local Government
Task Technology: All Inclusive	Task Category: Market Development

Objective:

Demonstrate practicality and availability

Rationale:

To generate interest at grass-roots level

Unique Opportunity:

To eliminate uncertainties and demonstrate practicality

Task Description:

To publicize and promote the utilization of solar (renewable) energy sources

Task Implementation (Subtasks):

1. State funding
2. Technological data research for selection (innovative)
3. Market research for short and long term
4. Selection
5. Construction
6. Operation & data collection & publicity

Implementation Subtasks	Proposed Schedule Milestones							
	1979	1980	1981	1982	1983	1984	1985	2000
1. (immediate)								
2.								
3.								
4.								
5.								
6.								
7. Manpower in Man-Months								
Materials								
TOTAL Dollars								

TASK SUMMARY OF IPH REGIONAL "TARGETS OF OPPORTUNITY" FOR SOLAR IPH (Title)

Market Sector: Industrial Process Heat	Task Implementor: MASEC/States
Task Technology: Hot Water/Air/Steam	Task Category: Market Development

Objective:

Identify opportunities for the replacement of fossil-fueled IPH systems with solar systems.

Rationale:

Determine magnitude, scope, and potential of solar IPH market in order to accelerate commercialization of solar IPH systems.

Unique Opportunity:

Will stimulate IPH users to consider solar IPH systems based upon sound data regarding solar equipment and design, opportunities for large-scale solar energy storage, availability of land and roof areas, and on sound solar economics.

Task Description:

Multidisciplinary, onsite survey of all IPH users to identify the solar IPH potential for each user and to disseminate the survey findings to users, designers, solar equipment producers and to energy planners.

Task Implementation (Subtasks):

1. Identify IPH users in states and region.
2. Develop survey methods, tools, and reporting format.
3. Structure and train teams to conduct field surveys.
4. Publicize survey and solicit voluntary cooperation.
5. Survey.
6. Compile, analyze, and publicize and distribute findings.

Implementation Subtasks	Proposed Schedule Milestones							
	1979	1980	1981	1982	1983	1984	1985	2000
1.								
2.								
3.								
4.								
5.								
6.		compile, publicize & distribute				Update		
7. Manpower in Man-Months	48	48	24	12	6	6		
Materials	10K	10K	10K	10K	--	--		
TOTAL Dollars	210K	210K	110K	60K	30K	30K		

Stewart Souby
(Title)

TASK SUMMARY OF ENCOURAGEMENT OF EFFICIENT AND PRODUCTIVE ENTERPRISES

Market Sector: All Sectors	Task Implementor: All
Task Technology: All	Task Category: All

Objective: To study tax structures, tax credits, tax deductions, subsidy programs and related revenue and cost-sharing programs which serve to encourage energy waste, centralized production facilities and high cost-low return projects.

Rationale: There is a need to discover and correct the various programs which work only in favor of inefficient and counterproductive energy producing business and project.

Unique Opportunity:

Task Description: A discover process whereby many of the competing factions applying a push-pull conflict against those who are trying to accomplish the

Task Implementation (Subtasks):

1. Identify major problematic areas
2. Developing major areas into critical sub-parts
3. Analyze data in terms of current problems
4. Recommend changes which would correct problems.

Implementation Subtasks	Proposed Schedule Milestones							
	1979	1980	1981	1982	1983	1984	1985	2000
1.								
2.								
3.								
4.								
5.								
6.								
7. Manpower in Man-Months	72	80	50					
Materials								
TOTAL Dollars								

TASK SUMMARY OF TAX INCENTIVES Jacobson (Title)

Market Sector: IPH	Task Implementor: Federal STate
Task Technology: IPH	Task Category: Institutional & Legal Barriers

Objective: Provide a solar tax credit and appropriate accelerated depreciation schedules for solar equipment and heat conservation equipment used for process heat.

Rationale: More BTU's can be saved in the field of process heat than in most other energy use areas and such implimentation needs encouragement.

Unique Opportunity: Greater need exits in industry for a short pay back on equipment in industry because of other costs such as production losses during changeover.

Task Description: Survey present tax credits, and depreciation schedules now authorized and develop greater reward for conversion to energy saving and conversion to conservation and solar use.

Task Implementation (Subtasks):

1. Survey existing legislation and tax credits
2. Survey industry for feasibility of conversions to solar
3. Survey industry for incentive needs
4. Propose tax legislation
5. Promote conversions
6. Publicize conversions

Implementation Subtasks	Proposed Schedule Milestones							
	1979	1980	1981	1982	1983	1984	1985	2000
1. Survey laws								
2. Survey Industry (Key Industry)								
3. Survey Industry (Incentives)								
4. Tax legislation Proposal								
5. Promote Conversions								
6. Publicize conversions								
7. Manpower in Man-Months Per state		60	123	135	36	36	36	
Materials								
TOTAL Dollars								

TASK SUMMARY OF IPH DISALLOW NONRENEWABLE ENERGY SOURCES AS EXPENSE FOR INDUSTRY ROM (Title)

Market Sector: All	Task Implementor: Congress, State and Local Government, MASEC, RSEC
Task Technology: All	Task Category:

Objective: To encourage the use of renewal energy sources by removing incentives for fossil fuel. Potential savings is of the order of 10 Quads.

Rationale: Industrial decisions are based on economic considerations. Use of fossil fuel must be discouraged through economic means. Tax disincentives for use of non-renewable energy can provide the needed impetus.

Unique Opportunity:

Solar energy can provide a major energy imput to industry to replace non-renewable resources. The manufacture, design and installation of equipment to replace non-renewable resources will provide jobs as well as save non-renewable resources.

Task Description: Provide information for Federal, State and local government administrative and legislative bodies.

Task Implementation (Subtasks):

1. Prepare economic impact and energy conservation study acomplished by disallowing the non-renewable energy sources as an expense.
2. Prepare educational materials
3. Prepare MASEC position paper
4. Present information to Federal State and local government

Implementation Subtasks	Proposed Schedule Milestones						
	1979	1980	1981	1982	1983	1984	1985	2000
1.								
2.								
3.								
4.								
5.								
6.								
7. Manpower in Man-Months		24	24	12	12	0	0	
Materials		0.1	0.05	0.02	0.02	0	0	
TOTAL Dollars		0.20	0.15	0.07	0.07	0	0	

ZIEBARTH IPH

TASK SUMMARY OF SOLAR SYSTEM USER LEASING AS BUSINESS EXPENSE DEDUCTION (Title)

Market Sector: All (IPH)	Task Implementor: Congress
Task Technology: All	Task Category: Institutional & Legal Barriers

Objective: To create a situation whereby businesses leasing solar systems have the benefit of deducting the lease as a business expense

Rationale: The only method for encouraging solar energy use for the industrial sector is to make solar economically attractive. This can only be done through a variety of economic incentives for conservation and the use of solar and disincentives for use of fossil fuels.

Unique Opportunity:

The tax code and structive already exist and we must see that solar takes or is able to take advantage of it.

Task Description:

Examine the tax codes and study the alternative methods for preparing legislation.

Task Implementation (Subtasks):

1. Examine the federal tax codes to see how the leasing arrangments is affected by current legislation
2. Study various methods of giving solar this benefit if it does not now exist and the impact regarding the revenue
3. Draw up the most appropriate legislation
4. Enact the legislation
5. Get the word out to companies

Implementation Subtasks	Proposed Schedule Milestones							
	1979	1980	1981	1982	1983	1984	1985	2000
1. Tax code examination								
2. Alternatives study								
3. Legal drafting								
4. Enactment								
5. Information dissemination								
6.								
7. Manpower in Man-Months	8	12						
Materials								
TOTAL Dollars	60,000	90,000						

IPH

TASK SUMMARY OF TAX INCENTIVES FOR INDUSTRIAL APPLICATION OF SOLAR ENERGY ROM (Title)

Market Sector: All	Task Implementor: Congress, State, MASEC, RSEC
Task Technology: All	Task Category: Institutional and legal firms

Objective: To encourage major energy conservation in the industrial sector through the use of solar energy. Potential is of the order of 10 Quads by 2000.

Rationale: Industrial decisions are based on economic considerations. Solar energy must be made attractive economically. Tax incentives for its use and tax desincentives for use of fossil fuels are necessary for economic viability to industry.

Unique Opportunity:

Solar energy can provide a major energy input to industry. The manufacture design and installation of equipment and systems will creat job opportunities of major significance.

Task Description:

Educational programs for Federal and State levels legislative and administrative bodies.

Task Implementation (Subtasks):

1. Review of Federal Tax structure to determine areas such as income tax credits & deductions, investment tax credits, solar tax credits etc. where substantial benefits can be given to industrial users of solar energy.

2. Similar review on a state - by - state basis examining areas much as property tax franchise tax, sales and use tax, solar credits etc.

3. Prepare MASEC position papers for Federal and State governments

4. Present recommendations and educate and provide information for Federal government officials.
5. Present recommendations and educate and provide information for State governments officials

Implementation Subtasks	Proposed Schedule Milestones							
	1979	1980	1981	1982	1983	1984	1985	2000
1.								
2.								
3.								
4.								
5.								
6.								
7. Manpower in Man-Months		72	48	36	24	12	0	
Materials millions		0.2	0.1	0.1	.05	.02	0	
TOTAL Dollars millions		0.5	0.3	0.25	0.10	0.07		-96-

TASK SUMMARY OF TAX INCENTIVE BASED ON BTU'S SAVED BY SOLAR IN LIEU OF CAPITAL INVESTMENT (Title)

Market Sector: IPH	Task Implementor: DOE,
Task Technology: Solar, Hot Water and Air/ Passive/Biomass	Task Category: Market Development

Objective: To accelerate solar usage in industry

Rationale: Two equal cost capital investments may not or will not save the same number of Btu's. The object is to save Btu's of fossil fuel.

Unique Opportunity: To focus on saving Btu's is an opportunity that should not be overlooked. Capital investment receiving tax incentives should produce results.

Task Description: Determine energy consumption before and after solar. The Btu saving should earn a refund each year to mfgr.

Task Implementation (Subtasks):

1. Firm to make a detailed energy consumption audit before solar, to be done by qualified engineering firm.
2. Energy consumption determined after solar, and only that attributable to solar
3. Equate Btu's saved to a barrel of oil equivalent
4. The refund amount/barrel of oil to be established by DOE or government. To be re-evaluated periodically to adjust for changing energy picture
5. Refund returned or made to the firm or mfgr. each year

Implementation Subtasks	Proposed Schedule Milestones 1979	1980	1981	1982	1983	1984	1985	2000
1. Firm-pays for audit original								
2. Firm-pays for audit after solar								
3. Request refund based on barrels of oil equivalent saved								
5.								
6.	Setting up System	Refunds						
7. Manpower in Man-Months	100							
Materials								
TOTAL Dollars	66,000	?	?	?	?	?	?	?

IPH

TASK SUMMARY OF ACCELERATED SOLAR ENERGY SYSTEM DEPRECIATION ALLOWANCE (Title

Market Sector: Industrial Process Heat	Task Implementor: Congress
Task Technology: All	Task Category: Institutional & Legal Barriers

Objective: A law permitting an accelerated depreciation method permitting rapid depreciation of solar energy systems which would make solar energy systems more competitive in the use of capital investment dollars.

Rationale:

Business make investment decisions on economics. This task would enhance the economics of owning/using a solar energy system.

Unique Opportunity:

An opportunity to increase the depreciation expense thus having an indirect positive impact on cash flow and profits.

Task Description:

Congress to pass a law delineating the use of a triple declining mehodology for solar energy system equipments to be incorporated into the internal revenue code.

Task Implementation (Subtasks):

1. Define equipmetns, methodology, & regulation changes to I.R. code
2. Define impact for businesses and government
3. Propose & pass legislation
4. Permit implementation & dissemination of law (awareness)

Implementation Subtasks	Proposed Schedule Milestones							
	1979	1980	1981	1982	1983	1984	1985	2000
1. Definition Ph. I								
2. Definition Ph. II								
3. Legislation								
4. Implement								
5.								
6.								
7. Manpower in Man-Months	35	15	3	3	3	0	0	
Materials	2,000	60,000	30,000	20,000	5,000	5,000	5,000	
TOTAL Dollars								

ZIEBARTH IPH

TASK SUMMARY OF TAX SHELTER FOR INVESTORS INVESTING IN SOLAR SYSTEMS TO BE LEASED (Title)

Market Sector: All (IPH)	Task Implementor: Congress
Task Technology: All	Task Category: Institutional & legal Barriers

Objective: To enact legislation creating tax shelters for investors to invest in systems (through some limited partnership etc.) for specific site leasing to businesses or to invest in corporations in the business of leasing solar systems to businesses that would deduct leasing costs as a business expense.

Rationale: We need to give investors incentives to invest in companies or projects involved in leasing solar systems to businesses which can deduct leasing costs as business expenses.

Unique Opportunity: Everybody with money is looking for tax shelters. Businessess will be encouraged to lease systems in order to deduct leasing costs as business expenses.

Task Description: Examine the tax codes to determine if such shelters now exist, if not then study the impact & draft legislation.

Task Implementation (Subtasks):

1. Examine federal tax codes to see if the shelter presently exists or how it might
2. Study the impact
3. Draft legislation
4. Enact it
5. Spread the word

Implementation Subtasks	Proposed Schedule Milestones							
	1979	1980	1981	1982	1983	1984	1985	2000
1. Examine tax code								
2. Study impact								
3. Draft legislation								
4. Enact it								
5. Spread the word								
6.								
7. Manpower in Man-Months	8	12						
Materials								
TOTAL Dollars	60,000	90,000						

TASK SUMMARY OF FUEL ALLOCATION CREDITS FOR ENERGY CONSERVATION (Titl

Market Sector: Industrial	Task Implementor: Federal Government
Task Technology: Administrative	Task Category: Legal

Objective: To emphasize the conservation of non-renewable sources of energy to increase the availability of non-renewable energy for energy efficient installations by providing conservation incentives to IPH users in the form of increased fuel allocations and decreased fuel interruptions.

Rationale:

To assure an energy source for the most efficient energy users, and insure uninterrupted production based on that efficiency

Unique Opportunity:

Increase significantly the promotion of conservation of non-renewable energy and provide a positive incentive for industrial conservation

Task Description: Design and implement, through legislation and public utility regulations, allocation preferences based on standards of fuel usage by industrial class (type)

Task Implementation (Subtasks):

1. Establish industrial classes (types) periodically on a regional basis
   Performer: Government contractor
2. Establish regional industry averages for each class periodically
   Performer: Government Contractor
3. Establish energy audit criteria
   Performer: Government Contractor
4. Conduct energy audit periodically
   Performer: Private Sector
5. Establish regional allocation percentages by fuel type based on regional class averages periodically. Performer: Government agency (FERC?)

Implementation Subtasks	Proposed Schedule Milestones							
	1979	1980	1981	1982	1983	1984	1985	2000
1.	12					3		
2.		36					12	
3.		36						
4.			Industry performs each year to obtain allocation					
5.			24					12
6.								
7. Manpower in Man-Months	12	72	24			3	12	12
Materials ($K)	10	50	30			10	50	~~100~~ 50
TOTAL Dollars /K	100	590	210			32.5	140	140

H. Beatty IPH

TASK SUMMARY OF NON TAXABLE CAPITAL STOCK DIVIDEND FOR SOLAR INVESTMENT (Title)

Market Sector: All	Task Implementor: Congress
Task Technology: All	Task Category: Institutional & Legal Barriers

Objective: To permit stockholders to push for solar investments by companies; thus providing incentives to both company owners (non taxable income) and company managers to abide by owners wishes.

Rationale: Real world pressure coming from stockholders will command company executives/managers to conduct serious activities in the solar usage area.

Unique Opportunity: By passing a law which would exclude a proportional share of a capital stock dividend which is directly related to the book value of the initial solar investment.

Task Description: Congress to pass a law delineating the concept and direction for tax exemption status to be incorporated into the internal revenue code.

Task Implementation (Subtasks):

1. Definition study of impact for stockholders & companies
2. Define I.R. code changes
3. Propose & pass legislation
4. Permit dissemination of information to public
5. Devise reporting means

Implementation Subtasks	Proposed Schedule Milestones							
	1979	1980	1981	1982	1983	1984	1985	2000
1. Def. study								
2. I.R. changes								
3. Legislation								
4. Info. Dissemination								
5. Reporting means								
6.								
7. Manpower in Man-Months	10	15	50	5	5	5	2	15
Materials	10 K	30 K	150 K	10 K	10 K	10 K	5 K	35 K
TOTAL Dollars								

MID-AMERICAN SOLAR ENERGY COMPLEX

TASK SUMMARY OF IMPORT QUOTAS ON FUELS (Title)

Market Sector: All	Task Implementor: Congress
Task Technology: Political-Legal Action	Task Category: Legal

Objective: To freeze and gradually reduce the importation of non-renewable fuels.

Rationale:
(1) To effectively stop the increase in U. S. oil consumption.
(2) To effectively decrease the U. S. imbalance of payments for oil and its resulting inflationary influence in the U. S.
(3) To FORCE the U. S. to effectively deal with the energy problem.

Unique Opportunity: Increased costs have repeatedly proven ineffective in decreasing significantly U. S. oil consumption. The only sure way of coming to grips with this problem is to put into action mandatory import quotas.

Task Description: U. S. Congress will enact legislation freezing the present level of U. S. oil imports and would also decrease this quota by 5% per year.

Task Implementation (Subtasks):
(1) Fully develop goals and rationale for placing in effect oil import quotas.
(2) Present these to the President and U. S. Congressional leaders for the development of political strategy for their implementation.
(3) Present and place quotas in effect.
(4) Push for constructive policy changes on all levels to decrease U. S. energy consumption so that we can live within the quotas.

Implementation Subtasks	Proposed Schedule Milestones							
	1979	1980	1981	1982	1983	1984	1985	2000
1.								
2.								
3.								
4.								
5.								
6.								
7. Manpower in Man-Months								
Materials								
TOTAL Dollars								

Weber/Dunlop

TASK SUMMARY OF INDUSTRIAL PROCESS RESTRUCTURING (Title)

Market Sector: IPH	Task Implementor: DOE (initially)
Task Technology: Industrial Process Restructuring for Renewable Resources	Task Category:

Objective: Studying of the modification of industrial processes for constant overall productivity to accommodate interfacing with availability of renewable resources

Rationale: More realistic expectation and utilization of renewable resources, recognition of near future dependence on renewable resources, lack of interface history of industrial process and renewable resource

Unique Opportunity:

Serious step for planning for a necessary process and energy relationship.

Task Description:

Evaluation of industrial processes using renewable resources

Task Implementation (Subtasks):

1. Renewable resource scenario development
2. Identification of industrial sectors for initial study, i.e., food processing, textile, etc.
3. Identifying personnel for cooperative study using both technical skills and renewable resource perspective.
4. Definition of revised process
5. Workshop presentation to industrial representatives on technical and renewable resource perspectives.

Implementation Subtasks	Proposed Schedule Milestones							
	1979	1980	1981	1982	1983	1984	1985	2000
1. Funding available		Summer						
2. 1,2,3								
3. 4								
4. 5								
5.								
6.								
7. Manpower in Man-Months								
Materials								
TOTAL Dollars								

IPH

TASK SUMMARY OF STORAGE SYSTEMS (Title

Market Sector: Industrial	Task Implementor: MASEC/DOE
Task Technology: Industrial Process Heat	Task Category:

Objective: Develop and evaluate storage systems for industrial process heat

Rationale: Through type collectors have already demonstrated technical feasibility and parabolic systems are being developed for testing, however mechnisms for storage of high temperatures is not yet readily available.

Unique Opportunity: To develop storage components

Task Description: Survey potential storage systems - develop a demonstration project for high temp. storage - perform technical and economic feasibility studies and evaluate thermal performance

Task Implementation (Subtasks):

1. Survey storage systems (existing & potential)
2. Development of demonstration program
3. Technical performance
4. Evaluate economic and technical performance
5. Look at environmental, institutional barriers.

Implementation Subtasks	Proposed Schedule Milestones							
	1979	1980	1981	1982	1983	1984	1985	2000
1. Survey and RFP	→							
2. Demo. Program		→	→	→				
3. Technical Performance			→	→				
4. Economic Analysis				→				
5. Technical evaluation				→	→			
6. Environmental impact/ ~~Institutional barriers~~					→			
7. Manpower in Man-Months	12 MM	30 MM	96 MM	168 MM	30 MM			
Materials 4-10 Projects		2 M	8 M	2 M	.5 M			
TOTAL Dollars	.3 M	2.8 M	10.6 M	5.6 M	1.3 M			

TASK SUMMARY OF PROPOSED SUPPORT PROGRAM (Title)

Market Sector: ALL (IPH)	Task Implementor: MASEC
Task Technology: ALL	Task Category: Institutional & Legal Barriers

Objective: To develop a program to provide support in the form of qualified people to assist prospective solar utilizers to find out about and apply for monetary support.

Rationale: Potential solar users will be more so inclined to use this energy if they can get some help in applying for the financial assistance available.

Unique Opportunity: The need and the opportunity both exist, all we need is to match them up.

Task Description: Develop the program and implement--perhaps this would be the type of program to contract with the private sector to implement.

Task Implementation (Subtasks):

1. Define goals and parameters of program
2. Set up the means for collecting the information about the financial assistance available and how to get it to the assistors
3. Set up the means for ratifying potential users of the service
4. Implement

Implementation Subtasks	Proposed Schedule Milestones							
	1979	1980	1981	1982	1983	1984	1985	2000
1. Definition								
2. Methodology-Assistors								
3. Methodology-Users								
4. Implement								
5.								
6.								
7. Manpower in Man-Months	24	36	36	36	36	36	36	36
Materials								
TOTAL Dollars	180,000	270,000	270,000	270,000	270,000	270,000	270,000	270,000

<u>NATIONAL PLAN FOR ACCELERATED COMMERCIALIZATION</u>

<u>OF</u>

<u>SOLAR ENERGY</u>

AGRICULTURAL SECTOR

I. MARKET CHARACTERIZATION

II. PROGRAMS

III. APPENDIX: BOILER ROOM PROGRAMS

MARKET SECTOR: AGRICULTURE

MARKET AND INDUSTRY CHARACTERIZATION

Of major field cropland in the U.S. (acres harvested), sixty percent is dedicated to the production of livestock, thirty percent to production for export and ten percent to production for other domestic purposes.[1] This excludes the contribution that pasture and range land make to support livestock. Thus, should consumer food preference shift away from animal protein, vast acreages of choice agricultural lands could be available for energy crop production purposes.

Nationally, approximately two percent of the total energy consumed in the United States annually is used directly on the farm. This amounted to 1.3×10^{15} Btu's in 1974. Another one percent is energy used in producing agricultural chemicals such as fertilizers, pesticides, feeds, etc. Various studies estimate that fifteen to twenty percent of the nation's energy goes into the food system, depending upon the boundaries given the system. "Production agriculture" requires nearly twenty percent of the total energy required by the food system with food processing, transportation, wholesale and retail trade, and final preparation utilizing the balance.[2] In general, it takes three times more energy to process, package, refrigerate, and transport food from the farm gate to the home than it does to produce it. Increased energy inputs to the agricultural sector have served largely to reduce labor requirements, thus increasing labor productivity, rather than greatly increasing yields. (Genetic improvements have been largely responsible for increased yields.) In fact, farm output per unit of nitrogen for the nation as a whole was five times higher in 1950 than in 1971. Output per horsepower of tractors fell by about thirty-one percent during the same period.[3] Equipment expenditure per hour of labor has risen from $.03 in 1940 to $1.14 in 1973.[4]

The MASEC Region accounted for approximately forty-seven percent of the nation's total agricultural energy consumption in 1974 (crops and livestock, including invested energy).[5] Table I shows the total and invested energy inputs to the agricultural sector for each state in the MASEC Region in 1974.

Table II shows national and regional energy consumption for the agricultural sector by fuel type in 1974. It should be noted that the MASEC Region produced eighty-two percent of the nation's corn and fifty-three percent of the nation's wheat in 1974. Tables III and IV depict corn and wheat production and the associated energy consumption for the MASEC Region and the nation as a whole in 1974. Table V depicts energy consumption for select end-use tasks for each state within the MASEC Region.

During the energy shortages of the early '70s, fertilizer costs increased more rapidly than fuel and labor costs. Safeguards against such future shortages are included in the National Energy Petroleum Allocation Act and the National Gas Policy Act of 1978. These safeguards generally put the agricultural system, including food processors, first in line for energy supplies should an energy allocation scheme be put into operation. However, recent disruptions of the distribution system demonstrate the

TABLE I

Invested and Total Energy Consumed
By The Agricultural Sector Within
The MASEC Region - 1974

State	Total Btu's (10^9) (invested energy)	Total Btu's (10^9)
Illinois	55,608	123,275
Indiana	34,422	70,436
Iowa	52,494	135,043
Kansas	32,168	98,457
Michigan	15,115	37,184
Minnesota	38,449	96,458
Missouri	29,024	63,576
Nebraska	44,893	128,219
North Dakota	12,717	43,302
Ohio	24,653	53,445
South Dakota	8,177	37,898
Wisconsin	16,635	53,698
	364,355	940,991
MASEC Region	.364Q	.941Q
U.S. Total	.716Q	2.01Q
Region as % of Nation	50%	47%

Source: Energy and U.S. Agriculture: 1974 Data Base, vol. 1
Federal Energy Adm. 8 U.S. Dept. of Agriculture, FEA/D-76/459,
September '76

TABLE II

Agricultural Energy Consumption by Fuel Type (1974)

Fuel	Nation	Region	
Gasoline	3.7 billion gallons	2 billion gallons	54%
Diesel	2.6 billion gallons	1.3 billion gallons	50%
Natural Gas	164 billion $ft.^3$	38.7 billion $ft.^3$	24%
LP Gas	1.5 billion gallons	.83 billion gallons	55%
Electricity	32 billion kwh	7.7 billion kwh	24%
Fuel Oil	304 million gallons	11.1 million gallons	4%
Coal	33,000 tons	2800 tons	8%

Source: Energy and U.S. Agriculture: 1974 Data Base
FEA/USDA, September '76

TABLE III

CORN (1974)

State	Bushels Harvested (10^8)	Total Btu's (10^{12}) (includes invested)	Btu/bushels Harvested
Illinois	8.31 bushels	79.08 Btu	9.52×10^4
Indiana	3.88 bushels	42.72 Btu	1.10×10^5
Iowa	9.48 bushels	82.46 Btu	8.70×10^4
Kansas	1.31 bushels	26.37 Btu	2.01×10^5
Michigan	1.10 bushels	11.36 Btu	1.03×10^5
Minnesota	3.60 bushels	38.82 Btu	1.08×10^5
Missouri	1.49 bushels	20.08 Btu	1.35×10^5
Nebraska	3.81 bushels	64.57 Btu	1.69×10^5
North Dakota	.07 bushels	.51 Btu	6.99×10^4
Ohio	2.66 bushels	25.60 Btu	9.62×10^4
South Dakota	.77 bushels	9.87 Btu	1.28×10^5
Wisconsin	1.54 bushels	13.70 Btu	8.90×10^4
Region Total	3.8×10^9 bushels	415.14×10^{12} Btu	
U.S.	4.65×10^9 bushels	$.5 \times 10^{15}$ Btu	
MASEC/U.S.	.817	.83	

TABLE IV

WHEAT (1974)

State	Bushels Harvested (10^6)	Total Btu's (10^{12}) (includes invested)	Btu's/Bushels Harvested
Illinois	55.7 bushels	4.89	8.78×10^4
Indiana	51.8 bushels	4.87	9.04×10^4
Iowa	1.3 bushels	1.15	9.23×10^4
Kansas	330.0 bushels	28.20	8.55×10^4
Michigan	38.0 bushels	2.49	6.55×10^4
Minnesota	82.6 bushels	8.94	1.08×10^5
Missouri	42.1 bushels	4.64	1.10×10^5
Nebraska	102.0 bushels	6.39	6.26×10^4
North Dakota	208.8 bushels	21.02	1.01×10^5
Ohio	66.4 bushels	4.56	6.87×10^4
South Dakota	61.2 bushels	5.32	8.69×10^4
Wisconsin	3.0 bushels	.18	6.00×10^4
Region Total	1043×10^6 bushels	92.66×10^{12}	8.88×10^4
U.S.	1959×10^6 bushels	201.47×10^{12}	1.03×10^5
MASEC/U.S.	.532	.460	

	Total Crop Value $10^9	Total Livestock Value $10^9	Total Ag. Value $10^9	Total Btu's 10^{12}	Fert. Prod. 10^{12} Btu	Fert. App. 10^{12} Btu	Irrigation 10^{12} Btu	Acre - Ft. Applied 1,000's	Crop Dry 10^{12} Btu	Total Crops 10^{12} Btu	Waste Disposal 10^{12} Btu	Water Supply 10^{12} Btu	Space Htg. 10^{12} Btu	Ventilation 10^{12} Btu	Water Htg. 10^{12} Btu	Total Livestock 10^{12} Btu	Farm Veh. Gas. (10^6 gallon)	Farm Veh. Diesel (10^6 gallon)	Tot.Ag.Val. / Btu $	Lvstk.Val. / Tot.Ag.Val. %	Value of all ag. products per 10^6 Btu $
Illinois	5.15	1.60	6.75	123.3	52.1	.69	.22	32	10.9	113.8	.91	.55	.92	.53	.22	9.4	269	130	5.48	23.7	54.75
Indiana	2.56	1.13	3.68	70.4	32.3	.42	.19	28	5.5	64.1	.64	.25	.29	.28	.19	6.3	144	67	5.22	30.7	52.24
Iowa	5.57	3.05	8.62	135.0	48.6	.71	.13	34	9.6	115.4	1.92	1.27	2.13	1.12	.35	19.7	328	165	6.38	35.4	63.83
Kansas	2.62	1.34	3.96	98.5	30.9	.33	23.83	3,458	4.3	92.0	.29	.04	.03	.02	.15	6.5	149	136	4.02	33.8	40.22
Michigan	1.35	.70	2.05	37.2	13.5	.45	.24	73	1.5	33.7	.52	.15	.09	.14	.34	3.5	85	49	5.51	34.1	55.14
Minnesota	3.35	1.86	5.21	96.5	35.8	.52	.40	99	4.4	84.2	1.32	.58	.65	.52	.67	12.2	244	110	5.40	35.7	54.01
Missouri	1.86	1.55	3.41	63.6	26.4	.35	.33	99	2.6	53.9	.75	.37	.62	.35	.30	9.7	140	76	5.36	45.5	53.63
Nebraska	2.80	1.67	4.47	128.2	42.9	.58	31.61	8,717	10.9	120.8	.29	.04	.02	.03	.16	7.4	141	241	3.49	37.4	34.86
North Dakota	1.81	.46	2.28	43.3	12.1	.07	.14	56	.1	39.0	.11	.02	.01	.02	.12	4.3	124	98	5.27	20.2	52.66
Ohio	2.21	.96	3.16	53.5	23.0	.35	.09	16	3.8	48.0	.70	.17	.17	.20	.36	5.4	119	52	5.91	30.4	59.12
South Dakota	1.21	1.18	2.38	37.9	7.1	.17	.98	167	2.3	31.5	.22	.03	.01	.04	.14	6.4	89	104	6.28	49.6	62.80
Wisconsin	1.66	2.00	3.66	53.9	15.5	.46	.41	142	1.9	43.6	1.30	.35	.19	.56	1.43	10.3	178	46	6.79	54.6	67.90
Total	32.15	17.50	49.63	943.2	340.1	5.11	58.57	12,918	57.8	840.1	9.00	3.82	5.13	3.80	4.43	101.1	2,011	1,273			

Agricultural Summary in the MASEC Region 1974. Abbreviated table taken from Agricultural Energy Use in the MASEC Region a Summary 1974 Data Base FEA/USDA '76 FEA/D-76-459

Table V

frailty of the overall food system. Supply shortages are often unanticipated and could cause more damage to the economy than higher energy prices. Energy supply interruptions and price increases will thus affect energy-intensive row crops such as corn, soybeans, cotton, and sorghum to a greater extent than the less energy-intensive small grain crops such as wheat, barley, and oats.

Production costs will increase at a faster rate for crops that are heavily dependent upon irrigation, large amounts of fertilizer, and fossil-fueled drying methods. It has been reported that the energy required for drying corn may exceed the total energy required for seed-bed preparation, planting, cultivating, and harvesting.[6]

In the future regional climatic differences and indigenous resource availabilities will increasingly dictate what types of crops and livestock are produced in a given area. In many cases, what have traditionally been dry-lands will be returned to pasture and range land rather than be used for energy and water intensive crop production purposes. Producing crops with lower energy requirements or subsidies, and a lower moisture content, would allow the use of manures (serving as fertilizer) to supply a larger percentage of crop lands than is currently possible while requiring less artificial crop/grain drying. While acreage yields may decrease under such programs, reduced energy subsidies and associated costs could increase the net value of production while conserving energy. Municipal sewage sludges and manures in general, will increasingly be regarded as a valuable resource for crop production purposes rather than a waste product to be disposed of in the most economical manner. Table VI depicts total manure production, including the fraction economically recoverable, for each state in the MASEC Region (1974).[7] Livestock and poultry manure is a valuable resource, especially when it is to be used to supplement or replace inorganic and organic fertilizer or livestock feed, for energy production, or other purposes. The quality of these manures varies significantly and is influenced primarily by the type of waste handling system used, climatic conditions, and general waste management practices. VanDyne and Gilbertson estimated that approximately 112 million tons (dry basis) of livestock and poultry manure was voided nationally in 1974. They estimated that 52 million tons, or about forty-seven percent of the total was economically recoverable. In this study, all the manure from feeder cattle, laying hens, and broilers is assumed to have been recoverable. Although almost half of the total manure estimated to be produced in the United States was from beef cattle on the range, only about four percent is estimated to have been economically recoverable. Of the 48 million tons of manure produced within the MASEC Region in 1974, fifty-three percent, or nearly 26 million tons, was determined to be economically recoverable. This economically recoverable manure tends to be high in moisture content and thus a potential candidate for anaerobic digestion to produce methane gas and other by-products. (Due to combustion efficiencies and feedstock drying costs, high moisture crops and manures should probably be digested rather than burned.

In Smith and Philbin's study of manure availability and biogas potential, six livestock confinement operations were examined.[8] The operations considered included:

1. Dairy
2. Cattle on feed
3. Swine

TABLE VI

Manure Production: Livestock and Poultry - 1974

State	Total Tons (10^6)	Tons Economically Recoverable (10^6)	Percent%
Illinois	3,711	1,897	51
Indiana	2,600	1,337	51
Iowa	8,166	4,506	55
Kansas	4,320	2,280	53
Michigan	1,549	1,123	72
Minnesota	4,374	2,917	67
Missouri	4,957	1,599	32
Nebraska	5,240	2,710	52
North Dakota	2,024	499	25
Ohio	2,406	1,431	59
South Dakota	3,959	1,312	33
Wisconsin	5,094	3,994	78
Region Total	48,400	25,605	53

Source: Estimating U.S. Livestock and Poultry Manure and Nutrient Production, Van Dyne and Gilbertson, 1978

4. Chicken broilers
5. Chicken layers
6. Turkey broilers

This study estimates the total annual energy potential (via anaerobic digestion) from all manures in these categories to be $.274 \times 10^{15}$ Btu's. Table VII depicts the energy potential within the MASEC Region for these six operations. This analysis estimates that the bulk of recoverable energy (about seventy-three percent) is on small farms. These farms range from ten to one thousand animal units. (For comparison purposes, an animal unit is assumed to be 1,000 pounds equivalent live weight.) It is very clear from the data in this analysis that there is a need to focus on the development of conversion technologies which can be applied to the small and intermediate size operation.

Numerous studies on the scale for using "continuous-stirred, rigid-tank reactors" (CSTR's) in anaerobic digestion have indicated that the economies of these systems require rather large farm operations to justify the investment.[9] The work by Jewell at Cornell is examining low-cost "plug flow reactor" designs for use on small dairy operations. This work is demonstrating that substantial cost reductions can be realized with such small-scale systems. Abeles, Ellsworth and Genereau have concluded that forty-nine percent of the available animal manure nationally could be econmically converted to methane given current state-of-the-art and present economic incentives.[10] This analysis also shows that siginificant economic advantages could be realized by those farm operations constructing their own systems. Thus they

TABLE VII

Annual Energy Potential - Smith, Philbin

West North Central (North Dakota, South Dakota, Nebraska, Kansas, Minnesota Iowa, Missouri)

Cattle on Feed	33.5	43.8%
Dairy	17.5	22.9%
Swine	16.8	21.9%
Turkey	5.5	7.3%
Layers	2.8	3.7%
Broilers	.3	.4%
	76.4×10^{12} Btu	100

East North Central (Wisconsin, Illinois, Michigan, Indiana, Ohio)

Dairy	25.5	53.4%
Swine	8.6	18.3%
Cattle on Feed	7.3	15.5%
Layers	3.6	7.6%
Turkeys	2.1	4.5%
Broilers	.3	.7%
	46.9×10^{12} Btu	100

MASEC Region Total 123.4×10^{12} Btu conclude, "much needs to be done in the area of education and engineering support for the farm community in the area of animal waste digestion." Another factor that is emphasized is that conventional energy prices are still so low that the value of the energy produced by digestors is small in comparison with the value of the effluent when used for animal feed, fertilizer, or other alternatives. Abeles, et. al conclude that anaerobic digestion technology is commercially viable today. Few plants have been built because of the mitigating circumstances of low energy costs and lack of interest in pollution control.

The nine leading crops in the U.S. produce nearly 400 million tons of crop residue a year. The leading residue-producing states are Iowa, Illinois, Kansas, Nebraska, and Minnesota. Highest residue-producing crops are corn, wheat, and soybeans. Crop residues, when returned to the soil, help retain plant nutrients and maintain soil tilth. When removed from the soil, residues remove large amounts of nutrients which must be replaced by mineral fertilizer or other sources, such as animal manure. Soil loss from crop land in the major land resource areas (MLRA's) of the United States is currently about three billion tons per year. This is an average of nine tons per acre. Larson has estimated that, given conventional tillage methods and current croping systems, there are 56 million tons of residues available for removal in the Corn Belt. This is thirty-six percent of the residue produced in the Corn Belt Region. Corn residues account for more than sixty-five percent of this amount.[11] Excessive removal of crop residues would increase wind and water erosion on cultivated land throughout the United States. Effective management techniques for controlling wind and water erosion include the use of cover crops, rotating crops and double cropping, the use of shelter belts, and other forms of residue management and tillage alternatives. Larson concludes, "if residues are needed for run-off and erosion control or maintenance of soil structure, and economically feasible alternatives are not available, then residues should remain on the land. However, if the soil's needs can be met with partial or near-full removal of crop residues (along with adequate fertilization and other feasible chemical practices), then there should be no objection by agriculture to their removal." In addition, Heichel reports that if ten percent of the nation's corn crop, about 7.5 million acres, were grown annually in rotation with alfalfa, the fertilizer nitrogen saved would reduce the annual demand for natural gas by 28 billion cubic feet.[12] Use of perennial crops eliminates annual planting/energy costs on low value or marginal land and deserves further investigation as an energy production technique.

A viable agricultural system must remain dynamic. Sound energy conservation and management techniques will become increasigly important as energy costs rise and supplies become uncertain. In the future agricultural applications of solar energy will become increasingly attractive.

Greenhouse agriculture utilizing solar reliant design features and municipal/industrial/agricultural waste-heat could increasingly serve as an economic means of producing high-yield crops near population centers on a year 'round basis. Such "local production for local consumption" schemes eliminate much transportation and processing/packaging costs, reduce energy consumption and make essential food supplies less subject to disruption.

Reed Maes has projected that there is the potential of saving one quad of energy nationally by widespread use of low-energy solar-reliant greenhouses when vegetables are produced near their point of end-use.[13]

The use of wind energy to provide mechanical and electrical power will increasingly serve remote irrigation, pumped storage and other variable and fixed demand loads on an economic basis. Rural electric utilities are a prime target of opportunity in rural areas for increased development of wind energy conversion systems as is the individual farm. The heating of water with flat-plate, concentrating or evacuated-tube collectors is usually a cost-effective application of solar energy today if systems are designed, sized, and installed properly. Such systems are capable of providing domestic hot water needs in dairy operations, space heating/cooling, crop drying and process heat needs. Hot air systems are also capable of similar applications. Passive solar design will increasingly become attractive for rural space heating needs as well as heating/ventilating of livestock buildings, farrowing houses, etc. Use of innovative heat exchange mechanisms (coupled with low-temperature solar) holds much potential for livestock/bird ventilation applications. Photovoltaics hold vast potential for on-site applications requiring electricity.

Chemical biomass conversion processes consist essentially of combustion and gasifications/pyrolysis options, while biological biomsss conversion processes include anaerobic digestion of organic wastes to produce methane gas and other by-products, and hydrolysis/fermentation/distillation processes to produce alcohol fuels. The fermentation of grains, crops and other organic residues to produce alcohol for use in numerous versions of gasohol programs is currently receiving much publicity -- especially in the MASEC Region, where much of the feedstock for any such program would be produced. The effectiveness of such a program would depend upon many factors including: the price and availability of relevant feedstocks, the price of gasoline and diesel fuels, the price and availability of various livestock feeds, production costs, energy efficiencies, the use of by-products and their effect on competitive products in the marketplace, etc. In order for many of these technologies to be economically and energetically efficient, it will become necessary to integrate systems and processes to demonstrate commercial viability. For instance, a feedlot might digest manure to produce methane gas that fuels a distillation process while re-feeding digestion effluent and fermentation/distillation by-products. All the technologies mentioned above are available today. Their cost-effective application will depend upon the cost and availability of conventional or alternative fuels, new technology infrastructure or lack thereof, financing, state and federal taxation policies, land use and urban-rural development policies and practices, pollution control/abatement incentives, municipal and industrial development bond issues, and other institutional areas of concern.

SRI (Stanford Research Institute) International recently completed a study for the Department of Energy that was designed to examine processes for producing useful fuels and chemicals from agricultural crops and residues in order to assist the Fuels from Biomass Systems branch in identifying the missions capable of contributing to U.S. energy supplies by 1985, 2000 and 2020.[14] The report states that "biomass offers a significant potential for reducing national dependence upon imported fossil fuel through the conversion of a renewable energy source to direct heat, liquid, and gaseous fuels, electric power, process steam, and chemicals." The study entailed the identification of over 1,100 possible missions (specific conversion routes from biomass feedstock to useful fuel and chemical products to end-use markets) before the selection of fifteen missions for detailed analysis. Using the base case assumptions for feedstock availability (without federal incentives) fifteen of the missions penetrate the market by the year 2020, producing approximately 5.4 quads (10^{15} Btu's) of fuel and chemical products, including electricity and steam. Assuming federal incentives and optimistic but achievable feedstock availability, seventeen missions penetrate the market by the year 2020, producing approximately 10.3 quads of fuel and chemical products. Table VIII indicates mission ranking factors, while Table IX indicates those missions selected for detailed analysis in the market penetration study. Table X indicates residue availability by type and price in 1975, 1985, 2000 and 2020. SRI mission rankings indicate the highest potential process technologies are 1) combustion of wood and low moisture plants to produce steam w/electrical by-product, 2) anaerobic digestion of manure to produce intermediate Btu gas (IBG), 3) pyrolysis (maximum liquid yields) of wood or low moisture plants to produce oil and charcoal, 4) gasification (staged air or oxygen blown) of wood or high moisture crops to produce ammonia, 5) anaerobic digestion of manure and high moisture crops to produce synthetic natural gas (SNG), 6) gasification (oxygen blown) of low moisture crops to produce IBG, 7) gasification (air blown) of high moisture crops to produce low Btu gas (LBG), 8) pyrolysis (maximum gas yield) of wood to produce SNG, 9) gasification (high moisture crops) to produce IBG and SNG, and 10) anaerobic digestion of high moisture crops to produce IBG. Table XI indicates biomass resource availability within the MASEC Region under the base and optimistic cases for 1985 and 2000.

EPRI (Electric Power Research Institute) reported in June, 1978, that "the economics of bio-fuels are still subject to considerable uncertainties. Site-specific estimates for purchase, collection, and transportation costs of agricultural residues vary at least two-fold . . . combustion is the least expensive and most competitive of the conversion processes, but gasification or anaerobic digestion is economically feasible for low-cost biomass resources. Liquid fuel prodution from biomass is too expensive to compete with presently available transportation fuels. While analysis of bio-fuel economics is complicated by site-specific factors, it is clear that this resource is already competitive with fossil fuels in some applications."[15]

The Department of Agriculture has primary responsibility and is the lead federal agency for policy matters relating to food crops, livestock forest activities, and rural development. This position was clarified and strengthened by Sections 1419 and 1420 of the Food and Agricultural Act of 1977, which provided for research and pilot projects and production and

TABLE VIII

SRI MISSION RANKING FACTORS

Factor	Relative Weighting*
1. Biomass Availability and Characteristics (Abundance of the feedstock resource, its compatibility with process conversion requirements and so forth.)	95
2. Potential Environmental Impact (Requirements of the mission for chemicals, fertilizers, catalysts, water, and other materials.)	85
3. Commercialization Potential (Possibility of reducing feedstock, capital and other expenses, and the feasibility of producing a useful and competitively priced product.)	80
4. Potential Energy Output (Ability of the process to provide a favorable energy balance.)	80
5. Product Slate and Marketability (Feasibility of producing a product with an established and broadly based market demand or the feasibility of penetrating or establishing a new market demand.)	75
6. Potential Competition from Alternatives (Ability of the mission to survive the introduction of substitute processes and product alternatives.)	60
7. Process Simplicity (Requirements for minimum preparation processing or synthesis steps.)	30

*Scale: 0 to 100.

Source: Mission Analysis: Fuels from Biomass, vol. II, SRI International, Jan. '79

TABLE IX

SRI Missions Selected for Market Penetration

Mission	Biomass Feedstock*	Conversion Process	Product	Major Market
1	Woody or low moisture	Catalytic liquefaction	Heavy fuel oil	Industrial, utility
2	Woody or low moisture	Gasification in oxygen blown reactors (OBRs)	Methanol from intermediate-Btu gas (IBG)	Transportation, utility
3	Woody or low moisture	Gasification in OBRs	Ammonia from IBG	Chemical--agricultural
4	Woody or low moisture	Gasification in OBRs	SNG from IBG	Industrial, commercial, and others
5	Woody or low moisture	Direct combustion	Steam	Utility, industrial
6	Woody or low moisture	Direct combustion	Electricity	Residential, industrial, commercial, etc.
7	Manure (from environmental feedlots)	Anaerobic digestion	IBG (CH_4 + CO_2)	Industrial, utility
8	Manure (from environmental feedlots)	Anaerobic digestion	SNG	Industrial, utility, and others
9	Wheat straw	Anaerobic digestion	IBG (CH_4 + CO_2)	Industrial, utility, and others
10	Wheat straw	Fermentation	Ethanol	Transportation
11	High sugar content plants	Fermentation	Ethanol	Transportation
12	Woody or low moisture	Pyrolysis for maximum liquid yield	Oil for direct combustion and char	Industrial, utility
13	Marine crop (kelp)	Anaerobic digestion	SNG	Industrial, utility
14	Algae	Fermentation	Ethanol	Tranportation
15	Woody or low moisture	Direct combustion	Steam with electricity by-product	Utility, industrial

*Another feedlot type was also considered in missions 7 and 8 (see Volume V).

Source: Mission Analysis: Fuels from Biomass, vol. II, SRI International, Jan. '79

SUMMARY OF RESIDUE AVAILABILITY IN 1975, 1985, 2000, AND 2020
BY TYPE OF RESIDUE AND PRICE (CUMULATIVE)

Residue	1975 Price per Dry Ton Delivered*	1975 Millions of Dry Tons Delivered	1985-2020 Price per Dry Ton Delivered*	Millions of Dry Tons Delivered 1985	2000	2020
Herbaceous high moisture	$10	10.7	$12.50	12.2	15.8	17.9
	30	55.4	37.50	64.2	83.8	94.5
	50	99.3	62.50	116.6	152.7	172.2
	70	107.7	87.50	127.1	166.6	187.9
	unavailable†	121.6	unavailable‡	143.4	187.4	211.5
Herbaceous low moisture	$ 6	16.3	$ 7.50	17.9	22.8	25.3
	16	68.3	20.00	68.6	81.5	90.6
	26	153.4	32.50	150.8	177.5	197.4
	37	200.1	46.25	204.4	246.2	274.0
	unavailable§	204.7	unavailable**	247.2	299.1	332.8
Animal manures	$ 2	13.8	$ 2.63	18.0	22.6	24.0
	10	38.1	13.15	49.8	63.1	67.9
	20	46.4	26.30	60.5	75.8	81.7
	30	48.2	39.45	62.7	78.2	84.3
	40	49.1	52.60	63.8	79.4	85.6
	unavailable	49.1	unavailable	63.8	79.4	85.6
Collected trash and hulls	$ 2	0.8	$ 2.70	1.0	1.2	1.4
	10	3.0	13.50	3.5	4.2	5.0
	20	4.9	27.00	5.8	7.0	8.6
	30	5.3	40.50	6.2	7.6	9.3
	unavailable§	7.6	unavailable**	8.7	10.5	12.8
Wood and woody plant residues	$ 3	36.7	$ 3.30	43.3	45.8	52.1
	7.50	55.7	8.25	65.6	69.3	78.9
	25	88.9	27.50	104.7	110.6	125.8
	40	125.0	44.00	147.4	155.7	177.1
	60	146.7	66.00	173.1	185.4	207.9
	unavailable†	182.9	unavailable‡	215.9	227.8	259.2

*In 1977 dollars.

†Plotted at $90.

‡Plotted at $112.50.

§Plotted at $70.

**Plotted at $87.50.

TABLE X

Source: Mission Analysis: Fuels From Biomass, Vol. III SRI, 1979

Table XI

Estimated Feedstock Availability in 1975--Base Case Scenario
(Millions of Dry Tons)

Price		East North Central (Region 5)			West North Central (Region 7)				Total All Regions				
Dollars Per Million Btu	Dollars Per Dry Ton	Low Moisture	High Moisture	Total	Low Moisture	High Moisture	Manure	Total	Low Moisture	High Moisture	Woody	Manure	Total
$0.67	$10	2	3	5	12	4	8	24	34	14	60	38	146
1.34	20	6	10	16	44	10	9	63	110	37	79	46	272
2.00	30	9	17	26	69	17	10	96	174	61	100	48	383
2.66	40	11	23	34	82	23	10	115	206	83	125	49	463
3.33	50	11	30	41	88	30	10	128	222	106	135	49	512

Estimated Feedstock Availability in 1985--Base Case Scenario
(Millions of Dry Tons)

Price		East North Central (Region 5)			West North Central (Region 7)				Total All Regions				
Dollars Per Million Btu	Dollars Per Dry Ton	Low Moisture	High Moisture	Total	Low Moisture	High Moisture	Manure	Total	Low Moisture	High Moisture	Woody	Manure	Total
$0.67	$10	1	2	3	11	2	10	23	26	9	68	49	152
1.34	20	3	8	11	28	8	12	48	69	32	88	57	246
2.00	30	7	14	21	54	14	12	80	136	54	111	61	362
2.66	40	9	21	30	74	20	13	107	184	75	138	63	460
3.33	50	11	21	32	84	21	13	118	210	77	155	64	506

Estimated Feedstock Availability in 2000--Base Case Scenario
(Millions of Dry Tons)

Price		East North Central (Region 5)				West North Central (Region 7)				Total All Regions					
Dollars Per Million Btu	Dollars Per Dry Ton	Low Moisture	High Moisture	Woody	Total	Low Moisture	High Moisture	Manure	Total	Low Moisture	High Moisture	Woody	Manure	Aquatic	Total
$0.67	$10	2	3	-	5	12	3	12	27	30	13	73	61	-	177
1.34	20	4	11	-	15	33	11	14	58	81	44	94	72	-	291
2.00	30	8	19	1	28	65	19	15	99	162	71	119	77	-	429
2.66	40	11	28	1	40	89	28	16	133	222	100	149	79	7	557
3.33	50	13	37	1	51	102	37	16	155	256	132	165	79	7	639

Table XI - Continued

Estimated Feedstock Availability in 1985--Optimistic Scenario
(Millions of Dry Tons)

Price		East North Central (Region 5)				West North Central (Region 7)					Total All Regions				
Dollars Per Million Btu	Dollars Per Dry Ton	Low Moisture	High Moisture	Woody	Total	Low Moisture	High Moisture	Woody	Manure	Total	Low Moisture	High Moisture	Woody	Manure	Total
$0.67	$10	1	2	-	3	11	2	-	10	23	26	9	68	49	152
1.33	20	3	8	1	12	28	8	-	12	48	69	32	97	57	255
2.00	30	13	26	3	42	78	20	2	12	112	170	78	171	61	480
2.66	40	34	80	9	123	145	39	9	13	206	303	187	465	63	1,018
3.33	50	71	135	22	228	204	51	22	13	290	488	305	1,027	64	1,884

Estimated Feedstock Availability in 2000--Optimistic Scenario
(Millions of Dry Tons)

Price		East North Central (Region 5)				West North Central (Region 7)					Total All Regions					
Dollars Per Million Btu	Dollars Per Dry Ton	Low Moisture	High Moisture	Woody	Total	Low Moisture	High Moisture	Woody	Manure	Total	Low Moisture	High Moisture	Woody	Manure	Aquatic	Total
$0.67	$10	2	3	-	5	12	3	-	12	27	30	13	73	61	-	177
1.34	20	4	10	1	15	42	14	-	14	70	91	49	126	72	-	338
2.00	30	19	44	4	67	111	33	4	15	163	244	127	227	77	-	675
2.66	40	53	136	14	203	208	65	14	16	303	449	314	649	79	7	1,498
3.33	50	74	150	29	253	331	120	29	16	496	675	456	1,322	79	7	2,539

marketing of industrial hydrocarbons and alcohols. More recently, the Emergency Agricultural Act of 1978 provided for industrial hydrocarbon and alcohol feedstock production on set-aside acres and for incentive payments to maintain production of these crops in years in which there is no set-aside program. On July 26, 1978, Agriculture Secretary Bergland identified the following quantitative targets in the agricultural and forestry sectors for the year 1990:

1. Agricultral production -- net energy self-sufficiency under conditions that sustain productivity.
2. Forest production and processing -- net energy self-sufficiency under conditions that sustain productivity.

Bradley has estimated that the current hardwood harvest in the MASEC region, approximatly 23.4 million tons annually, could be increased threefold while the current softwood yield of approximately 7 million tons annually could be doubled if all Forest Service recommended areas were harvested. This estimate does not consider local resource availability and cost however.[16]

Table XI indicates that the farm population within the MASEC Region in 1970 totaled four million people. Approximatley 364 million acres was devoted to agriculture, with over one million farms located within the Region. Major crops produced in the region include corn, wheat, soybeans, alfalfa, sorghum and silage while livestock consist largely of hogs, beef, milk cows, chickens and turkeys. Total regional agricultural sales amounted to over $40 billion in 1974.

Earlier it was mentioned that the MASEC Region utilized forty-seven percent of the total energy consumed in the agricultural sector nationally. Of this near one quad (.941 x 10^{15} Btu's) used within the MASEC Region, approximately forty-six percent is utilized by farm vehicles in the form of gasoline and diesel fuel, thirty-six percent in fertilizer production, and five percent in fertilizer application, 6.3 percent for irrigation and 6.2 percent for crop drying, with the balance being utilized for purposes such as space heating, ventilation, water heating and waste disposal. Thus liquid fuels, SNG for fertilizer production, low-temperature heat and mechanical power are the end-use needs to be met by solar.

Farmers have traditionally been self-determined and innovative and pride themselves in the degree of self-sufficiency they possess. They have been willing to use new technology to increase their dependence from uncontrollable market forces such as cattle prices, crop prices, weather, and more recently energy. Thus solar, in its many forms, will be increasingly attractive to them.

The U.S. Department of Agriculture has established a vast network of educational and extension programs, and the United States has historically supported agricultural developement. This vast network is a prime mechanism for technology transfer at the local level.

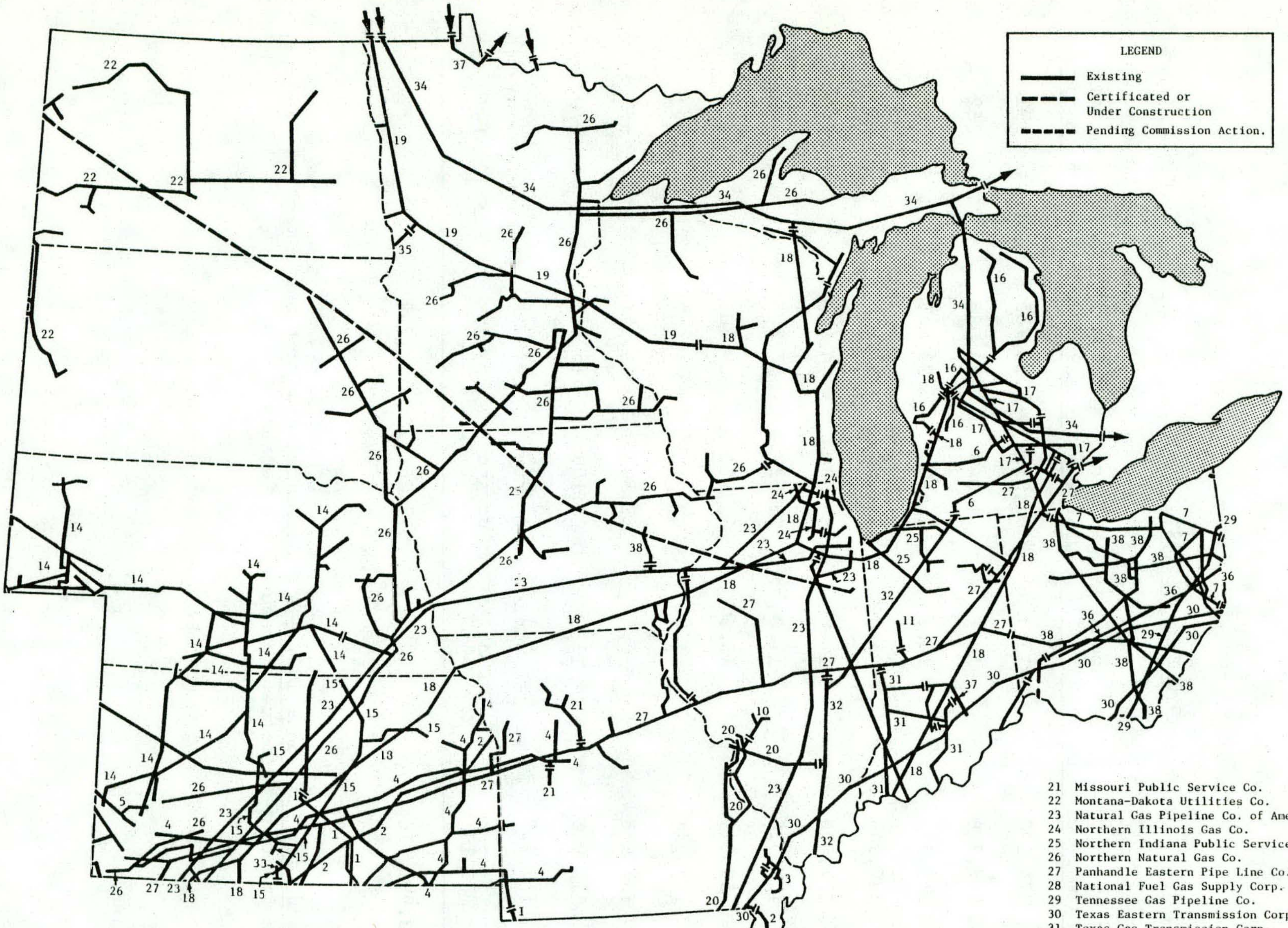
The agricultural community has geographic access to conventional energy transmission/distribution mechanisms and transportation systems - i.e., electric utility, gas pipelines, the railroads and barge traffic (See Figure 1). Farmers are familiar with cooperative business operations and recognize the value in pooling resources on a local level in order to realize economies of scale and increased distribution potential. Rural economic development options and asociated employement opportunity are attractive to rural area residents. The use of solar technologies on a decentralized basis is thus a prime target of opportunity for the agricultural community in particular and the rural population in general.

TABLE XII

1970 FARM STATISTICS

State	Farm Population	% Change '69 - '74	Number Of Farms	Total Acreage (1000's)	Average Farm Size
Indiana	374,590	-13.4	87,915	16,785	191
Illinois	428,726	-10.1	111,049	29,095	262
Iowa	512,371	-10.2	126,104	33,045	262
Kansas	237,944	- 8.0	79,188	47,946	605
Michigan	277,529	-17.8	64,094	10,832	169
Minnesota	454,516	-11.0	98,537	27,605	280
Missouri	359,319	-15.6	115,711	29,801	258
North Dakota	152,261	- 7.9	42,710	42,387	992
Nebraska	237,978	- 6.4	67,597	46,172	683
Ohio	370,946	-17.2	92,158	15,668	170
South Dakota	162,730	- 6.3	42,825	45,978	1074
Wisconsin	415,206	- 9.6	89,479	17,625	197
TOTAL	3,991,116		1,017,367	362,939	

From: Country and City Data Book, 1977 - A Statistical Abstract Supplement, U.S. Department of Commerce, Bureau of the Census.



1 Arkansas Louisiana Gas Co.
2 Arkansas-Missouri Power Co.
3 Associated Natural Gas Co.
4 Cities Service Gas Co.
5 Colorado Interstate Gas Co.
6 Columbia Gulf Transmission Co.
7 Consolidated Gas Supply Corp.
8 El Paso Natural Gas Co.
9 High Plains Natural Gas Co.
10 Illinois Power Co.
11 Indiana Gas Co., Inc.
12 Iowa-Illinois Gas & Electric Co.
13 National Fuel Gas Distribution Corp.
14 Kansas-Nebraska Natural Gas Co.
15 Kansas Power & Light Co., The
16 Michigan Consolidated Gas Co.
17 Michigan Gas Storage Co.
18 Michigan Wisconsin Pipe Line Co.
19 Midwestern Gas Transmission Co.
20 Mississippi River Transmission Co.
21 Missouri Public Service Co.
22 Montana-Dakota Utilities Co.
23 Natural Gas Pipeline Co. of America
24 Northern Illinois Gas Co.
25 Northern Indiana Public Service Co.
26 Northern Natural Gas Co.
27 Panhandle Eastern Pipe Line Co.
28 National Fuel Gas Supply Corp.
29 Tennessee Gas Pipeline Co.
30 Texas Eastern Transmission Corp.
31 Texas Gas Transmission Corp.
32 Trunkline Gas Co.
33 Zenith Natural Gas Co.
34 Great Lakes Gas Transmission Co.
35 Great Plains Natural Gas Co.
36 Consolidated Gas Supply Corp.
37 Inter-City Minnesota Pipeline Ltd., Inc.
38 Columbia Gas Transmission Corp.

Figure 1

Major Natural Gas Pipelines Serving the MASEC Region

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Volume 2: Mission Selection, Market Penetration Modeling and Economic Evaluation.
Volume 3: Feedstock Availability
Volume 4: Thermochemical Conversion
Volume 5: Biochemical Conversion
Volume 6: Mission Addendum
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AGRICULTURAL PROGRAMS

AGRICULTURAL SECTOR PROGRAMS

1. Agricultural Energy Consumption Survey
2. Thermodynamic Needs Assessment of End-Use Tasks in the Agricultural Sector
3. Survey of Renewable Resource Availability for Energy Production Purposes
4. Agriculture Energy Models Development
5. Agriculture Industry Advisory Council
6. Institutional Barriers to the Use of Solar In the Agricultural Sector
7. Innovative Finance Programs - Needs Assessment
8. Information Dissemination
9. Agricultural Uses of Solar Energy - Training Program
10. Solar Energy Information Transfer - Financial Community
11. Market Analysis - Solar Crop Drying
12. Market Analysis - Small Wind Energy Conversion Systems
13. Solar Crop Drying Demonstrations
14. Urban Solar - Reliant Greenhouse Demonstration
15. Dairy Hot Water Demonstration
16. Space Heating/Ventilation of Livestock and Bird Shelters Demonstration
17. Agricultural (on-farm) Application of Solar Thermal Industrial Process Heat (IPH)
18. Direct Combustion Demonstration
19. Small Wind Energy Conversion System (SWEC) Demonstrations
20. Small Wind Energy Conversion (SWEC)/Utility Interface Study
21. Large Wind Energy Demonstration Program
22. On-Farm Ethanol (ETOH) Production/By-Product Utilization Demonstration
23. On-Farm Methane (CH_4) Production/By-Product Utilization Demonstration
24. Consumer Protection - Agricultural Sector

Program 1 Agricultural Energy Consumption Survey

Objective:

To collect and analyze current energy consumption data, by task and fuel type, for the agricultural sector.

Rationale:

Current baseline data is necessary to effectively assess which solar technologies are appropriate for meeting end-use task requirements.

Task Statement/Description:

Obtain most current standardized (nationally) consumption data on a county or state level basis. Such data should be sufficiently detailed so as to indicate quantities and types of energy consumed in carrying out specific end-use tasks for various farm/ranch operations.

Evaluation Measures:

Consistency of data with other state and federal data i.e., Peer Review

Related Programs:

- Program 2

Implementor:

U.S. Department of Agriculture and U.S. Department of Energy

Program 2 **Thermodynamic Needs Assessment of the End-Use Tasks in the Agricultural Sector**

Objective:

To analyze all end-use tasks in the agricultural sector to determine energy quality requirements.

Rationale:

Such information will allow the identified end-use task thermodynamic requirements to be met via appropriate solar technologies based upon energy quality and load requirements.

Task Statement/Description:

Develop a "thermodynamic process requirement spectrum" and include all end-use agricultural tasks in said spectrum. All pertinent task/process requirements should be included in such an assessment (i.e., temperature and moisture differentials, time requirements if appropriate, pressure requirements, climatic and seasonal aspects, etc.).

Evaluation Measures:

"Process requirements" should be appropriate at the local level considering croping and climatic variables, etc. State review.

Related Programs:

- Program 1

Implementor:

U.S.D.A., land grant colleges and experiment stations and MASEC

Program 3 Survey of Renewable Resource Availability for Energy Production Purposes

Objective:

To determine types, quantities and replacement rates of various renewable resources usable for energy production purposes on a county-by-county basis throughout the country.

Rationale:

Once end-use task thermodynamic needs are identified, then indigenous renewable resource availability will determine the degree to which end-use task requirements can be met by renewable resources.

Task Statement/Description:

Determine quantities of and replacement rates for renewable resources available for and capable of producing energy at the county level throughout the U.S. (i.e., survey crop residues available above and beyond what is needed to prevent erosion and maintain soil tilth; types and quantities of manure available - numbers and sizes of confinement operations, types of waste management systems; forest potential on federal/state/local and private lands; wind potential; solar insolation; marginal lands availability, slope characteristics, etc.; wetlands, etc.). Similar work has been done for conventional fuels on a county-by-county basis by Brookhaven National Laboratory under contract to DOE (see The Energetics of the United States of America: An Atlas, BNL50501-R).

Evaluation Measures:

Appropriate state and federal review as to quantitative varification on existing biomass availability, production rates, sustainability, etc.

Related Programs:

- o Programs 1, 2 and 4

Implementor:

U.S.D.A., EPA, Interior and MASEC

Program 4 Agricultural Energy Models Development

Objective:

To model end-use task thermodynamic requirements, current energy sources and amounts used to meet task requirements, conservation potential, indigenous renewable resource availability, solar technology applications and determine optimum mix of solar (renewable) technologies available to meet demands of agricultural sector. Determine if demands can be manipulated to better utilize available renewable resources, while maximizing net energy production from the agricultural sector.

Rationale:

Such information would provide development options whereby non-renewable energy dependencies in the agricultural sector could be reduced or eliminated, with energy possibly being exported for use in other sectors.

Task Statement/Description:

Implement Programs 1, 2 and 3 and develop model to analyze and integrate information. Develop regional and state-level model. Evaluate and up-date.

Evaluation Measures:

Correlation between net energy production potential as determined by model and demonstrated field results based upon model recommendations.

Related Programs:

- Programs 1, 2 and 3, all demonstration programs

Implementor:

SERI, MASEC, states

Program 5 **Agriculture Industry Advisory Council**

Objective:

To obtain input from farmers/ranchers, small business representatives, equipment manufacturers and distributors, rural contractors and the finance community regarding new product needs, technology transfer activities needed, incentives and disincentives, product certification, financing, etc.

Rationale:

Input from various audiences of potential end-users will allow for continual feedback and updates on needed new directions and approaches to more effectively commercializing solar technologies within the agricultural sector of the economy.

Task Statement/Description:

Develop an "Agriculture Industry Advisory Council" from current SRAP membership. The individual SRAPs could form agricultural committees with committee chairpersons serving on the Regional Agriculture Industry Advisory Council. Regional Council meets semi-annually to evaluate and update existing programs while determining direction of future programs.

Evaluation Measures:

Programs implemented and projects completed. Quality of information distributed and public feedback.

Related Programs:

- SRAP and PRPB within MASEC program

Implementor:

MASEC and SRAPs in states, major agriculture trade organizations.

Program 6 <u>Institutional Barriers to the Use of Solar in the Agricultural Sector</u>

<u>Objective:</u>

To identify the needs and issues important to solar technology utilization in the agricultural sector. Analyze these needs and issues and any potential options or alternatives. Define institutional barriers and develop model solutions.

<u>Rationale:</u>

It is often unclear what the priority needs are in the agricultural sector since they tend to vary with climate, local economies, tax schedules and regulations and local agricultural practices, etc. A comprehensive analysis of local, state and federal policies (zoning, land-use, set-aside acreage, taxation, etc.) and programs will provide sub-regional targets of opportunity for solar development and identify major barriers and constraints to solar development.

<u>Task Statement/Description:</u>

6.1 Collect data on 1) historic land-use trends and current state policy; 2) state taxation policy pertinent to agricultural lands; 3) state farm legislation; 4) federal legislation relevang to maintenance of agricultural lands, water quality, rural development and credit and processing of agricultural products, etc.; 5) federal set-aside acreage historically including payments; 6) commodity pricing schedules and parity supports; and 7) other information as determined necessary.

6.2 Such information compiled according to state for comparison purposes. Information then reviewed and commented on by experts in agricultural policy and economics from each state on a contract basis. All reviews and comments compiled to form basis of "Regional Barriers, Constraints and Solutions to Implementing Solar Technologies in the Agricultural Sector" for the MASEC Region. Distribute widely.

6.3 Information Transfer/training programs developed upon recommendations and needs i.d., as defined in above document.

Evaluation Measures:

New legislation at state and federal level regarding solar development in agricultural sector. Peer review and recommendations of Barriers/Solutions document at state level.

Related Programs:

- Barriers and Constraints Studies for other sectors as implemented by SERI, DOE, and Solar Action, Inc.
- Solar Law Reporter by SERI
- Program 5 - Ag. Industry Advisory Council
- Program 24 - Consumer Protection

Implementor:

MASEC

Program 7 **Innovative Finance Programs - Needs Assessment**

Objective:

To determine optimal finance programs to accelerate the use of solar technologies in the agricultural sector - reduce first costs for new and retrofit equipment installations.

Rationale:

Equipment and installation costs coupled with today's high cost of money serve to slow solar implementation in the agricultural sector. Existing finance programs with attractive terms need to be identified while other options such as investment tax credits and accelerated depreciation need investigation as to appropriateness for the agricultural sector.

Task Statement/Description:

Survey existing state/federal finance programs available to the agricultural sector, including farmers/ranchers, processors, cooperators, etc. Assess effectiveness of such programs and determine what new programs/policies are needed. Work with state/federal agencies and elected representatives to implement effective finance programs.

Evaluation Measures:

Usage rates of existing programs before and after survey and publicity - increased funds committed, etc. New legislation as a result of program.

Related Programs:

- Barriers program
- Information Dissemination Program

Implementor:

MASEC, SSO's

Program 8 Information Dissemination

Objective:

To transfer technical and socio-economic information concerning agricultural applications of solar energy.

Rationale:

A great deal of such information is available to a very limited audience via numerous professional journals and computer facilities. Much of this information should be digested and summarized for a more general audience i.e., results of successful demonstrations, why something didn't operate properly, available financing, technical assistance available, etc. Such information should be readily accessable to farmers/ranchers and other potential end-users, the finance community, equipment manufacturers and distributors, contractors, educators, designers and installers, energy suppliers and state/local public officials.

Task Statement/Description:

8.1 Develop information transfer/training aid materials for use by those interested in the agricultural applications of solar energy. For example:

1) Solar Agriculture newsletter
2) slide/tape cassette presentations for loan
3) movies for loan
4) bibliographies

5) articles in agricultural journals and alternate energy publications

6) toll-free hot line

These materials should include information classified according to specific technologies, their potential applications and agriculturally oriented end-use task requirements.

8.2 An attempt should be made not to duplicate current private sector activities. Where current private sector activities are in place, additional support to expand and/or improve such activities may be warranted. Thus, in many instances this program would stimulate better information transfer on the part of existing organizations to what may become an expanded audience.

8.3 Task 1

Survey existing information distribution mechanisms within region. Determine informational needs and determine where gaps exist.

8.4 Task 2

Provide assistance to existing organizations where appropriate. Develop appropriate materials where necessary.

Evaluation Measures:

Reliable information transferred and solar installations as a result. Increased readership, etc.

Related Programs:

- SERI's TID Program
- SEIDB
- TIC
- U.S.D.A.
- NCAT
- RAIN
- Alternative Sources of Energy, Organic Gardening, Farm Journal, etc.

Implementor:

MASEC

Program 9 **Agricultural Uses of Solar Energy - Training Program**

Objective:

To train educators in Vocational-Technical and Agricultural Schools in the basic design, installation and maintenance of agriculturally oriented solar technologies.

Rationale:

If the existing educational (agriculture) infrastructure is adequately trained in the basic design, installation and maintenance of various solar technologies, then students and the agricultural population in general will benefit from increased solar energy information transfer and technology utilization.

Task Statement/Description:

Survey reports on federally funded demonstration projects (DOE, USDA) to determine optimal systems designs and applications for the following technologies and end-use tasks:

active/passive space heating (liquid/air)	space heat (homes & livestock shelters)
ag. applications of industrial process heat	ventilation (livestock shelters)
small wind energy conversion systems	hot water requirements (i.e. dairy)
anaerobic digestion	crop/grain drying
fermentation/distillation	water pumping/irrigation
direct combustion	waste disposal/management
low-cost heat exchangers	vehicular needs (liquid fuels)
	feed supplements
	fertilizer production
	electricity

Based on the above information, develop basic informational brochures and advanced training packages with aids on 1) solar energy availability throughout region; 2) generic technologies, systems designs, materials, components, installation, maintenance, etc.; 3) end-use task requirements for appropriate technological application; 4) integration of seasonal tasks to economically optimize given technology applications; and 5) on-site utilization on all products and by-products.

When above materials are in draft stage an extensive review/evaluation by experts in the field should be implemented prior to initial trial training sessions. Extensive feedback on trial sessions would precede the development of "final programs." Core educators from throughout region would then be trained extensively whereupon they would transfer information to field personnel and end-users (farmers/ranchers).

Evaluation Measures:

Personal contact of solar education nature in the field, i.e., vo-tech schools and extension programs. Solar installations and conventional energy displaced as a result of said contacts.

Related Programs:

- o Cooperative Extension Service
- o Energy Extension Service
- o U.S.D.A. Science and Education Administration and Agricultural Research Service
- o land grant university programs
- o Information Dissemination Program 8

Implementor:

SERI, MASEC

Program 10 Solar Energy Information Transfer - Financial Community

Objective:

To provide rural financiers with information on agricultural applications of solar energy and economics of various technologies and their respective end-use applications. Emphasis on integrated system designs, life cycle cost accounting and the potential for energy production in the agricultural sector.

Rationale:

The financial community serving the agricultural sector needs sound economic information regarding solar technology performance, and capabilities compared with conventional alternatives. Without support of the financial community the agricultural sector will not be able to implement solar technology options.

Task Statement/Description:

After surveying and monitoring solar installations in the agricultural sector, economic analyses can be performed and data compiled for the finance community. Such information would be transferred via agricultural economists and technical personnel emphasizing life cycle costing methods, security from supply interruptions, etc.

Evaluation Measures:

Private sector loans for solar applications in the agricultural community. A before and after survey of lending institutions regarding past activity and knowledge of solar-repeated after training.

Related Programs:

- All demonstration/monitoring programs listed herein
- F-Chart
- SESOP and potentially other technical/economic programs

Implementor:

SERI, MASEC, agricultural schools

Program 11 Market Analysis - Solar Crop Drying

Objective:

To determine potential market for solar crop drying in the MASEC Region based upon projected new-equipment purchases.

Rationale:

Equipment manufacturers need this type of market analysis, including information on consumer attitudes and financing available in order to determine the level-of-effort to place into this "new-product" development. Until new, off-the-shelf solar crop dryers are available the retrofit market will provide for relatively slow market penetration via the on-site, owner-built installations

Task Statement/Description:

Survey market to determine maximum potential sales of new equipment; consumer preference, needs and attitudes, and financing available for solar crop dryers. Provide information to agricultural equipment manufacturers/distributors, agricultural publications and trade organizations

Evaluation Measures:

Level of manufacture and product sales

Related Programs:

- o Ag. Industry Advisory Council Program #4
- o SWEC's Marked Analysis Program #12
- o Solar Crop Drying Demonstrations Program #13

Implementor:

MASEC

Program 12 Market Analysis - Small Wind Energy Conversion Systems

Objective:

To determine characteristic loads of most farms/ranches in region (by type and size of operation) and consider management techniques to reduce peaks thus allowing manufacturers to design several sizes/ types of SWEC systems to meet the needs of most operators in region.

Rationale:

Little is known about average load demands for various types of farm/ ranch operations (i.e., dairy, hog, turkey, feeder cattle) and viable methods of reducing peaks in the respective operations. If load-management techniques and average load information were available on a categorized basis, manufacturers would be better able to assess marketing potential for various system designs and sizes.

Task Statement/Description:

Assess major types of farm/ranch operations (end-use task) and determine major scale of various operations (i.e., number of operators falling under three scales according to size). Determine most viable load-management techniques and project potential markets for various sizes of SWEC systems. Distribute results widely and make available to existing and/or potential manufacturers.

Evaluation Measures:

Interest in market analysis by private sector and increased manufacturing activity/sales based upon results.

Related Programs:

- o SWEC demonstration program
- o Agriculture Industry Advisory Council program
- o Thermodynamic Needs Assessment of End-Use Tasks Program
- o Agricultural Uses of Solar Energy-Training Program

Implementor:

MASEC

Program 13 Solar Crop Drying Demonstrations

Objective:

To displace conventional energy sources used for crop drying with solar alternatives.

Rationale:

Nearly 58×10^{12} Btu of high quality energy was consumed within the MASEC Region in 1974 to dry crops. Crop drying requires very low ΔT's - just enough to lower the humidity of the drying air enough to dry the crop to a moisture level safe for storage, transportation and marketing. High-speed corn drying methods require approximately 10-15,000 Btu per bushel. Slower drying, using low-temperature (i.e., 85°-150°F) solar applications assisted by wind powered ventilation turbines offers great potential for reducing current levels of fossil fuel consumption. If crop-drying equipment can be integrated with other end-use tasks (i.e., heating/ventilating livestock shelters) the annual period of use increases thus improving system economics.

Task Statement/Description:

13.1 Survey current research projects to determine the most cost-effective/efficient methods and technologies of drying crops with solar thermal and wind energy with the potential of integrating the system with other end-use tasks.

13.2 Develop six "systems designs" for various scales of operation and specific end-uses. These designs would be evaluated by the agricultural community, and made available through extension agents and offices.

13.3 Based upon survey and designs developed, farmers would be solicited to construct full-scale field demonstrations (fully monitored for two seasons) on a cost-share basis. Ten such units would be constructed and monitored with results widely distributed i.e., farm journals, extension, lenders.

Evaluation:

Monitored results of systems installed, publicity and demand for designs, etc.

Related Programs:

- All information transfer programs
- Energy Model Program #4

Implementor:

MASEC and SSOs

Program 14 Urban Solar-Reliant Greenhouse Demonstration

Objective:

To displace conventional energy consumed in the normal "food production, transport, process/package, transport, wholesale/retail" distribution mechanism by producing fresh vegetables on a year 'round basis in solar reliant greenhouses for local consumption.

Rationale:

Greenhouse energy consumption can be greatly reduced via proper site orientation and design methods. Fresh produce can be available throughout the year at reduced cost due to reduced energy inputs. Such operations also offer local economic development potential and employment opportunity in urban areas.

Task Statement/Description:

Solicit proposals for an urban located solar-reliant greenhouse to be used for food production purposes. Six awards made on a cost-share basis (awards not to exceed $10K) for construction of greenhouses. All systems monitored for two years. Plans/specifications and operational results, recommendations widely publicized.

Evaluation Measures:

Food production costs on life cycle basis compared with conventional alternatives. Local economic development (income generated) employment, etc. Interest in program and other greenhouse operations constructed as a result of this program.

Related Programs:

- o DOE
- o U.S.D.A.
- o CSA operational results
- o Information transfer programs contained herein

Implementor:

MASEC, local organizations

Program 15 Dairy Hot Water Demonstration

Objective:

To demonstrate the technical and economic feasibility of using solar energy and waste heat to heat water for dairy needs.

Rationale:

Solar thermal and refrigeration/electrical generation waste heat can be used economically to provide service hot water to meet dairy needs. Well publicized demonstrations will serve to stimulate dairy operators to adopt this new application of standard technologies.

Task Statement/Description:

Solicit proposals from farmer/contractor teams to design and install solar thermal and waste heat utilization systems on dairy operations within the MASEC Region. Awards on a cost-share basis, with installations monitored for a period of two years. Two awards in the region. Document and publicize operational results.

Evaluation Measures:

Monitored technical and economic performance. Increased interest by dairy operators and new installations as a result of these demos.

Related Programs:

- DOE/U.S.D.A. research results and all information transfer programs contained herein
- Energy Model Program #4

Implementor:

MASEC

Program 16 Space Heating/Ventilating of Livestock and Bird Shelters Demonstration

Objective:

To demonstrate the technical and economic feasibility of space heating and/or ventilating livestock/bird shelters thus displacing conventional energy currently used for said purpose while stimulating the market toward increased utilization of such new technology.

Rationale:

The MASEC Region consumed over five billion Btu's for space heating and nearly 4 billion Btu's for ventilation of livestock/bird shelters in 1974. By using low-temperature applications of solar thermal energy and low-cost heat exchangers, this amount of conventional fuel consumption can be greatly reduced. Also, allowing for lower-cost environmental control of such structures more farmers/ranchers will be able to use such methods to improve their livestock/bird operations i.e., optimal temperatures/humidity reduce feed requirements and improve animal health.

Task Statement/Description:

Survey existing applications of solar to heating/ventilating of livestock shelters and determine optimal approaches. Develop system designs for 1) hog farrowing, 2) feeder pigs, and 3) turkey/chicken operations. Construct on a cosh-share basis and monitor-evaluate at least one hog and one bird demonstration per state. Disseminate results widely i.e., extension network, farm journals and agricultural schools.

Evaluation Measures:

Monitored results and demonstrated interest by farmers/ranchers

Related Programs:

- o All information transfer/training programs
- o Energy Model Program #4

Implementor:

MASEC

Program 17 Agricultural (on-farm) Application of Solar Thermal Industrial Process Heat (IPH)

Objective:

To demonstrate the technical and economic feasibility of on-farm applications of IPH.

Rationale:

Approximately five percent of total U.S. energy consumption is devoted to food processing tasks, with transportation of raw and processed foods adding to this amount substantially. The processing of foods via solar energy on-the-farm or in a cooperative venture among a number of farms offers potential energy savings over conventional (fossil fueled) alternatives while reducing transportation costs. Such "decentralized production/processing/distribution" schemes also offer industrial and economic development/employment opportunities to rural areas. Financing for such "rural development" is available under attractive terms from U.S.D.A., EDA and CSA.

Task Statement/Description:

17.1 Survey IPH applications and solicit proposals from farmer/cooperator/contractor teams to design and install three IPH systems in the MASEC Region. Based upon original proposals, ten feasibility studies would be funded at not greater than $5K each. Three projects would then be funded on a cost-share basis with program grant funds limited to $10K.

17.2 Financial support for construction would be solicited from U.S.D.A. and the private sector. Installations would be monitored for three years with results widely distributed.

Evaluation Measures:

Cost effectiveness of process, improved local economy and interest expressed by other farmers, ranchers and cooperators.

Related Programs:

- o DOE/U.S.D.A. IPH research results
- o Information transfer programs mentioned herein
- o Energy Model Program #4

Implementor:

SERI, MASEC

Program 18 **Direct Combustion Demonstration**

Objective:

To demonstrate the economic viability of direct combustion applications on the farm.

Rationale:

Many end-use tasks require power in a form that could be supplied by direct combustion of wood or agricultural residues. Some potential applications include crop drying, process heat for on-farm/ranch needs and generation of electricity.

Task Statement/Description:

Survey current activities to assess problems and successes. Solicit input from interested farmers/ranchers concerning specific applications. Award six "feasibility study" contracts to determine technical and economic feasibility with a cost-share construction contract going to best three applications. Monitor and document operational results and publicize widely.

Evaluation Measures:

Conventional energy displaced per installed cost on a life cycle basis, etc. Interest expressed as a result of publicity.

Related Programs:

- o All Information Dissemination Programs
- o Ag. Industry Advisory Council Program #5
- o Energy Model Program #4

Implementor:

MASEC

Program 19 Small Wind Energy Conversion System (SWEC) Demonstrations

Objective:

To demonstrate the technical and economic feasibility of commercially available SWECs in meeting agricultural demands.

Rationale:

SWECs can be applied to agricultural tasks in an economic manner if appropriate wind systems are applied to appropriate demand-tasks. (Thus, effort should be made to reduce the entropy requirements of end-use tasks.) Many end-use tasks require only variable-speed mechanical power i.e., pumping heat and water, compressing air as a storage medium and potential energy source, grinding, milling and hydraulic operations. If an electric generator/alternator is used it should be applied to end-use tasks that require electricity in such a manner as to reduce expensive peak-load demands. Loads that can be varied according to wind availability would be another good application.

In many cases end-use demand loads should be manipulated so that all power produced can be used on-site, thus eliminating the need for costly utility-interface equipment, and the situation whereby excess power is purchased by the utility at very low wholesale rates.

Task Statement/Description:

Solicit proposals from commercially available SWECs manufacturers/distributors and private contractors/farmers to install/integrate cost-effective SWECs ($<$100 kW) on farms. Primary criteria for award would be innovative technical applications and ability to be duplicated elsewhere. All systems would be adequately monitored to demonstrate effectiveness while promoting market acceptance and demand. At least one unit should be installed per state with at least 1/3 providing mechanical power.

Evaluation Measures:

Cost-effectiveness in terms of reducing non-renewable energy demands and/or increasing production output in an economic manner.

Related Programs:

- o Other wind demonstration programs and information transfer/training programs.
- o Energy Model Program #4

Implementor:

DOE, U.S.D.A., MASEC

Program 20 Small Wind Energy Conversion (SWEC)/Utility Interface Study

Objective:

To determine cost-effectiveness of integrating various sized SWEC systems with utility grids.

Rationale:

Interface equipment is expensive and small energy producers receive wholesale (or less) rates for power purchased by the utilities. A survey of available equipment, costs and capacity factors and wholesale rate structures would allow for development of an economic feasibility curve for various regions of the country.

Task Statement/Description:

Survey pertinent component manufacturers, suppliers and installers to determine installed costs of various SWEC/utility interfaced systems. Integrate such information with climatological data to determine capacity factors and compare with current and projected wholesale utility rates to determine cost-effectiveness.

Evaluation Measures:

Compare cost-effectiveness of installed systems (monitored data) with Study projections.

Related Programs:

- Energy Model Program #4
- Information Transfer

Implementor:

DOE, U.S.D.A., MASEC

Program 21 <u>Large Wind Energy Demonstration Program</u>

<u>Objective:</u>

To demonstrate the technical and economic feasibility of large wind systems in agriculture and rural areas.

<u>Rationale:</u>

Widespread use of large wind systems (100 kW) in agricultural and rural areas holds much potential for reducing or eliminating the need for costly new central station fossil/nuclear generation capacity and distribution grids (note recent opposition to/cost of large central sized systems and transmission liens).

An excellent target of opportunity for large wind systems in the agricultural sector is the rural electric network. Most rural electrics purchase power from IOUs (investor owned utilities) at highly inflationary rates. (Rural electrics are cooperative organizations that strive to keep costs down for members/stockholders.)

Rural electrics are afforded very attractive finance capabilities via the Rural Electric Administration (in some cases, IOUs are using this REA financial benefit to their advantage by including rural electrics as part owners in new central-station capacity thus reducing their capital costs). Many rural and municipal electrics are connected to grids supplied by federally financed hydro-electric facilities. This hydro has traditionally provided low-cost base load capacity, although in the future, it will increasingly serve to meet expensive peak loads with expensive (purchased) fossil/nuclear capacity providing base load capacity. Coupled with new and existing hydro facilities wind can serve to provide pumped storage thus increasing hydro capacity. Large wind systems tied to rural grids would also serve to reduce purchased power costs.

Task Statement/Description:

Solicit proposals from Rural Electric/Systems Contractor teams to install on a cost-share basis, large wind systems to reduce consumption of fossil/nuclear central station power. Rural Electric would be expected to provide sixty percent of the installed cost of system. All systems would be monitored to document technical and economic performance.

Evaluation Measures:

Cost-effectiveness as compared to marginal costs of alternative central-station capacity and distribution.

Related Programs:

- Energy Model Program #4
- Information Transfer Programs

Implementor:

DOE, Rural Electric Administration, U.S. Army Corps. of Engineers, MASEC

Program 22 On-Farm Ethanol (ETOH) Production/By-Product Utilization Demonstration

Objective:

To demonstrate the technical and economic feasibility of producing ETOH and using distillers dried grains and soluables on the farm with a net-energy gain based on non-renewable energy consumed in process.

Rationale:

The technology to produce ETOH from sugars, starches, carbohydrates and cellulosic residues is available and is being improved continually. Primary areas of concern are the cost and availability of feedstock material; amount, type, and cost of energy fueling the process; degree of distillation and quality of ETOH product; and residue (DDGS) utilization. The use of ETOH on the farm can reduce or eliminate the on-farm use of conventional liquid fuels directly while reducing the associated transportation/distribution costs. Use of solar (any form) to fuel distribution process increases the above mentioned net-energy aspects of the process. Thus, total system design is very important. Visible and well publicized systems in the field will serve to stimulate market development thus encouraging private sector involvement.

Task Statement/Description:

Survey design options/opportunities on a bio-regional basis to determine optimal types of systems i.e., feedstock, quality of alcohol, use of by-products and process fuel source. Publish results widely and solicit cost-share proposals for design/construction/demonstration purposes. Provide assistance in obtaining licensing, etc., and monitor for technical-economic efficiency. Approximately sixty demonstration systems (not greater than 1,000 gallon/week capacity) should be constructed throughout the 12-state region over a period of three years.

Evaluation Measures:

Cost-effectiveness and energy efficiency based upon non-renewable energy inputs, and system performance/durability.

Related Programs:

- DOE/U.S.D.A. experimental projects

Implementor:

SERI, MASEC

Program 23 On-Farm Methane (CH_4) Production/By-Product Utilization Demonstration

Objective:

To demonstrate the technical and economic feasibility of using anaerobic digestion to produce CH_4 and then to efficiently use the gas and liquid/solids effluent in an on-farm situation.

Rationale:

The technology to produce methane gas via the anaerobic digestion of organic wastes and then to utilize said gas and other process effluents in an economic manner is currently available. A "total systems" design approach will help to ensure optimal use of all process products and by-products and thus a positive system economics. A favorable net-energy balance should be obtained based upon any non-renewable energy sources consumed in the process(es). Visible and well publicized demonstration systems will serve to stimulate private sector involvement in the widespread development and implementation of on-farm digestion systems, thus reducing real and potential pollution while producing renewable energy.

Task Statement/Description:

Survey design options/opportunities on a bio-regional basis to determine optimal "systems designs" based upon feedstock availability and end-use of all process products and by- products. Publish results widely and solicit cost-share proposals for design/construction/demonstration purposes. Also provide operational training. Approximately twenty demonstrations (not greater than 20,000 gallon capacity) should be constructed throughout the 12-state region over a period of three years. All systems will be monitored for 3-5 years to determine technical and economic feasibility.

Evaluation Measures:

Cost-effectiveness and energy efficiency along with demonstrated system performance and durability. Private sector interest as a result of demonstrations. New systems built.

Related Programs:

- o Large scale projects funded by U.S.D.A., EPA, and DOE

Implementor:

SERI, MASEC

Program 24 Consumer Protection - Agricultural Sector

Objective:

To provide farmers/ranchers/cooperators with objective socio-economic and technical information regarding state-of-the-art and currently feasible solar technologies and their application in the agricultural sector.

Rationale:

Potential end-users need reliable information concerning particular solar technologies and their sound application i.e., what works now and what it costs, what factors influence cost/payback and what will be available in the near-term. If end-users invest in poor equipment and are not satisfied their experience will translate into retarded growth of the industry in general.

Task Statement/Description

Monitor state/federal programs (incentives and barriers) and provide input for their sound development. Monitor technology/component manufacturers and installation/maintenance infrastructure for trends (problems and potentials), development of standards/certification/ warranty programs, etc. Work with those people/organizations mentioned above as well as consumers (potential end-users) to help ensure a healthy and rapid growth of the industry through an accelerated penetration in the agricultural sector.

Evaluation Measures:

Amount of information disseminated and growth of the industry.

Related Programs:

- o All information transfer and demonstration programs

Implementor:

SERI, MASEC, states

APPENDIX

BOILER ROOM PROGRAMS

BOILER ROOM RECOMMENDATIONS

Programs and Task Category	Percentile
Wind Energy Demonstrations - Market Development	100
On-Farm Alcohol Production/By-Product Utilization Demonstration - Product Development	100
On-Farm Methane Production/By-Product Utilization Demonstration - Product Development	93
Solar Energy Information Transfer and Training Program - Institutional/Legal	79
Urban Agriculture - Market Development	93
Solar Heating Demonstrations - Market Development	86
Agricultural Sector Policy Development/Implementation - Institutional/Legal	86
Agricultural Energy Products Development - Product Development	75
Residential Wood Fuels Demonstration - Industrial Infrastructure	71
On-Farm Energy End-Use Needs Analysis - Institutional/Legal	50
Agricultural Energy Models Development - Market Development	50
State/Regional Policy Formation and Review Process Development - Legal/Institutional	32
Energy Performance Standards for Farms - Institutional/Legal	14

TASK SUMMARY OF Wind Energy Demonstrations (Title)

Market Sector: Agricultural	Task Implementor: RSECs and States
Task Technology: Wind	Task Category: Market Development

Objective: To reduce the amount of central station electricity required by farms.

Rationale: Demonstration projects at the on-farm level could establish that wind power is feasible and cost-effective in agricultural applications.

Unique Opportunity: The rural aspect of the agricultural sector allows for easier implementation of wind technologies than in urban situations. Rural use of wind power could reduce demand on central station capacity and extensive distribution networks.

Task Description: Install wind electric and mechanical systems to provide electric power, irrigation, etc. Approximately 50 demos per state, averaging 5-20 kW in size.

Task Implementation (Subtasks):

1. Select farms based on wind characteristics, site availability, load characteristics, potential applications, accessability for demo purposes, etc.
2. Identify and install systems.
3. Monitor systems.
4. Evaluation and distribution of results.

Implementation Subtasks	Proposed Schedule Milestones							
	1979	1980	1981	1982	1983	1984	1985	2000
1.								
2.								
3.								
4.								
5.								
6.								
7. Manpower in Man-Months	10	156	30	12	10	10	10	150
Materials		2.5M	1M	.5M				
TOTAL Dollars	.1M	3M	1.5M	.6M	25K	25K	30K	500K

TASK SUMMARY OF On-Farm Alcohol Production/By-Product Utilization Demonstration (Title)

Market Sector: Agriculture	Task Implementor: RSEC, State/Local
Task Technology: Biomass Fermentation	Task Category: Product Development

Objective: Demonstration of on-farm alcohol production (ETOH) and by-product utilization.

Rationale: To obtain energy from agricultural biomass products, produced on-site, and utilization of by-product DDGS as feed supplement, etc.

Unique Opportunity: Technology is available and the opportunity exists for the agricultural sector to produce E (from grains, distressed grains and residues) for on-site use or regional/national demand.

Task Description: Develop plans for on-farm small-scale production units to demonstrate energy efficiencies, by-product utilization and cost effectiveness.

Task Implementation (Subtasks):

1. Survey and choose plant design and size (100-800 gallon, 180^{o}/week).
2. Construct various systems (one per state).
   - Use of other renewable resources throughout the production process to reduce conventional energy inputs.
   - Analyze methods of using ETOH totally on-farm as well as by-products.
3. Evaluation of technical and economic performance.
4. Optimize Systems Designs for small-scale use based upon demonstration results.

Implementation Subtasks	Proposed Schedule Milestones							
	1979	1980	1981	1982	1983	1984	1985	2000
1.								
2.								
3.								
4.								
5.								
6.								
7. Manpower in Man-Months	144	144	144	144	72			
Materials	60K	120K	60K	60K	20K			
TOTAL Dollars	.5M	.6M	.5M	.5M	.2M			

TASK SUMMARY OF On-Farm Methane Production/By-Product Utilization (Title)

Market Sector: Agriculture	Task Implementor: RSEC,State/Local
Task Technology: Anaerobic Digestion	Task Category: Product Development

Objective: To demonstrate on-farm production of methane gas and other by-products via anaerobic digestion of livestock manures and cellulosic materials, and to use all process products efficiently.

Rationale: To use what are currently considered "wastes" to reduce dependence upon conventional fuels.

Unique Opportunity: The agricultural sector currently has vast quantities of manures and cellulosic materials available for such use. The technology is available and rural demonstrations are necessary.

Task Description: Develop plans for small-scale (5,000 - 25,000 gallon) anaerobic systems, construct systems and monitor operation.

Task Implementation (Subtasks):

1. Survey current systems & designs, evaluate & optimize for specific needs and sites chosen for construction, etc.
2. Design/construct systems (one per state) to utilize other renewable resources in process to increase efficiencies (i.e., solar heating, geothermal, etc.)
3. Optimize methane and other by-product utilization. Monitor performance.
4. Evaluation and distribution of results.

Implementation Subtasks	Proposed Schedule Milestones							
	1979	1980	1981	1982	1983	1984	1985	2000
1.	———	——→						
2.		———	——→					
3.		———	———	———	———	——→	- - -→	
4.		———	———	———	———	———	——→	- - -→
5.								
6.								
7. Manpower in Man-Months	72	88	88	48	48	48	12	
Materials		.6M	.6M	.2M	.1M	.1M		
TOTAL Dollars	.2M	.8M	.8M	.4M	.2M	.2M	25K	

TASK SUMMARY OF Information Transfer and Training Program (Title)

Market Sector: Agriculture	Task Implementor: RSECs, State Energy & Ag. Offi
Task Technology: All	Task Category: Institutional/Legal

Objective: Improve information transfer on agricultural/rural/low population density applications of solar energy based upon monitored demonstration results.

Rationale: There are existing programs in information transfer (extension, SCS, etc.) some of which have implicit and/or explicit energy program components. A marginal input to existing programs will provide a least-cost solar energy information transfer to this sector.

Unique Opportunity: Improve understanding and demonstration of solar by a modest extension of existing programs rather than through creation of entirely new information transfer network.

Task Description: RESECs and States cooperatively develop training programs with states ultimately implementing information transfer/training.

Task Implementation (Subtasks):

1. Develop training programs/instructional aids through regional task force.
2. RSECs/States train information and technology transfer agents.
3. State and county agents implement information transfer at local level.

Implementation Subtasks	Proposed Schedule Milestones							
	1979	1980	1981	1982	1983	1984	1985	2000
1.								
2.								
3.								
4.								
5.								
6.								
7. Manpower in Man-Months	30	156	156	156	100	100	100	
Materials	0.1M	.5M	.2M	.2M	.2M	.2M	.2M	
TOTAL Dollars	.06M	1M	.7M	.8M	.4M	.4M	.4M	

TASK SUMMARY OF Urban Agriculture Program (Title)

Market Sector: Agricultural	Task Implementor: RSEC and local organizations
Task Technology: Passive/Biomass Use	Task Category: Market Development

Objective: To initially subsidize organizations devoted to small-scale, urban agricultural systems to increase food self-sufficiency within urban areas.

Rationale: Garden Clubs, etc. currently assist interested parties and promote specialty/hobby functions. A similar process is suggested for promoting the construction and use of urban agri-systems (e.g., solar reliant greenhouses, community gardens, roof-top gardens, hydoponies, etc.)

Unique Opportunity: Although numerous "greenhouse workshops" have been held, an organization continually available for advice on "construction and operation/maintenance" and "site/application specific" processes is not in place (i.e., readily available expertise of a local nature).

Task Description: To fund a core staff and initial costs of organizing a "solar garden club" to provide construction advice, workshops on specific areas of interest locally, newsletter and information clearinghouse.

Task Implementation (Subtasks):

1. Determine functional needs and hire core staff.
2. Establish information system, clearinghouse, etc. Use existing organizations to maximum extent possible.
3. Develop workshops.
4. Pilot Projects in selected urban areas (10 projects/state-materials funds not provided.
5. Evaluation of Projects and expansion of programs based upon pilot results.
6. Project would be self-funded by 1985 with RSEC funds reduced annually.

Implementation Subtasks	Proposed Schedule Milestones							
	1979	1980	1981	1982	1983	1984	1985	2000
1.								
2.								
3.								
4.								
5.								
6.								
7. Manpower in Man-Months	18	18	12	10	10	10	5	
Materials	15K	20K	15K	15K	15K	15K	10K	
TOTAL Dollars	50K	60K	40K	30K	30K	30K	20K	

TASK SUMMARY OF Solar Heating Demonstrations (Title)

Market Sector: Agriculture	Task Implementor: Regional Solar Centers
Task Technology: Passive/Active	Task Category: Market Development

Objective: Demonstration of passive/active systems for water heating, space heating and preheating of ventilation air for agricultural applications. Systems should be monitored to assess technical and economic efficiency.

Rationale: Midwest farms are vital to the economy and provide much of the food for U.S. and foreign populations. The energy intensive nature of these farms affects both these areas of midwest agriculture. If farmers can actually "see" the benefits of solar they will be more inclined to utilize the resource.

Unique Opportunity: To combine disparate active/passive efforts to form a coherent demonstration and analysis within the regional agricultural sector. Verbal and written demonstrations are not effective.

Task Description: Determine technical and economic performance of various active/passive systems for domestic water/dairy water heating, space heating, grain/crop drying, ventilating animal containment structures, etc. Proven technologies and applications should be used for demo purposes. New construction and retrofit.

Task Implementation (Subtasks):

1. Identify technologies and applications.
2. Identify existing projects.
3. Design, install and monitor systems and/or existing systems/projects.
4. Document feasibility data for systems and projects.
5. Evaluate technical and economic data and distribute results widely.
6. Periodic review and update.

Implementation Subtasks	Proposed Schedule Milestones							
	1979	1980	1981	1982	1983	1984	1985	2000
1.	——→							
2.	———	——→						
3.		———	——→	- - -	- - -	- - -	- - →|	
4.		———	——→	- - -	- - -	- - -	- - →|	
5.			——→	- - -	- - -	- - -	- - -	- - →
6.				———	———	———	———	——→
7. Manpower in Man-Months	48	60	60	18	18	18	18	18
Materials	2.2M	6.5M	1M	.1M	.2M	.1M	.1M	.2M
TOTAL Dollars	3.5M	8M	2.5M	.5M	.5M	.5M	.5M	1M

TASK SUMMARY OF Agricultural Policy Development/Implementation (Title)

Market Sector: Agriculture	Task Implementor: Executive Branch of Federal Govt
Task Technology: All	Task Category: Institutional/Legal

Objective: To effect major policy changes in U.S. agricultural production techniques: To assess on-farm energy end-use and to design integrated renewable energy systems to assure continuity in agricultural production. The implementation of such systems being mandated to respective federal agencies.

Rationale: Farm production is the production of food E. Farm production must be guaranteed in perpetuity. It must recognize and work with the natural E replacement of soil fertility. The agricultural area has the potential of being a positive contributor to the E. sector.

Unique Opportunity: To re-evaluate agricultural techniques in relationship to the conscientious use of renewable and non-renewable resources. (Minerals, fuel, nutrients.) To increase agricultural energy efficiency.

Task Description: To create policy and research base for integrated agricultural systems predicated upon the use of renewable resources and biological controls.

Task Implementation (Subtasks):

Suggested Areas of Research and Implementation:

1. Integration of renewable energy sources/systems for on-farm fuel production technologies.
2. On-farm energy resource self sufficiency.
3. Review of Agricultural history for E efficiency and renewable resource use.
4. Biological-fertilizers, pest control, weed management, etc.
5. Study of tax incentives/disincentive for goal attainment.
6. Localized food processing and distribution; urban agriculture.
7. Integrated model farm demonstrations and info dissemination.

Implementation Subtasks	Proposed Schedule Milestones							
	1979	1980	1981	1982	1983	1984	1985	2000
1. Integration of reports		→						
2. Final report			→	→				
3. Continuing re-evaluation				→	→	→	→	→
4.								
5.								
6.								
7. Manpower in Man-Months		120	300	200	120	120	120	120
Materials								
TOTAL Dollars		1 M	2 M	1 M	.5 M	.5 M	.5 M	10M

TASK SUMMARY OF Biomass Combustion (Title)

Market Sector: Agricultural	Task Implementor: RSECs, State, Local
Task Technology: Direct Combustion	Task Category: Industrial Infrastructure

Objective: To demonstrate silviculture/wood lot management for fuel production purposes - residential and process heat for on-farm needs.

Rationale: The increasing use of fuel wood has the potential to damage woodlands and increase soil erosion damage. Such negative aspects can be minimized or eliminated through good management. Investigate potential of N-rich pod bearing varieties.

Unique Opportunity: No such demonstrations are visably evident in region to demonstrate viability. Possible on cost-share basis with federal and state lands as well as private.

Task Description: Select demonstration sites, tree species and management techniques. Implement programs in states with potential (i.e., 1 project/state in MASEC region).

Task Implementation (Subtasks):

1. Site and specie selection. Investigate multi-croping (i.e., use of leguminous cover crops).
2. Plant and management.
3. Harvest and Distribute.

Implementation Subtasks	Proposed Schedule Milestones							
	1979	1980	1981	1982	1983	1984	1985	2000
1.	———	———→						
2.		———	———	———	———	———	———→	- - - →
3.						———	———→	- - - →
4.								
5.								
6.								
7. Manpower in Man-Months	6	72	72	15	15	20	20	
Materials	10K	25K	10K	5K	5K	15K	15K	
TOTAL Dollars	25K	1.5M	1.5M	50K	50K	75K	75K	

TASK SUMMARY OF Solar Product Development (Title)

Market Sector: Agricultural	Task Implementor: USDA, DOE, SERI, States
Task Technology: All	Task Category: Product Development

Objective: Provide tested and proven equipment/process designs for manufacturers.

Rationale: Present agricultural R&D funds come largely from high tech. agricultural business concerns. This program would stress the development/utilization of proven equipment/processes that are appropriate for individual states, climates or regions.

Unique Opportunity: University agricultural schools, land grant colleges, and extension programs have been successful in raising the labor productivity of the agricultural sector. Emphasis should now be placed on increasing the energy productivity of agriculture via good equipment/processes.

Task Description: Develop conservation oriented and solar equipment/processes and test them at state experimental farms.

Task Implementation (Subtasks):

1. Product Development
2. Test Performance, Evaluation/Modification
3. Develop Marketing Information (technical/economic)
4. Determine Manufacturing Needs (technical/economic)
5. Distribute such information to potential manufacturers. Provide financial incentive to gear-up, re-tool, etc. (Low interest loans, grants, tax credits.)

Implementation Subtasks	Proposed Schedule Milestones 1979	1980	1981	1982	1983	1984	1985	2000
1.	——	——	——→					
2.	——	——	——	——	——→			
3.			——	——	——→			
4.				——	——	——→		
5.				——	——	——	——→	- - - →
6.								
7. Manpower in Man-Months	180	180	180	204	144	144	144	48
Materials	400K	1.5M	1.5M	1M	10M	10M	5M	
TOTAL Dollars	.75M	2M	3M	3M	10.3M	10.3M	6M	2M

TASK SUMMARY OF On-Farm Energy End-Use Needs Analysis (Title)

Market Sector: Agricultural	**Task Implementor:** RSECs and States
Task Technology: All	**Task Category:** Institutional/Legal

Objective: The development of a regional data collection model with state and sub-state models that would inventory end-use needs, technology applications, and information needs.

Rationale: Provide adequately sophisticated data base for policy analysis review and formation.

Unique Opportunity: Many states in region are participating in programs (DOE, Old West, USDA-Statistical Data Services) that are collecting this type of information. A coordinated and expanded effort would significantly improve this data base.

Task Description: Identify, develop, implement and manage such a data base collection, analysis and distribution models/programs.

Task Implementation (Subtasks):

1. Inventory existing data bases in region.
2. Assess bases for adequacy and integration potential.
3. Develop model regional, state and sub-state systems.
4. Implement systems.
5. Evaluation.

Implementation Subtasks	Proposed Schedule Milestones							
	1979	1980	1981	1982	1983	1984	1985	2000
1.	→	→						
2.		→	→					
3.			→					
4.				→				
5.				→	→			
6.								
7. Manpower in Man-Months	156	300	300	156	84			
Materials	.1M	.2M	1M	1M	.2M			
TOTAL Dollars	.5M	1M	1.8M	1.4M	.5M			

NATIONAL PLAN FOR ACCELERATED COMMERCIALIZATION OF SOLAR ENERGY

UTILITIES SECTOR

UTILITIES SECTOR

PROGRAMS

UTILITIES SECTOR PROGRAMS

1. Energy Cost/Value Assessment
2. Comprehensive Public Power Utility Assessment
3. Liquid and Gaseous Fuels from Municipal Waste
4. Energy Independent Farm
5. Wind/Hydrogen Storage

Program 1 **Energy Cost/Value Assessment**

Objective:

The objective of this program is to explore the basic energy infrastructure to determine the total economic, social and environmental costs (i.e., real costs) of energy production. This will lead to a better understanding and the more effective use of all energy resources.

Rationale:

The purpose of this program is to determine how best to use our finite and diminishing fossil fuel resources and to provide a long-term assessment of our energy resources. This will produce rational planning bases for both energy policy makers and energy users alike. The study should provide critical information about the history and development of the current energy situation and suggest guidelines for actions to avoid future crises in energy production and use. It should also produce invaluable information on the types and quantities of energy required to meet future American growth. Finally, it should form a reshaping basis of tax and accounting policies which have lead to inefficient use of our energy resources.

This program should provide a comprehensive overview of past policies and programs that have lead to the present system of total energy usage and methods of matching of energy resources to energy requirements. The study should provide an extremely good long-run prospective for energy policy decision makers to evaluate the roles of all parties involved in the energy infrastructure and provide a secure energy future for the United States.

Task Statement/Description:

A systems approach should be developed to analyze and identify the structure and function of the energy infrastructure in America. Methodology should be developed to evaluate and compare the various costs (social, economic and environmental) of energy production, distribution and use. This system should also be able to qualify energy as to its second law thermodynamic characteristics, quantify the amount of energy consumed in various end-uses and compare the value of each of the energy subcomponents. The analysis should then determine the most efficient and economic method of meeting each of the energy end-use requirements and develop methodologies which will lead to a smooth and swift transition toward more suitable energy production and use methods. Finally, the analysis should establish national priorities by which federal, state and local governments and individuals may plan for a stable energy future for the United States.

Evaluation Measures:

The primary measure of evaluation will be the rate at which federal, state and local government officials and the energy consuming public at large accept and implement the recommendations on energy utilization resulting from this analysis.

Related Programs:

- o Battelle Northwest Laboratories: "An Analysis Of Federal Incentives Used To Stimulate Energy Production", June, 1978
- o Center for Advanced Computation, University of Illinois, ongoing research on energy input and output
- o Amory Lovins: Soft Energy Paths, 1977

Implementor:

DOE, SERI, MASEC and subcontractors

Program 2 Comprehensive Public Power Utility Assessment

Objective:

The objective of this program is to provide public power utility programs and policies which encourage the efficient use of energy resources and foster the development of conservation and solar energy applications.

Rationale:

The utilities are in a unique position of being able to transfer information directly to almost every energy consumer within the region. This direct line of access makes them a prime focal point for information transfer and follow-up on energy conservation audit and programs. Additionally, since utilities have access to large quantities of capital, they can become prime funding applications. These actions will lessen or eliminate the requirements for new base and peak load facilities by the utility and at the same time allow the utilities to maintain a reasonable return on profit by means of the lending program.

Unique Opportunity: This program offers unique opportunities in the areas of energy and capital conservation. The program should allow utilities to maximize the efficiency of existing power plants while simultaneously providing a funding base to implement critically needed conservation and solar programs on an individual household and business basis. Since these loan programs can be incorporated into the billing schedule, there should be no problems of front end capital or cash flows.

This program offers a unique opportunity for comprehensive understanding of transitional problems encountered by public utilities a way in moving toward maximizing efficient use of available energy resources. Finally, this program will provide an opportunity not only to save fossil fuels, but also to guarantee consumers virtually inflation-proof energy delivery.

Task Statement/Delivery:

2.1 Relevant research on rate reform programs which encourage efficient use of energy including conservation and solar applications should be surveyed and effective subregional models should be developed. Willing private, public and rural electric cooperative utilities within the region should be solicited and selected as pilot utilities.

2.2 A data base should be developed on base and peak load energy displacement potential through available energy conservation and solar energy technologies.

2.3 A model for priortizing energy conservation and solar energy technologies by cost and energy effectivity for a specific utility should be developed.

2.4 Lending criteria and repayment formats for implementing conservation and solar technologies through private pilot utilities areas should be developed.

2.5 Required incentives and regulatory changes implied by this program should be developed in cooperation with local public utility commissions.

2.6 Overall models should be implemented on pilot bases within selected utilities.

2.7 The program should be monitored and its results disseminated regionally.

Evaluation Measures:

This program should be evaluated through measures of willingness of utilities within a region to offer their services as pilot programs, and the cost and energy effectiveness of the overall program.

Related Programs:

- Programs similar to this have been conducted, but not as yet implemented, by the California Energy Commission, the State of Arkansas, and the Long Island Power and Light Company. This program also overlaps with the Department of Energy Residential Conservation Services Program, the Energy Extension Service and a similar program currently under way by Tennessee Valley Authority.

Implementor:

U.S. Department of Energy, SERI, MASEC, selected public, municipal and rural electric cooperative utilities and selected subcontractors.

Program 3 Liquid and Gaseous Fuels from Municipal Waste

Objective:

The objective of this program is to provide an integrated approach toward the utilization of municipal wastes to provide liquid and/or gaseous fuels and other useful by-products.

Rationale:

By utilizing materials which are presently categorized as environmental problems, municipal wastes can be converted to useable energy. Technologies are presently available through which these waste products can be converted to liquid and/or gaseous fuels that may 1) displace fossil energy, 2) produce useful by-products and 3) reduce an environmental problem simultaneously.

Task Statement/Description:

3.1 An inventory of waste materials available in large municipalities (greater than 25,000 population) should be compiled.

3.2 Methods for converting waste materials to gaseous and liquid fuels should be investigated.

3.3 The environmental impact of toxic and hazardous wastes and their disposal should be assessed and potential solutions such as source separation should be investigated.

3.4 Production technologies available for conversion of wastes to biofuels should be integrated with the availability of municipal wastes.

3.5 These procedures should be tested and monitored in a site demonstration pilot program. Pilot projects should be solicited to testing various technologies and implement these technologies in various sizes.

Evaluation Measures:

Primary evaluation criteria for this program would be:

1. Net energy balances for proposed technologies
2. Cost effectiveness of proposed technologies
3. Ability to match waste resources with available technologies
4. Response to solicitations for pilot programs

Related Programs:

- Several municipalities throughout the country have investigated possibilities of conversion of waste materials to gasious and liquid fuels. Within the Mid-American Region, the Chicago Metropolitan Sanitary District has received an appropriate technology grant to study such a process.

Implementor:

U.S. Department of Energy, MASEC, subcontractors, municipalities within region and SERI

Program 4 **Energy Independent Farm**

Objective:

The objective of this program is to develop various scenarios for energy independence for farms varying by type of agricultural products produced and size. As a subelement of this program, a major objective will be to provide information about non-fossiled organic fuels and their impacts upon food productivity, energy efficiency and soil fertility over the long term.

Rationale:

Our agricultural system is based on usage of liquid fuels which are becoming scarce, unavailable and expensive. If farms can be designed to become nearly totally energy self-sufficient, American agricultural productivity will become unaffected by energy embargos and sustained maximum production can be guaranteed. On-site production of fuels can reduce the need for raw material transportation and may prove to have a positive net energy balance.

Task Statement/Description:

4.1 An agricultural energy information data base relating to size of farm, type of farm (primary agricultural outputs), and types of waste products available should be developed.

4.2 An extensive resource assessment of technologies available for conversion of waste products to gaseous fuels should be compiled.

4.3 Energy production technologies should be matched with type and size of farms.

4.4 Pilot demonstration programs should be solicited from the region in order to match converstion technologies to available waste products and to develop new products and technologies.

4.5 Pilot programs should be implemented and results monitored.

4.6 The findings of this program should be disseminated to the agricultural community at large.

Evaluation Measures:

A primary criteria for evaluation will be the ability to match available waste products to energy conversion technologies which provide fuels needed by specific types of mid-western farms. Secondary evaluation criteria will be the acceptance of these types of programs by the agricultural community as measured by the response to solicitations for pilot programs.

Related Programs:

- Washington University in St. Louis, Missouri, has received a large grant from the Ford Foundation to investigate the optimized sizing of renewable energy systems for on-farm use.

Implementor:

U.S. Department of Energy, SERI, MASEC, subcontractors and farmers

Program 5 **Wind/Hydrogen Storage**

Objective:

The goal of this program is to determine the cost and energy effectiveness of the production of hydrogen from wind energy through the process of electrolysis.

Rationale:

Hydrogen is a versatile fuel that may prove economically feasible for both large and small scale production. Hydrogen may be more cost effective as a storage media than existing battery technologies.

Task Statement/Description:

5.1 Existing operating models of wind/hydrogen systems should be identified and analyzed.

5.2 Systems applicable to small communities and farms should be designed and sized.

5.3 Economic methodologies should be developed to analyze cost and energy effectiveness of these systems.

5.4 Applications for pilot demonstration programs should be solicited.

5.5 Pilot programs should be monitored and promoted.

Evaluation Measures:

Suitable evaluation measures for this program are:

1. Cost and energy effectiveness of wind/hydrogen storage systems
2. Response to solicitation for pilot programs
3. Economic and energy efficiency of pilot systems

Implementor:

U.S. Department of Energy, MASEC, SERI, subcontractors, community officials and farmers.

UTILITIES SECTOR

Appendix

TASK SUMMARY OF PROFIT FOR UTILITIES VIA CONSERVATION Hufford/Majors (Title)

MID-AMERICAN SOLAR ENERGY COMPLEX

Market Sector: UTILITIES	Task Implementor: Public Service Commission
Task Technology: Conservation	Task Category: Institutional & Legal Barriers

Objective:

To substitute energy conservation as basis for company profits rather than the present method of calculating profits on capital investment.

Rationale:

If utilities can be rewarded for conservation rather than building new facilities, utilities could still stay in business and provide service as required by law.

Unique Opportunity:

To save energy and conventional fuels while at the same time keeping costs for consumers at a minimum.

Task Description:

To determine methodology for actual energy saved in the electrical sector through conservation technology investment, advertising, and promotional activities and data on energy actually saved.

Task Implementation (Subtasks):

1. Collect data from existing utility models using objective outlined above.
2. Contract support economists to analyze and incorporate data.
3. Apply data to specific utilities in MASEC Region.
4. Develop and implement any regulatory or legal changes.
5. Implement program on a trial basis with a "pilot" utility.
6. Implement on a larger basis.

Implementation Subtasks	Proposed Schedule Milestones							
	1979	1980	1981	1982	1983	1984	1985	2000
1.								
2.								
3.								
4.								
5.								
6. (to be revised)								
7. Manpower in Man-Months	72,000	144,000	72,000					
Materials	1,000	1,000	1,000					
TOTAL Dollars	73,000	145,000	72,000					

TASK SUMMARY OF CONSERVATION/RATES Hufford/Magers (Title)

Market Sector: UTILITIES	Task Implementor: REGULATORY AGENCIES
Task Technology: ALL	Task Category: PRODUCT DEVELOPMENT

Objective:

To implement conservation of electrical energy through innovative rate structures and metering techniques.

Rationale:

To minimize new power plant requirements and to fully utilize existing generating facilities.

Unique Opportunity:

To maximize efficiencies of existing power generating facilities.

Task Description:

Provide regulatory agencies and utilities with data, rationale, and incentives to structure rates applicable to stated objectives.

Task Implementation (Subtasks):

Survey existing research:

1. Develop model rate structures, pilot programs
2. Develop timeframe for implementation
3. Provide information dissemination programs
4. Develop incentives for utility implementation

Implementation Subtasks	Proposed Schedule Milestones							
	1979	1980	1981	1982	1983	1984	1985	2000
1.								
2.								
3.								
4.								
5.								
6.								
7. Manpower in Man-Months								
Materials								
TOTAL Dollars								

MID-AMERICAN SOLAR ENERGY COMPLEX

TASK SUMMARY OF INTEGRATED PRODUCTION OF LIQUID/GASEOUS FUELS FROM MUNICIPAL WASTES (Title

Market Sector: UTILITIES	Task Implementor: STATE INTER-AGENCY PROGRAMS
Task Technology: BIOMASS	Task Category: LIQUID/GASEOUS FUEL

Objective:

Provide an integrated approach to the utilization of municipal wastes to provide liquid and/or gaseous fuels and other useful by-products. Also utilizing other renewable energy resources.

Rationale:

By using materials which are presently a problem in terms of disposal to produce liquid and/or gaseous fuels the energy used for disposal can be saved while at the same time providing a replacement.

Unique Opportunity:

The possibility of creating usable clean fuels from materials which presently cause disposal and/or pollution problems.

Task Description:

Develop a methodology for converting many of the municipal waste by-products in an integrated manner.

Task Implementation (Subtasks):

1. Develop an inventory of waste materials available in most municipalities.
2. Develop methods for utilizing waste materials.
3. Assess environment impacts--toxic and hazardous wastes and disposal.
4. Integrate production of fuels and other useful by-products.
5. Test procedures in an on-site demonstration pilot program.

Implementation Subtasks	Proposed Schedule Milestones							
	1979	1980	1981	1982	1983	1984	1985	2000
1.								
2.								
3.								
4.								
5.								
6.								
7. Manpower in Man-Months	24	48	60	100	240	240	240	240
Materials	75,000	95,000	250,000	500,000	500,000	200,000	150,000	100,000
TOTAL Dollars								

TASK SUMMARY OF UTILITY STORAGE SYSTEMS (Title)

Market Sector: SYNTHETIC FUELS	Task Implementor: REGIONAL SOLAR OFFICE
Task Technology: WIND	Task Category: PRODUCT DEVELOPMENT

Objective:

To achieve storage of wind energy via the conversion of another resource, hydrogen.

Rationale:

Hydrogen is in itself a versatile fuel that is economically feasible if converted by means of wind energy. The hydrogen would also help better utilize the wind energy--it beats charging batteries.

Unique Opportunity:

This method might allevaite the tremendous expense for storage in wind systems, and gain a versatile fuel besides.

Task Description:

To encourage hydrogen/wind systems on a small (individual) or decentralized basis.

Task Implementation (Subtasks):

1. Look at the models already operating.
2. Analyze models for applying to small communities.
3. Develop economic printouts to use as base information dissemination.

Implementation Subtasks	Proposed Schedule Milestones							
	1979	1980	1981	1982	1983	1984	1985	2000
1.								
2.								
3.								
4.								
5.								
6.								
7. Manpower in Man-Months								
Materials								
TOTAL Dollars								

TASK SUMMARY OF ON FARM PRODUCTIONOF LIQUID FUELS Archer/Heck (Title)

Market Sector: AGRICULTURE	Task Implementor: MASEC
Task Technology: LIQUID FUELS	Task Category: PRODUCE DEVELOPMENT

Objective: Produce liquid fuels from agricultural waste materials.

Rationale: Our agricultural system is based on usage of liquid fuels which are becoming scarce or expensive.

Unique Opportunity:

To produce liquid fuels from (crop residue utilizing) renewable resources for their production, at point of usage. Farmer is one of the few people who have the resource available to produce the fuel they need while being able to return residue to the land.

Task Description:

To design and produce small scale units which are capable of producing liquid fuels from crop residues.

Task Implementation (Subtasks):

1. Education of agricultural sector on usage of alc. fuels.
2. Determine market feasibility.
3. Research and compile information on production and utilization of alc. fuel.
4. Design equipment for production and utilization of alc. fuels in on the farm sector.

Implementation Subtasks	Proposed Schedule Milestones							
	1979	1980	1981	1982	1983	1984	1985	2000
1.								
2.								
3.								
4.								
5.								
6.								
7. Manpower in Man-Months	48	48	60	36	36	12	12	12
Materials	70,000	90,000	150,000	120,000	120,000	50,000	50,000	50,000
TOTAL Dollars								

TASK SUMMARY OF ENCOURAGEMENT OF EFFICIENT AND PRODUCTIVE ENTERPRISES (Title)

Market Sector: ALL SECTORS	Task Implementor: ALL
Task Technology: TAX STUDY	Task Category: ALL

Objective: To study tax structures, tax credits, tax deductions, subsidy programs, government regulatory programs, and related revenue and cost-sharing programs which serve to encourage energy waste, centralized production facilities and high cost-low return projects.

Rationale: There is a need to discover and correct the various programs which work only in favor of inefficient and counterproductive energy producing businesses and projects.

Unique Opportunity:
For the first time, to comprehensively compare programs, laws and policies that tend to encourage inefficient or counterproductive natural resource consumption-use patterns.

Task Description:
A discovery process whereby we can identify these programs which apply a push-pull conflict between those who are trying to conserve rather than exploit natural resources. Then to recommend programmatic changes where necessary.

Task Implementation (Subtasks):

1. Identify major problematic areas.
2. Developing major areas into critical sub-parts.
3. Analyze data in terms of current problems.
4. Recommend changes which would correct problems.

Implementation Subtasks	Proposed Schedule Milestones							
	1979	1980	1981	1982	1983	1984	1985	2000
1.	————	———┤						
2.		——┤						
3.			——┤					
4.			——┤					
5.								
6.								
7. Manpower in Man-Months	72	80	50					
Materials								
TOTAL Dollars								

TASK SUMMARY OF Weber (Title)

Market Sector: UTILITIES/BUILDINGS	Task Implementor: PUBLIC AND PRIVATE FINANCIAL COMMUNITY
Task Technology: LOW INTEREST LOANS	Task Category:

Objective: To develop sliding interest loans based on income that the interest rate is based on yearly inflation rate computed for residential and commercial solar collectors yearly, and payback of the loan is based on inflating Btu cost computed yearly.

Rationale: Money for consumers is inflating consequently interest rates should be based on yearly inflation rate. Fuel cost is inflating, payback should be based on this rate.

Unique Opportunity:

To replace fossil fuel use commercially and residentially with solar energy, predicated on inflating general and specific prices.

Task Description:

Task Implementation (Subtasks):

Implementation Subtasks	Proposed Schedule Milestones							
	1979	1980	1981	1982	1983	1984	1985	2000
1.								
2.								
3.								
4.								
5.								
6.								
7. Manpower in Man-Months								
Materials								
TOTAL Dollars								

TASK SUMMARY OF IMPACT OF FUELS ON PRODUCTIVITY, ENERGY EFFICIENTY & FERTILITY OF FARMS (Title)

Market Sector: FUEL/AGRICULTURE	Task Implementor: REG. SOLAR ENERGY CENTER
Task Technology: BIOMASS	Task Category: PRODUCT DEVELOPMENT

Objective: Provide information relative to non-fossil organic fuels as to their impact on food productivity, energy efficiency, and biological soil fertility for the long term.

Rationale: To assure an integrated approach for non-fossil organic fuels that fit into ecological cycles.

Unique Opportunity:

Potential for producing organic fuels at point of use with minimum environmental impact.

Task Description:

Unique opportunity to assume an integrated approach to non-fossil fuel production.

Task Implementation (Subtasks):

1. Identify issues and data needed.
2. Develop information base.
3. Analysis of data via systems approach.
4. Publication and dissemination of initial information and identification of research needs.
5. Experimental programs for information gaps.
6. Final report and suggestions for implementation.

Implementation Subtasks	Proposed Schedule Milestones							
	1979	1980	1981	1982	1983	1984	1985	2000
1.								
2.								
3.								
4.								
5.								
6.								
7. Manpower in Man-Months		24	320	250	100			
Materials								
TOTAL Dollars								

MID-AMERICAN SOLAR ENERGY COMPLEX

TASK SUMMARY OF LEVELING OF LOAD DEMAND (Title)

Market Sector: Utilities	Task Implementor: Public Service Commission
Task Technology: Conservation/Solar	Task Category:

Objective:

Incorporate conservation/solar systems into utilities for purpose of leveling of load demand and making more efficient use of the existing electrical power system

Rationale:

System results in a more appropriate use of energy source with energy end-use and still satisfies energy demand

Unique Opportunity:

To understand unique problems of utilities in adapting solar and conservation.

Task Description:

Analyze system demands to reduce peak electrical usage--and more peak load demands to base load times.

Task Implementation (Subtasks):

1. Define usages and problems of utility
2. Determine possible solutions: a) time of day metering, b) off-peak air conditioning systems, c) others
3. Assess current research--gain support of utility to implement most appropriate solutions for 5-year "pilot" period.
4. Monitor during pilot period and report results

Implementation Subtasks	Proposed Schedule Milestones							
	1979	1980	1981	1982	1983	1984	1985	2000
1.								
2.								
3.								
4.								
5.								
6.								
7. Manpower in Man-Months								
Materials								
TOTAL Dollars								

TASK SUMMARY OF "TRUE" COST HOLISTIC LIVING Scoby (Title)

Market Sector: All	Task Implementor:
Task Technology: All	Task Category: Market Development/Legal & Instit. Barriers/Product Development

Objective: To provide society with a realistic cost structure whereby renewable and non-renewable resources approximate their actual impact on the environment.

Rationale: In our subsidized free enterprise society, goods and services are priced in such a way that low impact environmentally sound activities and goods can't compete with many environmentally unsound practices (i.e.,non-recycling of materials,ineffective public&private transportation systems,non-consuming leisure time activities,food production&processing,etc). Up to 2000 years ago explanation of finite resources was necessary to achieve growth. It is now apparent that materialistic growth must not be at the sacrifice of these finite resources.

To correct this situation, holistic living (appropriate technology and a quality life style) can insure our country's continued growth.

Unique Opportunity: It is an opportunity for the citizens of a society to assume the responsibilities that accompany their rights.

Task Description:

Task Implementation (Subtasks):

1. Systems approach to analyze and identify the structure and function of our society.
2. Establish rural and urban units to demonstrate comparative systems and cost flows.
3. Congress to establish national priorities (principles or goals) from which state and local governments may plan, i.e., population stability and redistribution, recycling of resources, protection of "prime" agricultural land, conservation not waste of energy and resources, realistic consumer costs of products, etc.

Implementation Subtasks	Proposed Schedule Milestones							
	1979	1980	1981	1982	1983	1984	1985	2000
1.								
2.								
3.								
4.								
5.								
6.								
7. Manpower in Man-Months	50	300						
Materials								
TOTAL Dollars			Billions					

MID-AMERICAN SOLAR ENERGY COMPLEX

NATIONAL PLAN FOR ACCELERATED COMMERCIALIZATION OF SOLAR ENERGY

BOILER ROOM

Future Technologies Session

April 18, 1979

NPAC BOILER ROOM

Future Technologies Session
April 18, 1979

The intention of this session was to discuss basic research needs, engineering and developmental areas of concern and the commercialization strategies and efforts required to realize near-term market penetration as well as mid-term potentials.

Technologies emphasized included photovoltaic applications, (R8D) ocean thermal, wind energy, anaerobic digestion, alcohol production and direct combustion. Several methods of producing synthetic or high-BTU natural gas were also discussed, including gasification of coal and biomass resources. The importance of liquid fuels was discussed and alternatives such as coal liquifacation, shale oil, methanol and ethanol production from biomass were mentioned. Several unique applications of interest included pumped storage options, compressed air as a storage medium and solid-fuels development. Much emphasis was placed on second-law efficientcies (thermodynamics) and net-energy concerns. The need to emphasize integrated renewable resource-based technologies to improve system economics (financial and energy) was of paramount concern. There was a great deal of interest expressed in waste-heat utilization, district heating and co-generation schemes.

Most participants expressed an interest in local or community based integrated renewable based systems that allow an increased level of self-reliance at the local level. Conservation potential, education and life-style adjustments were topics that were continually mentioned in relation to virtually all technologies discussed.

Emphasis was placed on the need to manipulate plant genetics in ways that increased net-energy yields i.e. nitrogen-fixation capabilities, lower water requirements, less energy-inputs, etc. Biomass for foodstock & feedstock was discussed at great length.

Institutional issues such as urban planning for solar, ownership & use of underground space, energy-related employment impacts, capital formation & availability, environmental degradation, recycling, and international stability were major areas of concern.

It was felt that a need existed to improve and expand interagency cooperation at the federal level concerning new technology development and utilization as well as real and potential socioeconomic implications of implimenting transition and renewable-based technologies. The regional solar energy centers must work in concert with the national solar energy research institute (SERI) to determine which developing technologies are most appropriate for regional applications and in the development of regionally specific marketing techniques. The regional solar energy centers should keep in close contact with agencies & national R & D contractors such as SERI, DOE, USDA, NSF and NAS and the national labs to be better able to access technology readiness and commercialization potential.

LIST OF ATTENDEES

FROM THE

"BOILER ROOM"

MASEC REGIONAL PLANNING MEETING

HELD ON

APRIL 18 - 22, 1979

L I S T   O F   A T T E N D E E S

Name: Bonnie Albright
Position: State Solar Coordinator
Address: Wisconsin Energy Office
Room 201, One West Wilson Street
Madison, Wisconsin 53702
Phone: (608) 266-9861
Education: B. A. English, University of Wisconsin, Madison, Wisconsin

Experience: Energy research and policy analysis. Member of Wisconsin Chapter of ISES. Environmental review and consumer analysis in Division of Systems Planning, environmental review and consumer analysis in Public Service Commission of Wisconsin. Specialist with energy systems and policy research group at University of Wisconsin.

Name: John S. Allen
Position: Partner, James Associates
Architects and Engineers
Address: James Associates, Architects and Engineers
221 Main Street
Lafayette, Indiana 47901
Phone: (317) 742-4125
Education: B. S. Architecture, University of Illinois
Registered Architect, 20 states

Experience: Designer, residential active and passive systems; code development, national and state, and member of Indiana Solar Resource Advisory Panel; Energy conservation standards and legislation development; Chairman of Indiana Society of Architects Energy Committee; AIA National Energy Committee, and DOE appropriate technology advisor.

Name: Juliane Allisbaugh
Position: President, How All Products, Inc.
Address: 1351 Deloss Street
Indianapolis, Indiana 46203
Phone: (317) 631-8798
Education: B. S. Indiana University School of Public and Environmental Affairs

Experience: Manufacturer of air type solar collectors; research and development in active and passive systems; research and development of air to air solar cells and storage of solar heat. A member of ISES and Hoosier Solar Energy Association.

Name: Richard E. Archer
Position: Co-ordinator, Design Program
Southern Illinois University
Address: Design Program
Southern Illinois University
Carbondale, Illinois 62901
Phone: (618) 453-5761
Education: B. A. Southern Illinois University
Current: M. S. Human Ecology, Governor State University

Experience: Assisted in development of hybrid greenhouse, 1970, home weatherization and low cost solar--Department of Labor Grant, 1977, and Illinois Solar Curriculum Development Grant. Recipient of Solar Education Grant from the Illinois Board of Higher Education; Designer of the Sparta Vocational High School solar system, Sparta, Illinois; designer of the methanol electric hybrid vehicle; principal investigator on the Illinois INR Grant to design an on-farm system to produce ethanol from corn stover, and designer of several racing engines for alcohol usage, 1961-1970.

Name: Howard W. Beatty, Jr.
Position: President, Wolverine Solar Industries Inc.
Address: 13450 Northland Drive
Big Rapids, Michigan 49307
Phone: (616) 796-5501
Education: B.S.I.E. University of Michigan
B.S.M.E. University of Michigan
M.B.A. University of Michigan

Experience: Solar energy heating systems; hot water heating, space heating, and combined heating; heat pump assisted solar energy heating system; technical support and distribution of solar energy products and systems; registered engineer; manager and technical consultant; industrial and aerospace engineer and business management.

Name: Verne Brakke
Position: State Solar Officer, South Dakota
Address: Office of Energy Policy
Capitol Lake Plaza
Pierre, South Dakota 57501
Phone: (605) 773-3603
Education: B.S. Health Science, South Dakota State University, Brookings
B.S. Microbiology, South Dakota State University, Brookings
M.S. Microbiology, South Dakota State University, Brookings

Experience: Biomass research in own lab, conversion to alcohol. Research in bioconversion, using cellulase enzymes and acid hydrolysis. Product development scientist and medical research.

Name:	Leanne Sowande-Brent
Position:	Project Co-ordinator, Evanston Environmental Association
Address:	Evanston Environmental Association 2024 McCormick Boulevard Evanston, Illinois 60201
Phone:	(312) 864-5181
Education:	Current: Environmental Science, Northern Illinois University, Chicago
Experience:	Co-ordinator, Education/Demonstration Project. Solar/Wind and Active and Passive Systems. Member of Minority Coalition Center for Renewable Resources. Director Low-Income Solarization Project.

Name:	Charles D. Carey, Jr.
Position:	Executive Director, Mechanical Contractors Association of Kansas
Address:	325 First National Bank Tower Topeka, Kansas 66603
Phone:	(913) 354-1130
Education:	B.S. Engineering, University of Kansas
Experience:	Solar design course, University of Colorado; solar talks to civics clubs, apprenticeship schools; consultant for a residential solar system; member of ASHRAE; lobbyist for adoption of ASHRAE and solar incentives to Kansas Energy and Natural Resources Committee; 25 years experience in installation of mechanical, plumbing, heating and air conditioning systems as a contractor, plumber and fitter.

Name:	Bing Chen
Position:	Associate Professor, University of Nebraska
Address:	University of Nebraska 60th and Dodge Omaha, Nebraska 68182
Phone:	(402) 554-2289
Education:	B.S. University of Nebraska, Lincoln M.S. University of Nebraska, Lincoln Ph.D. University of Nebraska, Lincoln P.E. Electrical Engineering
Experience:	Director of program in passive solar energy research at the University of Nebraska at Omaha. Previous research experience in solar-assisted heat pumps. Research into manned habitats at the Naval Weapons Center, and development of world and energy models.

Name: Dave Dunlavy
Position: President, Iowa Solar, Inc.
Address: 425 Jacolyn Drive, N.W.
Cedar Rapids, Iowa 52405
Phone: (319) 396-3381
Education: Devry Technical School, Chicago
University of Iowa (1 year)

Experience: Experience in solar sales, engineering and manufacturing. Designer/retailer of air systems for space heat. Teacher of Community College Solar Program (Adult Education).

Name: John R. Dunlop
Position: Solar Office Manager, Minnesota Energy Agency
Address: Minnesota Solar Office
980 American Centre Building
St. Paul, Minnesota 55101
Phone: (612) 296-4737
Education: B.S. Physics, Westmar College, Lemars, Iowa
B.S. Mechanical Engineering, University of Colorado

Experience: Solar planning co-ordination, industrial heat recovery system engineering and active member A.S.M.E.

Name: Anabel Dwyer
Position: Graduate Assistant
Address: 801-108 Cherry Lane
East Lansing, Michigan 48824
Phone: (517) 355-7847
Education: B.A. Wellesley College
M.A. Urban Planning, Michigan State University

Experience: Attended solar energy and culture change conferences; solar retrofit for single house; Vice-Chairman, Michigan Solar Energy Association; member, State Grass Roots Solar Group and Urban Options Board, and local solar demonstration and planning task forces.

Name: Burt Eno
Position: Professor
Address: Department of Mechanical Engineering
South Dakota State University
Brookings, South Dakota 57007
Phone: (605) 688-4817
Education: Ph.D. Thermal Engineering

Experience: Worked in solar research and teaching, and solar products and engineering.

Name: Jim Etheridge
Position: Owner, Etheridge and Sun
Address: Etheridge and Sun
Route #1
Arlington, Wisconsin 53911
Phone: (608) 846-5479
Education: Business Administration
Navy Nuclear Power Program

Experience: Sale of active systems and designer of active and passive systems. Eight years Navy Nuclear Power Submarine Program.

Name: Patrick T. Fagan
Position: Solar Designer and Builder
Address: Energy Efficient Designs
Box 276
Columbia, Missouri 65205
Phone: (314) 445-6407
Education: B.S. Horticulture, University of Missouri

Experience: Designed and built present solar home; teacher of adult education class, 'Solar Utilization for the Home'; president of local solar group, Missouri Solar Energy Associates. Extensive lecture experience on home energy conservation and solar energy use.

Name: Mary Failey
Position: State Solar Program Co-ordinator and Acting State Solar Officer, Indiana
Address: Indiana Department of Commerce Energy Group
115 N. Penn Street, 7th Floor
Indianapolis, Indiana 46204
Phone: (317) 633-6753
Education: B.S. Environmental Affairs, Indiana University

Experience: Indiana Solar Office. Internship with Resource and Economic Development Planning Group, Indiana Department of Commerce.

Name: E. John Felderman
Position: Associate Professor
Address: Department of Mechanical Engineering
South Dakota State University
Brookings, South Dakota 57007
Phone: (605) 688-5717
Education: Ph.D. Mechanical Engineering, Iowa State University

Experience: Associate investigator on solar source test project (DOE-USDA sponsorship). Teacher of heating, ventilating, air conditioning course.

Name: Weston A. Fisher
Position: Associate
Address: William Tao and Associates
Consulting Engineers
2357 59th St.
St. Louis, Missouri 63110
Phone: (314) 644-1400
Education: B.S. Geology, Stanford University
M.S. Geology, Stanford University

Experience: After attending the Hubert H. Humphrey School of Public Affairs in Minnesota for two years, he worked as a research scientist and resource conservation specialist for the Minnesota Pollution Control Agency (1972-1974) specializing in state programs to promote reuse and recycling of materials and energy conservation. In 1974 he became chief policy analyst for the Division of Conservation and Planning in the Minnesota Energy Agency. From 1975-1977 he served as director of the Missouri Energy Office responsible for the State's energy program in the areas of conservation, research and development, data gathering and analysis, and fuel allocation. He was the Missouri Council of States representative to MASEC in 1978.

At William Tao & Associates, he is responsible for coordinating the firm's current activities in energy research and management projects involving new energy technologies.

Name:	Daniel Flaherty
Position:	Owner, Energy Alternatives; Teacher and Consultant, Solar Technology, Red Wing Vocational School, Minnesota
Address:	Energy Alternatives 9535 - 18th Avenue North OR c/o Red Wing Vo-Tech Plymouth, Minnesota 55441 Red Wing, MN 55066
Phone:	(612) 544-6235
Education:	Current: Appropriate Technology, Solar University of Minnesota
Experience:	Installer of solar systems and consultant. Worked on passive systems and installed approximately 4,000 sq. ft. collectors for active systems.

Name:	Tom Heck
Position:	State Solar Officer, Michigan
Address:	Energy Administration Michigan Department of Commerce P. O. Box 30228 Lansing, Michigan 48909
Phone:	(517) 373-6430
Education:	B.S. Business Administration, Michigan Technological University, Houghton B.S. Forestry Management, Michigan Technological University, Houghton M.A. Management and Supervision, Central Michigan University, Mount Pleasant
Experience:	Biomass research and feasibility studies for economic impact on Northern Michigan. Wind and heat applications and research on low-head hydro.

Name:	William W. Holmes, AIA
Position:	Assistant Professor of Engineering Technology & Information Director, Passive Solar Test Project
Address:	Construction Systems Technology Department 60th and Dodge Streets Omaha, Nebraska 68182
Phone:	(402) 554-2497
Education:	B.A. Hastings College, Nebraska Bachelor of Architecture, University of Nebraska Licensed Architect, 2 states and NCARB
Experience:	Passive research and testing. Consultant in passive design as applied to buildings. Application of Programmable Calculators (TI-59, HP-97) to design procedures for active and passive solar design. Solar educational program development and delivery. Architectural practice and university teaching. Member of ISES, the American Underground Space Association and the American Institute of Architects.

Name: Howard Hufford
Position: Conservation Engineer
Address: Willard Given & Associates
1031 E. Battlefield, Suite 211
Springfield, Missouri 65807
Phone: (417) 887-4894
Education: B.S. Mathematics/Physics
Current: Graduate Work, UMR, UMC, SMSU

Experience: Charter Member, & President, S.W. Missouri Solar Energy Assoc., Inc. Instructor in solar energy and in physics departments, SMSU and Drury. Registered P.E., State of Missouri.

Name: William Hurrle
Position: Journalist/Carpenter, self-employed
Address: 219 South Irwin
Green Bay, Wisconsin 54301
Phone: (414) 432-2882
Education: B.A. English, University of Minnesota, Minneapolis
M.A. English, Kansas State University, Manhattan

Experience: Design and building of residential and commercial systems, solar hot water and heat, solar greenhouses, and passive structures. Reporter, columnist and editor.

Name: Merton R. Jacobson
Position: Department Chairman, Adult Education, Trade and Industrial
Address: Anoka Area Vocational Technical Institute
Box 191
Anoka, Minnesota 55303
Phone: (612) 427-1880
Education: Vocational School, Electrical
A. A. North Dakota State School of Science
A. S. North Dakota State School of Science
B. A. Vocational Education, St. Cloud University

Experience: Instructor of adult solar classes. Member and officer of Minnesota Solar Resource Advisory Panel. Full time teaching in vocational education. Instructor in electrical heating, air conditioning, installation, building, construction, and maintenance. Member of ISES, Minnesota Educational Association Vocational Board of Directors, member of Minnesota Electrical Designers Group, and member of the Electrical Inspectors Association. Work experience in the construction field, Master Electrician with contractor experience, campus maintenance and installation experience with boilers, heating, air conditioning, refrigeration and plumbing systems.

Name: Jerry W. Johnson
Position: Professor of Economics; Director, Business Research Bureau
Address: Patterson Hall, School of Business
University of South Dakota
Vermillion, South Dakota 57069
Phone: (605) 677-5287
Education: B.A. Business Administration, Buena Vista College, Iowa
M.B.A. University of South Dakota
Ph.D. Economics, Iowa State University

Experience: Conducted economic feasibility studies relative to energy impacts. Conducted studies relating to economic impacts relative to energy and other exogenous changes in the economy. Served as a consultant on economic matters to the state of South Dakota.

Name: Joseph J. Kawecki
Position: President, Solar Designer and Building Contractor
Address: 296 Cliffside Drive
Columbus, Ohio 43202
Phone: (614) 267-8598
Education: A.A.S. Electronics, Alfred State University, New York
B.S. Architecture, Ohio State University

Experience: Designer of 32 Solar Systems: active, passive, underground and berm. Built solar passive and berm homes. Conductor of three solar conferences in Ohio, and lecturer for State of Ohio Energy Code Seminars. Designer and builder of prototype energy walls. Presently conducting independent research on heat loss of various building components, and writing book on pitfalls of solar energy conservation.

Name: Edward J. Kelly, Jr.
Position: Architectural Designer and Partner, Sunstructures, Inc.
Integrated Architectural Design
Address: 201 E. Liberty Street
Ann Arbor, Michigan 48104
Phone: (313) 994-5650
Education: B.S. Aerospace Engineering, University of Michigan
M.S. Aerospace Engineering, University of Michigan
B.S. Architecture, University of Michigan
M. Architecture, University of Michigan

Experience: Active and passive solar system and energy conscience building design. AIA/Research Corporation and HUD "Design Integration Monitor" in Midwest Region for HUD funded and monitored solar demonstration projects. Design of 4 prototypical passive and energy conserving solar residential house designs for the AIA/RC and Boeing Aerospace Co. HUD passive solar residential design competition winner. Chairperson, Michigan Solar Energy Association and Member of ISES.

Name: Randy Korda
Position: Co-ordinator, Center for Community Technology
Address: Center for Community Technology
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Phone: (608) 251-2207
Education: Ph.D. Chemistry, University of Wisconsin

Experience: Community education, demonstration projects, insulating window coverings, solar greenhouses and conservation. Environmental chemistry, University of Wisconsin.

Name: Jill Kunka
Position: State Solar Office Co-ordinator, Illinois
Address: Institute of Natural Resources
Alternative Energy Division
222 South College Avenue
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Education: B.S.J. Advertising (Journalism), Northwestern University, Illinois

Experience: Assistant co-ordinator, Illinois Sun Week 1978. Illinois State Solar Office Co-ordinator. Student co-ordinator, Northwestern Students for a Better Environment, and work in public relations.

Name: Donald W. Macke
Position: Research Analyst, Nebraska Legislature
Address: Senator Don Wesley
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Education: B.S. Physical Science, University of Nebraska, Lincoln

Experience: Member, Midwest Energy Alternatives. Economic/Political Policy Analysis, Nebraska Legislature. Nebraska University Public Interest Research Group.

Name: Jane Magers
Position: Consultant to Iowa State University for the Energy Extension Office
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Phone: (515) 294-4266 OR 278-2283
Education: B.A. Education, Heidelburg College, Tiffin, Ohio

Experience: Citizen participation through Citizens United for Responsible Energy (CURE). Technical application, information, and lobbying (state and federal). Communication by means of publications, mass media and audio-visual. Director of workshops. Journalism, organizational work, and environmental study and monitoring.

Name: Lee McQueen
Position: Alternate Energy Division Manager, Energy Management and Control Corporation
Address: 634 Harrison
Topeka, Kansas 66603
Phone: (913) 233-0289
Education: B.S. Mechanical Engineering, Kansas State University, Manhattan
B.S. Business Administration, Kansas State University, Manhattan

Experience: Design and feasibility studies for several projects in Northeast Kansas. Research in biomass-electrical generation systems for residences. Research in wind rotor materials.

Name: Larry Neubauer
Position: State Solar Officer, North Dakota
Address: Energy Management and Conservation
1533 North 12th Street
Bismarck, North Dakota 58501
Phone: (701) 224-2250
Education: B.S. Chemistry, North Dakota State University
M.S. Chemistry, North Dakota State University
M.S. Meteorology, University of Utah

Experience: State Solar Officer. Participant in a wind energy research program, University of Wyoming.

Name: Frank E. Rom
Position: President, Solar Energy Products Co.
Address: Solar Energy Products Co.
121 Miller Road
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Phone: (216) 933-5000
Education: B.S.M.E. Cornell University
M.S.M.E. Cornell University

Experience: Research and development and national program planning for all forms of solar heating, cooling, biomass, wind, OTEC and solar thermal at NASA. Also stationary and automotive power plants. Holder of 9 patents in the fields of nuclear propulsion and solar energy. Development, manufacture and sales of solar systems since 1973. Directed and conducted energy related research in nuclear and chemically powered propulsion systems including turbojets, turboprops, turbofans, ramjets, and rockets at NASA and NACA for 25 years. Work in advanced fission, fusion, and laser rocket propulsion.

Name: Donald R. Scoby
Position: Professor of Biology, North Dakota State University
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Education: B.S. Social Science, Kansas State University
M.S. Biology(Zoology) Nebraska State Teacher's College
Post Graduate Biology and Science Education, University of Texas
Ph.D. Botany (Ecology), North Dakota State University

Experience: Involved in environmental biology, holistic self-sufficiency, appropriate technology, biological farming and biology education. Application of ecological principles to holistic living.

Name: John Selfridge
Position: Associate Professor, Kansas State University; Designer, Plain Energy
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Manhattan, Kansas 66506

Phone: (913) 537-7411
Education: B.A. University of Kansas
M.C.P. Yale University

Experience: Domestic heating/hot water, solar education and solar promotion. Organizer and board member of Kansas Solar Energy Society. Environmental education and transportation planning. Editor of KanSUN*News

Name: Bert Peters
Position: Professor Emeritus, Black Hills College
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Phone: (605) 642-4175
Education: B.S. Mathematics, Lafayette College, E. Pennsylvania
M.Th. Princeton Seminary, Princeton, New Jersey
M.Ed. South Dakota State University, Brookings
D.D. (HON.) Huron College, Spearfish, South Dakota

Experience: Used and sold concentrating collectors (air). Constructed flat plate collectors and a solar heated greenhouse which includes domestic hot water heating, plus passive and active solar air for domestic space heating. Talks on subject of solar energy, demonstrating air units, group dynamics and leadership.

Name: Peter Pfister
Position: Architect
Address: Architectural Alliance
400 Clifton Avenue South
Minneapolis, Minnesota 55403
Phone: (612) 871-5703
Education: B.S. Architecture, University of Wisconsin
M.S. Architecture, University of Wisconsin

Experience: Architectural design of active, passive, earth-sheltered and retrofit applications in single family residences. Large scale solar applications on multi-family housing, and design of commercial facilities utilizing conservation, heat reclaim and storage, and passive solar. Chairman of Minnesota SRAP and Chairman of the Minnesota Solar Energy Association. Member of the Energy Task Force to the Metropolitan Airport Commission. Project architect for an energy audit of Terminal Buildings at Minneapolis/St. Paul Airport.

Name: Roland C. Riemers
Position: Energy Education Director
Concern for Low Income People, Inc. (Community Action Program)
Address: Box 1836
Minot, North Dakota 58701
Phone: (701) 839-7221
Education: A.A. Nursing, Anoka-Ramsey College, Coon Rapids, Minnesota
Current: Engineering, San Antonio Junior College, San Antonio Texas
Business Law Courses, University of Minnesota, Minneapolis, Minnesota

Experience: Designed, built and tested various low cost solar devices and 100% solar homes. Conducted public workshops on solar/energy conservation in seven county area. Basic research and development on home weatherization techniques for the homeowner in North Dakota.

Name: Paul Sidles
Position: Associate Physicist, Iowa State University
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Iowa State University
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Phone: (515) 294-6844
Education: B.A. Iowa Wesleyan College
M.S. Physics, Iowa State University

Experience: Solar energy information co-ordinator, Ames Laboratory. Technical consultant for commercial solar heating and cooling demonstration program. Research in semiconductor physics and materials suitable for solar cell production. Numerous publications on heat transport and storage, electrical properties of semi-conductors, and the performance and economics of solar heating and cooling of buildings.

Name: Jay W. Smith
Position: Solar Code Co-ordinator, Administrative Building Council
Address: 215 N. Senate
Indianapolis, Indiana 46204
Phone: (317) 633-5433
Education: Marketing-Technical (Mech. & Chem.)

Experience: Codes, inspections and research education. Energy seminars for State. Forty-five years in construction (structural, mechanical, contracting). State code administration.

Name: Mason H. Somerville
Position: Director of Engineering Experiment Station and Associate Professor of Mechanical Engineering
Address: Box 8103
Engineering Experiment Station
University of North Dakota
Grand Forks, North Dakota 58201
Education: B.S. Mechanical Engineering, Worcester Polytechnic Institute, Mass.
M.S. Mechanical Engineering, Northeastern University, Boston
Ph.D. Mechanical Engineering, Penn State University, University Park, Pennsylvania

Experience: Applied research. Designer and developer of 3 solar houses. Builder of hybrid heat pump and designer of 2 commercial systems. Experience devoted to energy and related issues, including fuel cells, nuclear power and coal gasification.

Name:	Douglas Steege
Position:	Planning Analyst, Department of Local Affairs and Development
Address:	Department of Local Affairs and Development 4802 Sheboygan Avenue, Room 99A Madison, Wisconsin 53702
Phone:	(608) 266-7773
Education:	B.S. Zoology, University of Wisconsin, Madison
Experience:	Designer/Installer of more than 20 active systems. Designer of passive structures. Winner of HUD/DOE Passive Design Competition. Planning experience, 6 years.

Name:	Donald R. Stewart
Position:	Vice-President, Stewart Enterprises, Inc.; Chairman of the Kansas Solar Energy Society
Address:	1202 South Washington Wichita, Kansas 67211
Phone:	(316) 262-7427
Education:	B.A. Political Science, Washburn University Courses in law, Syracuse University Various technical and professional training programs
Experience:	Active design and installation, passive design, domestic hot water heating and agricultural water applications. Design and building underground solar homes.

Name:	Philip H. Svanoe
Position:	Solar Co-ordinator, Iowa Energy Policy Council
Address:	Iowa Energy Policy Council 215 E. 7th Street Des Moines, Iowa 55319
Phone:	(515) 281-4420
Education:	B.A. Political Science, Luther College, Decorah, Iowa
Experience:	Research, manufacturing, sales and government administration.

Name: Stephen J. Temming
Position: Research Associate, University of Cincinnati
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Phone: (513) 475-3539
Education: B.A. Physics, Thomas More College, Ft. Mitchell, Kentucky
B.M.E., University of Detroit
M.E., University of Detroit
Ph.D., University of Cincinnati

Experience: System design, systems applications, computer modeling, engineering economics, applications research, and computer program development. Member of Ohio Solar Resource Advisory Panel.

Name: Charles L. Thomsen
Position: Principal Mechanical and Electrical Engineer; Corporate Secretary
Address: The Clark Enersen Partners
600 NBC Center
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Phone: (402) 477-9291
Education: B.S.M.E. University of Nebraska

Experience: Designer of several solar systems now in operation for projects ranging from residences to major commercial buildings. Has lectured, presented papers and been published nationally on solar energy. Twenty-seven years as a consulting HVAC and electrical systems engineer.

Name: W. H. Totton
Position: Mechanical Designer
Address: Lennox, Matthews, Simmons and Ford A/E
2201 East 46th Street
Indianapolis, Indiana 46205
Phone: (317) 257-5361
Education: M.E. Purdue University

Experience: Design and installation of flat plate collectors. Design of passive structures, heat recovery systems and domestic and hot water heating systems. HVAC and plumbing design. Project engineer, field installations.

Name: Gordon Vandertill
Position: Director, Energy Division, Jordan College
Address: 360 Pine Street
Cedar Springs, Michigan 49319
Phone: (616) 696-1180
Education: B.A. Calvin College
M.P.A. University of Michigan
Current: Doctoral work Political Science, Michigan State University

Experience: Federal Energy Administration. Government (local and state) interface. Jordan College, Solar Education/Commercialization. Congressional staff and state legislative staff member.

Name: John R. Veenstra
Position: Energy Co-ordinator, Ingham County
Address: 121 E. Maple
Mason, Michigan 48854
Phone: (517) 676-3550
Education: B.A. Kalamazoo College
M.A. Michigan State University

Experience: Active member of Michigan Solar Energy Association. Member of organizing committee of Michigan Solar Resource Advisory Panel. County energy co-ordinator. High school science teacher (Physics). Citizen political activist, county commissioner and transportation planner.

Name: Herbert Wade
Position: Manager, Solar Program, Department of Natural Resources
Address: Department of Natural Resources
Missouri Energy Program
P. O. Box 176
Jefferson City, Missouri 65102
Phone: (314) 751-4000
Education: B.S. Engineering, U.S. Naval Academy
M.B.A. Management, University of Rhode Island
M.S. Biology, North Arizona University

Experience: Solar instrumentation design. Solar manufacturer, designer/builder, solar educator and solar state administrator.

Name: C. L. Warren
Position: Tax Practitioner, Public Accountant, Energy Consultant, Teacher, Self-employed
Address: 2915 E. Dudley
Indianapolis, Indiana 46227
Phone: (317) 784-7744
Education: B.S.M.E. Purdue University
Business Major, Indiana Central University
A. & E. Mechanic, U.S. Air Force
Electrical Specialist, U.S. Air Force

Experience: Chairperson, Alternative Technologies Associates. Member of ISES and New England Solar Energy Association. Builder of passive and domestic hot water systems for own home. Experimental test engineer, turbine engines. Senior value engineer. Treasurer, Central Indiana Chapter-044, Society of American Value Engineers. Volunteer income tax preparer with the Internal Revenue Service, 5 years

Name: George A. Watkins
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