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FOREWORD

This report documents work performed in compliance with Contract No. EG-77-C-01-4042, Task No. 5125. The report was prepared by J. H. Ashworth, B. D. Green, and R. L. Saltonstall of the Policy Analysis Branch; P. L. Pollock and R. Odland of the Institutional and Environmental Analysis Branch; and L. J. Perelman of the Program Evaluation Branch of the Solar Energy Research Institute.

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REPORT

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REPORT SUMMARY

This report examines the implementation experience in selected case study states for four major types of solar energy programs: financial incentives; state-funded research, development, and demonstration; testing and certification; and land-use planning for solar access. Information gathered on state education and information programs in the case study states is also presented, in addition to an essay on evaluation methodology and evaluation experience for state incentives.

For the four major incentive types, a review of the policy instruments available to each state is provided, along with a short summary of the incentives enacted by the fifty states in the period 1973-1978. The bulk of each section is devoted to an examination of the experience of implementing an incentive type in four to six case study states. The choice of the rule-setting and administering agencies is discussed, administrative procedures are analyzed, and problems encountered in each state are contrasted and compared.

From the experience of the nine case study states, a number of general conclusions on the implementation of incentives for solar energy are drawn, as well as specific findings and recommendations for each subject area. These general findings, as well as specific observations for the four major incentive types, are given below in capsule form.

GENERAL FINDINGS

- The implementation process is an important determinant of the final form and of the effectiveness of a state incentive for solar energy. Implementation is particularly important for determining which technologies and components are eligible for an incentive, what eligibility or performance criteria a particular solar system must meet, and what coordination exists among incentive programs within the same state.

- There is a strong need for an unambiguous statement of legislative intent for each enacted solar energy incentive. Many of the problems encountered by implementing agencies in the case study states was due to a lack of legislatively defined priority among multiple program objectives or to a lack of definition of what systems should be included in the term "solar energy device."

- It is important for incentive legislation to contain a clear delegation of administrative authority. This is important particularly when more than one agency will be involved in rule-setting, administrative, information dissemination, and evaluation activities.

- Agencies charged with implementing incentives for solar energy should be given substantial discretion to revise their rules and procedures. This discretion is required because of lack of experience at the state level with administering solar energy incentives and because of the need to evolve new mechanisms appropriate to solar

energy sources. In addition, the solar energy technologies are undergoing rapid change. The administrator must be able to revise rules and practices to reflect technological innovations as they occur. Such administrative discretion must be bounded by a clear statement of legislative purpose and by active legislative oversight.

- There is a serious conflict between the continued creation of state standards and eligibility criteria and the development of nation-wide marketing for solar energy systems.

- There is a potential conflict between the protection of consumers and two important aspects of the commercialization of solar energy: the promotion of product innovation, and the encouragement of low-cost home-built solar energy systems.

- Concerns over the willingness or ability of state agencies to administer innovative mechanisms for the implementation of solar energy incentives are largely unwarranted. So long as clear guidelines are provided in either the initial legislation or during the rule-setting process, state agencies have routinely administered financial rebates, small-scale grants programs, prior certification of solar systems, and other unfamiliar mechanisms.

SPECIFIC FINDINGS

- Financial Incentives (Section 2.0)

  * The setting of policy in major problem areas (i.e., passive systems, labor costs, mandatory conservation requirements, and speculatively built housing) was usually done by the rule-setting agency because of lack of guidance from the enabling legislation. This was particularly true in passive design.

  * The choice of rule-setting and administrative agencies was not as crucial to interpretation of legislative mandate as had been predicted. Taxing authorities and independent agencies adopted eligibility criteria for solar systems similar to that of energy offices.

  * Certain of the more innovative implementation mechanisms for financial incentives (rebates, grants, and the prior certification of eligible systems) have important secondary impacts, including ease of administration. However, these innovative mechanisms to date have been primarily employed in small, sparsely populated states. It is difficult to predict whether they could be adapted successfully for use in large, populous states.

- State Funded Research, Development, and Demonstration Projects (RD&D) (Section 3.0)

  * State solar energy RD&D programs have primarily funded low-cost, low-risk, near-term, high-visibility projects, with a major emphasis on commercialization activities. This approach complements the federal solar energy research program.

  * Communications between state solar energy RD&D program administrators and staff and their federal counterparts generally has been poor, resulting in missed opportunities for cooperation and for the coordination of research activities.

  * It is desirable to coordinate state RD&D activities closely with state universities. This provides a more effective use of limited program funds by drawing upon the university's equipment, facilities, and personnel. It also provides program stability and political support for the RD&D effort.

  * Special interest groups can be valuable to state RD&D programs. They can assist state administrators and staff in program planning, project monitoring and evaluation, and program information dissemination.

  * Outside advisory groups, drawn from the state's solar energy community, have served as important components of the implementation of solar energy RD&D programs in several states. They have helped to screen potential projects, and have provided a continuous flow of valuable information to program administrators and staff.

- Testing and Certification (Section 4.0)

  * The desire of many states to protect the health, safety, and welfare of their residents through testing and certification programs may conflict with desire of the solar energy industry to establish a consistent program to encourage a national market for solar equipment and systems.

  * A complex and evolving subject such as the testing and certification of solar energy systems may require increased administrative discretion because of the need for technical expertise and the need to accommodate frequent changes. Such an approach requires clear policy guidelines to avoid legal and administrative problems.

  * Testing serves an important function for manufacturers as well as consumers by providing the producer with valuable information for improving his product. This test data is particularly valuable to small producers who might not be able to afford to purchase the test equipment.

* State involvement in testing and certification probably will decrease as national programs involving the solar industry expand. State involvement in development of criteria used for qualifying equipment for state incentives will parallel the activity in the incentive programs themselves.

- Land-Use Planning to Insure Solar Access (Section 5.0)

  * Solar access legislation should be provided, but should be carefully designed to meet an actual need or perceived barrier within the state.

  * Solar access legislation should be developed by each state to be compatible with its local political structure, local attitudes, and level of expertise, as well as the level of energy savings desired from solar energy use.

  * Coordination of state-level agencies with jurisdiction over land use and energy should be performed in the adoption of a particular solar access initiative.

  * Technical information such as design handbooks, model ordinances and easements, and baseline energy information should be provided to local jurisdictions as early as possible in order to assist them in the implementation of state-level initiatives.

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SECTION 1.0

INTRODUCTION

1.1 PURPOSE OF THE STUDY

The following paper reports the findings of a six-month pilot project conducted by the Analysis and Assessment Division of the Solar Energy Research Institute. This research effort was designed to gather, analyze, and disseminate information on the operation of state incentives for solar energy. The primary purpose of this report is to provide timely and practical information on the lessons learned from and the problems encountered to date in state incentive programs for solar energy diffusion, adoption, and commercialization. The secondary intent of this SERI program is to identify those research areas within the broad spectrum of implementation experience which require more extensive future examination to improve the effectiveness of state solar energy incentive programs.

1.2 SCOPE OF THE STUDY

The focus of this study is the implementation of official state solar energy incentives programs. Questions of incentive design and program effectiveness are addressed in certain portions of the text, but the bulk of the research effort is directed toward examining how laws and legislative mandates have been transformed into rules, regulations, eligibility criteria, standards, comprehensive land-use plans, grants, tax deductions, and demonstration projects. Most of the programs discussed will be official governmental actions, although the roles of private groups, advisory councils, and universities are addressed in Sections 2.0 and 5.0.

Four major types of incentive programs are discussed in Sections 2.0 through 5.0 below: state financial incentives; state-funded research, demonstration, and development (RD&D) projects; state testing and certification of solar systems; and state land-use planning for solar access. In the course of gathering information on state programs in these four issue areas, the project staff also assembled considerable information on two aspects of state activities not contained in the original design of the project: education and information programs, and state efforts at internal evaluation of solar incentive programs. After field interviews for the four major incentives were completed, it was decided to include in this report a catalogue of education programs that had been encountered, as well as a brief essay on the evaluation of state solar incentives and on evaluation methodology. Both of these chapters should be viewed by the reader as supplemental information to the text rather than as major research components. They are included as useful indications of vital state activities, and will be addressed more systematically in forthcoming SERI research projects.

Criteria used to select state programs to be examined differed for each of the four major incentive areas, and detailed criteria are explained in each of the individual chapters. In general, state programs to be analyzed in depth below contain three or more of the following characteristics:

- They have been in place for several years and developed administrative procedures to implement the legislative mandate. The exception to this rule is in land-use planning, where most of the programs in the nation have been enacted in the last two years.
- They are innovative in design.
- They have served or are currently being considered as models by other states contemplating the adoption of solar energy incentives.
- They provide incentives which are significant in size or scale. This characteristic is important primarily for the selection of programs to be included in the sections on financial incentives and state-funded RD&D programs.

Using these criteria, the SERI research team in conjunction with experts in each of the incentive fields selected eighteen programs in nine states to examine in detail. The list of states and the programs assessed is contained in Table I below.

TABLE 1-1

State Incentive Programs Examined

State	Financial	RD&D	Land-Use Planning	Testing and Certification
Arizona	X			
California	X	X	X	X
Florida		X		X
Maine	X			
Massachussetts	X			
Minnesota			X	X
Montana		X		
New Mexico	X	X	X	
Oregon	X		X	X

1.3 METHOD OF THE RESEARCH EFFORT

Prior to the field research component of this report, extensive secondary information was collected on each of the eighteen selected incentive programs. This information was supplemented by telephone interviews of key officials of these nine states and of regional and professional organizations. During July, August, and September of 1978, members of the SERI research team visited each of the nine states. One to two hour interviews were held for each of the eighteen incentive programs with three types of state officials: state legislators and legislative staffs; state energy office and/or solar office personnel; and implementing agency staff, where these were different from energy office personnel (i.e., state revenue and taxation officials in the case of income tax incentives). Wherever possible, discussions were also held with local solar energy advocates, solar energy industry spokesmen, and other individuals who might be affected by or involved in the implementation of the state incentives for solar energy. The length and size of on-site visits by SERI personnel ranged from a single person-day in one or two cases to three days for five staff members in the case of the most complex programs. All interviews were tape-recorded to insure accuracy and to provide a valuable resource to future researchers.

1.4 PRESENTATION OF THE PILOT STUDY FINDINGS

Each of the four main chapters has been designed to stand alone. Each can be read without the benefit of the material contained in the other portions of the report. This structure has been adopted for methodological and pragmatic reasons. After a careful examination of all the individual observations and conclusions, the SERI research team concluded that there were only a limited number of rigorous public policy generalizations which could be developed based on this initial examination of the implementation experience of selected states in four disparate incentive areas. These generalizations have been incorporated into the text of the individual chapters and appear in the concluding chapter of this report along with a series of recommendations for future research. Second, the SERI staff has determined that most state administrators, legislative staff members, and federal energy officials are primarily concerned with one or at most two of the four incentive areas covered by this report. By making each of the major incentive chapters self-contained, SERI will be able to disseminate rapidly the specific information on implementation experience of interest to each sector of the potential audience. This audience includes the following functional groups:

- state officials and legislators considering the creation of incentives for solar energy;
- state officials who are currently revising, amending, or expanding existing solar energy incentives;
- local land-use planners and city officials;
- specialists in standards, testing, codes, and equipment certification;

- members of the solar energy industry; and
- federal energy officials interested in the promotion of decentralized solar energy research and development and in the application of the lessons learned in state programs to the new federal financial incentives programs.

1.5 LIMITATIONS OF THIS PILOT STUDY

Given the time and resource limitations of this research effort, it has not been possible to perform comprehensive analysis of all existing state incentive programs. This has two implications for the observations and conclusions reached for each incentive type. First, the small sample of programs examined (ranging from four to six per incentive type) limits the validity of all generalizations. This problem is reinforced by the variations among the states in which these programs are being implemented. A successful RD&D program developed in Montana, a land-use planning mechanism used in Oregon, or a financial incentive implementation technique used in New Mexico may have limited applicability for California or New York.

Secondly, the selective sample used in this study may have led to omission of one or more innovative, important state solar incentive programs. This methodological issue will be resolved in the next phase of this project, which will contain a systematic examination of the major state financial incentives and state-funded RD&D programs.

Lastly, this project does not try to evaluate the final outcomes of the incentive programs: how many solar systems have been installed, what technological innovations have been stimulated, etc., nor does it calculate the cost-effectiveness of alternative configurations of incentives. The basic data required to provide this type of policy analysis has not yet been collected in any state, and initial plans are just now being formulated in a few locations to begin the monitoring necessary to gather this type of information. Until the necessary data required for rigorous program evaluation is developed, it is hoped that the information in this report on the operation of existing incentives will assist policymakers in formulating more effective state programs for the promotion and commercialization of solar energy systems.

Section 2.0 State Financial Incentives

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SECTION 2.0 SUMMARY

Financial incentives to stimulate the use of solar energy systems have been enacted in over 30 states in the period since the 1973 Arab oil embargo. Some of these incentives have had substantial impacts on consumer choices, while others have been largely symbolic gestures which have not affected levels of demand for solar equipment or for solar design. In approving these incentives, state legislators have provided mechanisms which assist in the achievement of either of two solar energy commercialization strategies: the reduction of market prices or the removal of perceived barriers to solar energy equipment installation.

In formulating solar incentive policy, each state has had a choice among a number of different fiscal instruments. In the following section, the full range of incentives are presented in summary form. These range from those judged to be largely symbolic in nature (sales tax exemptions and slightly subsidized conventional loans) to those with major potential either to reduce solar market prices or to remove institutional and legal barriers to solar usage. The rate and degree of adoption by the 50 states of each incentive option has varied widely, and the section briefly outlines the adoption process for seven incentive types.

The success of these incentive programs is dependent not only on their size and scope but also on the way they are administered. The rule-setting and administrative processes are central for the determination of what solar systems or components qualify for the incentive, which portions of the population will be able to take advantage of the incentive, and how rapidly the benefits of the incentive will be distributed. They also help determine the ease with which individual consumers can take advantage of the incentive.

To clarify the role of implementation in incentive success, the section examines the recent experience with financial incentives in six states: California, New Mexico, Arizona, Oregon, Maine, and Massachusetts. These states have been selected because their incentive programs possess one or more of the following characteristics: they have been in placé for several years; they offer incentives which are substantial in size, producing large market price reductions for the consumer; they are innovative in design; and/or they have served as models for other state incentive programs. California, New Mexico, Arizona, and Oregon all allow large credits or rebates against the state income tax. Arizona and Oregon also exempt homeowners from property tax increases due to the installation of a solar system as do Maine and Massachusetts. Oregon and Massachusetts have developed subsidized loan programs for solar energy equipment purchase and installation. Maine recently sponsored a grant program to encourage the installation of solar hot water heaters.

Each of these programs is examined for lessons learned. Particular emphasis is placed on the choice of the rule-setting agency, the eligibility guidelines developed, and the relationship between rule-setting and administering agencies. In the six case study states, three different locations for rule-setting are identified: the state energy office, the state taxing authority,

and the independent state agency. Each of these organizational types is examined for its effects on the implementation of the incentive. Several issue areas which created problems for rule-setting in most of the case study states are briefly outlined: e.g., passive systems, the inclusion of labor costs, mandatory conservation, and speculatively built housing. A systematic survey of the six states shows that the setting of policy in these difficult areas is usually done by the rule-setting agency because of lack of guidance from the enabling legislation. This is found to be especially true in passive design, an area which received a great deal of attention from rule-setting officials and administrators but on which legislative history is usually silent. Many of the difficulties which had been predicted for rule-setting by state tax authorities and independent agency officials do not exist in the six case study states. For example, taxing authorities adopted approaches similar to the energy office for passive technologies and exhibited an admirable penchant for clear and concise eligibility regulations. The independent agencies examined also demonstrate considerable administrative flexibility in the evaluation of solar systems.

In the final portion of the section, a number of tentative conclusions and items for further research are set forth. Clarity of eligibility guidelines is essential to the successful implementation of a financial incentive, regardless of the type of incentive mechanism, the size of the state, or the nature of the administering agency. The choice of the type of implementing agency is not as crucial as was expected, with great variations occurring in the types of rules and procedures adopted. Certain of the more innovative implementation techniques (prior certification of systems, rebates and grants) have important positive secondary impacts on the ease of implementation and on consumer choice. Because these programs are currently in existence only in small states, it is difficult to predict whether they could be adapted for successful use in large populous states.

Innovative implementation mechanisms for financial incentives have been administered by state agencies without difficulty, so long as the eligibility guidelines are clear and precise. Concerns over the unwillingness or inability of state agencies to run efficiently relatively unfamiliar programs such as rebates appear to be unwarranted.

2.1 INTRODUCTION

This section examines the experience of selected states in implementing financial incentives for solar energy. While the range of available fiscal mechanisms is surveyed in Section 4.0, the emphasis throughout this section will be upon "major" incentives--those which possess the potential to have a significant impact on the rate of installation of solar energy systems, either through a reduction in the market cost to buyers or through the removal of a legal or institutional barrier to the use of solar energy systems. The objective of this study is not to judge the design of state incentive programs or to criticize the activities of rule-setting and administering agencies. Rather, the emphasis will be on gathering, assessing, and disseminating information resulting from the practical experience of officials in pioneering states. Specifically, we will focus on what factors are important for the translation of a law into a workable solar energy financial incentive program. It is hoped that this information will be useful to officials of states contemplating the adoption of incentives of solar energy, to state officials considering the modification of existing incentives, and to federal policy analysts seeking to promote the diffusion of solar technologies.

2.2 REVIEW OF THE AVAILABLE FINANCIAL INCENTIVES AT THE STATE LEVEL

There are a large number of fiscal instruments which individual states can use to encourage the installation of alternative energy systems. Most of these instruments are rooted in the power of the state government to tax and to grant exemptions to existing taxes. In addition, there are direct grant and direct subsidy options, as well as regulatory actions which the state government can take to influence the lending practices of the private financial sector and the standard practices of key sectors, such as the building industry.

All these financial incentives are directed at assisting in the development of either of two strategies:

- the reduction of the market price of solar units;
- the removal of barriers to installation of solar units.

These two different strategies are often inextricably joined in the minds of state governmental policymakers and of solar advocates alike. Actually, these objectives are quite different, and are best approached by means of two different sets of incentive packages. Since this section deals primarily with major financial instruments, we will focus on price reduction strategies. As we will see in the discussion of state implementation procedures below, concern over barrier removal often enters into rule-making decisions and the creation of administrative guidelines.

Market price reduction strategies are aimed at the solar consumer. They usually seek to lower the price of a solar unit at the time of purchase (or shortly afterwards). Less commonly, they seek not to affect the first cost but to lower the life-cycle cost of the solar system (primarily through low or

no-interest loan programs). These strategies are aimed at increasing the use of and demand for solar systems by bringing the initial cost in the marketplace closer to the initial capital costs of conventionally-powered systems. In the case study states, many advocates of price reduction strategies argue to the legislature that these incentives are temporary and transitional: the combination of sharply rising fossil fuel costs and of increasing mass production of solar units will soon make solar energy systems economically attractive without any governmental encouragement.

There are six basic solar financial incentives which are currently in use and aimed at lowering the price to the end consumer. While many more than six solar incentive programs have been enacted or are being currently considered by individual states and localities, they vary from one another primarily in the magnitude of each incentive, the mix of the six basic types enacted, and the method of administration. The six market price reducion strategies are:

- Direct Grants
- Income Tax Rebates
- Income Tax Credits
- Deductions from Taxable Income
- Sales Tax Exemptions
- Subsidized Loan Programs

These incentives all affect the perceived consumer price, but they are not identical and they are not necessarily interchangeable. They differ in the amount of price reduction they bring about, in the social groups within the society that can take advantage of the incentive, and in the types of solar technologies that they encourage. These differences may well be magnified by the rules and regulations adopted by state administrators in the implementation of the incentive. For example, a tax credit of any magnitude may well exclude any solar systems created by the poor, since low-income groups do not normally pay significant amounts of state taxes. Strict performance criteria may exclude many low-cost, home-built systems, and the exclusion of labor from allowable costs will favor manufactured active systems (where the labor component is already included in the market price) over site-built active systems and over passive systems. Subsection 2.4 will examine further these questions of the impact of incentive type on consumer choice and on the distribution of benefits among sectors of the society.

The removal of barriers involves the elimination of laws, procedures, perceptions, and practices which prevent solar energy from competing on an equal basis with conventional forms of energy. Many of these barriers to solar commercialization do not require (and probably would not be responsive to) financial incentives. Most are questions of land-use planning, zoning and administrative procedure, rather than of barriers within the energy marketplace. For example, zoning which prohibits the location of solar collectors on the roof of a house will require legal changes at the local or county

level, and will not be altered without those legal modifications. The protection of a solar device from shading by adjoining structures and foliage will also require legislative action. These issues are thoroughly addressed in the land-use planning section of this report.

There are two barriers to the installation of current solar technologies which are amenable to fiscal solutions. The first problem is the valuation of solar systems for property tax purposes. Current solar technologies are highly capital intensive. Active systems in particular require the installation of collectors, pumps, storage devices, and supporting structures. These can cost from $1,000 to over $20,000. If the costs of these solar components are immediately added into the valuation of the house or commercial building on which they are installed, the increase in property taxes will greatly reduce or possibly offset the savings generated by reduced consumption of conventional fuels. This barrier can be overcome by granting to the purchaser or to the builder of the solar system an exemption to increased property taxation. This tax variance is most commonly permanent, but it can also be for a set number of years ranging from five (Maine and North Dakota) to 15 (New York). A slightly different approach is to assess the home as if it has a conventional system rather than solar components.

The second barrier amenable to state fiscal remedies is the availability of credit to finance the purchase of a solar system. A common assumption is that the private banking sector is unwilling to grant conventional loans for residences using an alternative energy system. This preliminary research effort has not found that financial institutions discriminate against homeowners or businesses planning solar installations. Nonetheless, the widespread perception that financing is unavailable has generated several loan guarantee programs. These programs, patterned after existing state and federal programs aimed at special sectors of the population (such as armed services veterans, farmers, and low-income groups), transfer risk from the private to the public sectors by promising to the participating financial institution that it will recover from the government a certain percentage of the loan value (usually 75%-100%) if the borrower should default or if the system does not perform as anticipated.

2.3 STATE FINANCIAL INCENTIVE INITIATIVES IN THE PERIOD 1973-1978

Prior to the 1973 Arab oil embargo and the subsequent quintupling of world petroleum prices, there were no state solar incentives. The promotion of the installation of solar technologies and the removal of barriers to solar energy use were not seen as state functions. The dramatic rise in fossil fuel (and nuclear fuel) prices, combined with growing environmental concerns and with increasing awareness of U.S. dependence on imported petroleum, all led to a strong interest by individual state legislators in initiating new solar energy financial programs.

There was an initial delay in state action on these proposals, as the result of the intermittent nature of state legislative sessions and of the need to identify and study alternative solutions. By mid-1978, however, 37 states had passed over 135 laws which dealt with solar issues. Sixty-one of the laws

contained provisions for one or more of the financial incentives outlined in Subsection 2.2 above. Since there are already a number of excellent current summaries of state solar legislation,* this report will not provide an exhaustive catalogue and comparison of existing incentive packages. Rather, it will briefly touch upon selected general issues central to the process of enactment of solar incentives and then turn to the main focus of this project--the experience of the states in implementing the enacted solar incentives laws. For reference purposes, a two-page summary of state financial incentives is included in Appendix 2-A below.

In the past five years, there have been enacted a number of state programs which are primarily symbolic in nature. By the term symbolic, we mean incentives which in the opinion of state officials and solar industry members thus far have not had a significant impact on the rate of solar installation or on the distribution of these installations among the different solar technologies. These incentives do not by themselves affect consumer market decisions, but rather give a slight "bonus" to those who have already decided to purchase or build a solar system for other reasons. Before turning to major incentives, we will briefly outline state experience with the two major types of symbolic assistance: sales tax exemptions and slightly subsidized loans.

2.3.1 Sales Tax Exemptions

Starting with Texas in 1975, eight states have enacted laws which exempt solar systems from state sales taxes or which later refund the sales tax collected to the end user.** Such an exemption lowers the first cost to the consumer by 3% to 6% but does not overcome the problem of high initial capital costs for solar systems. For a $2,000 domestic hot water system, an exemption from a 5% sales tax would mean a savings of $100. This would not be expected to induce consumer participation when the front-end cost of a comparable natural gas heater would be $150-300.

However, the state sales tax exemption does have several attractive secondary features when it is administered as a rebate. First, it provides a convenient mechanism for collecting data on the number and type of solar installations:

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*The Franklin Institute, State Solar Legislation, National Solar Heating and Cooling Information Center, Washington, D.C., July 1978.

Joan E. Porte, "Solar Legislation of the Fifty States," Consumer Action Now, Washington, D.C., April 19, 1978.

Janet Pardue, "State Solar Legislation 1974-1977," Energy Report to the States, Volume 4, Number 8, National Conference of State Legislatures, Denver, April 28, 1978.

**Arizona, Connecticut, Georgia, Maine, Massachusetts, Michigan, New Jersey, and Texas.

individuals must apply to receive it. Secondly, the rebated sales tax will reach more individuals. The rebate form allows participation by the do-it-yourself solar builder, who may have gathered his construction materials from a wide variety of sources. He or she submits copies of his or her receipts and is reimbursed by the state treasury for the sales tax paid. Otherwise, only retailers who specialize in solar units (primarily manufactured systems) would be prepared to make the sales tax exemption at the time of purchase.

2.3.2 Slightly Subsidized Loans

The second major type of symbolic incentive is the "slightly subsidized" loan, meaning commercial loans which are available with standard downpayment and repayment schedules but with a rate of interest 1/2% to 1% below the current lending rate. Such programs have not yet proved to be important in sparking consumer participation, because the dollar amount involved is not significant. For example, if a consumer decides to retrofit his existing home with a $2,000 hot water system and a $5,000 hot air space heating system, a 25% down payment, 11.5% five-year loan would mean an initial downpayment of $1,750 and monthly payments of $115.45. A 1/2% interest reduction would mean the same down payment and $114.14 per month, while a 1% interest reduction would only lower the monthly payments by $2.65 to $112.80.* Such a program has been attempted on a voluntary basis by the Massachusetts Department of Consumer Affairs. In January 1978, the governor and ranking state officials met with representatives of the state's banking community. One hundred fifteen savings, commercial, and cooperative banks and credit unions agreed to write loans for energy conservation measures and for solar systems at 1% to 2% below the current interest rate. From fragmentary evidence gained by a survey of the participating banks, it appears that the consumer response to the program by the end of July 1978 has been limited. The 39 banks answering the survey indicated that they had received 744 inquiries about the program and had granted a total of 354 loans. Virtually all these loans were for energy-conserving home improvements, with less than 1% being for solar systems.**

The Massachusetts experience has shown that slightly subsidized loans are not a major financial incentive to the installation of solar energy systems. However, a detailed analysis of the same program shows that the response varied widely from bank to bank and from region to region within the state. Six of the 39 banks responding to the survey accounted for over 60% of the loans granted and ten banks provided 268 or more than 75% of the loans. This active consumer response to a few of the lending institutions is based on the willingness of these particular banks to actively advertise and promote the program.

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*Calculated from repayment schedule tables in David Thorndike (ed.), Thorndike Encyclopedia of Banking and Financial Tables Warren, Gorhan and Lamont, Inc., New York, 1974.

**Data drawn from Massachusetts Energy Office internal memorandum, "Results of Low-Cost Loan Program Questionnaires," July 25, 1978.

It is important that a private bank or governmental agency advertise that it is willing to make solar loans. The interest reduction simply serves as notice to the consumer that the financial institution is serious in its commitment to promote solar utilization. The question remains: how low does the rate of interest have to fall before it begins to become an incentive to consumer participation? The Oregon Department of Veterans Affairs has provided financing for 50 to 60 solar systems in the first few months of its solar loan program, which allows up to $3,000 at 5.9% interest for alternative energy systems. However, the success of this program, to be discussed at length below, may be attributable to factors other than the interest rate--such as the lack of a down payment, the long repayment schedule, and the many local offices of the department--than to the interest charged.

2.3.3 Property Tax Exemptions

After the oil embargo and the rapid rise of world crude oil prices, state legislatures first moved to address the issue of procedural barriers to solar installations. They focused initially on the question of property taxes. Requiring or permitting an exemption from increased property taxes because of the addition of solar components was an ideal first step. This step had high visibility, placed the legislature on record as endorsing equal or preferential treatment for solar technologies, but required no expenditure of state funds. The income foregone came out of municipal and local revenue rather than state tax income. No new administrative agencies had to be created, either at the state or local level. The additional training for existing assessors was simple and relatively straight forward. By the end of 1975, ten states had passed laws which took one of three approaches:

- solar systems will be assessed no more than comparable conventional fossil-fuel systems;
- solar systems will be exempt entirely from property taxation; or
- local governments have the right to enact measures which exempt solar systems from property taxes.

The number of states enacting one of these three approaches has grown steadily each year. By July 1978, 25 states had passed some form of property tax incentive legislation. Bills patterned after existing laws have been proposed in a number of the other states and will be considered in the 1979 legislative session. If these new initiatives pass, the property tax barrier for solar systems will become one of decreasing importance. However, given current concern in the state legislatures over citizen revolt over the subject of tax levels in general and property tax levels in particular, there is some concern over whether the movement toward universal adoption of solar property tax exemptions may be halted. There is growing legislative unwillingness to grant property tax exemptions or reductions of any kind unless they are administered across-the-board to all taxpayers.

2.3.4 Income Tax Rebates, Credits, and Deductions

The development and passage of legislation authorizing state income tax rebates, income tax credits, and income tax deductions for solar energy equipment has been slower and more deliberate than that of property tax exemptions. Unlike property tax or sales tax exemptions, solar tax credit and rebates could possibly constitute a significant demand upon the state treasury. In drafting tax legislation, each state has had to determine the size of the incentive needed to meet the legislature's objectives. This was complicated by a lack of consensus on what the goals should be. Mechanisms for administration had to be developed, standards and codes for systems drafted, and legislative oversight planned. Starting with the pioneering programs in Arizona and New Mexico in 1975, 16 states to date have enacted financial incentives which involve rebates, credits, or deductions from the state income tax.* These range all the way from the California 55% tax credit to the programs in Idaho and Colorado which allow the taxpayer to deduct the cost of his solar system from his gross income before determining his state tax liability. These incentives, together with the property tax programs, are listed in Appendix 2-A. Half of these income tax related incentives are targeted solely at the residential consumer, while the others also serve commercial and industrial solar users.

2.3.5 Low-Interest or Guaranteed Loans

Beginning in 1975, six states** have adopted laws which provide for the granting or insuring of loans for the purchase of solar systems. As noted above, several of these programs have proved to be symbolic rather than major incentives since they provide for loan terms close to those of standard commercial banks. Others, however, offer significant savings to potential borrowers, either from reduced interest rates or from more liberal conditions (such as low down payments and extended repayment schedules). Several loan programs have been made available only to certain specific groups within the state population. For example, California has a no-interest loan program for disaster victims which provides up to $2,000 if they install solar systems while rebuilding their homes, and has recently granted the Department of Veterans Affairs the power to increase its lending for homes with solar systems. Oregon has a program available only to veterans. The source of the capital to be lent in these programs ranges from electric utilities (Montana) to general state revenues (California) to special bond issues (the Oregon Department of Veterans Affairs).

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*Alaska, Arizona, Arkansas, California, Colorado, Hawaii, Idaho, Kansas, Massachusetts, Montana, New Mexico, North Carolina, North Dakota, Oklahoma, Oregon, and Wisconsin.

**California, Massachusetts, Minnesota, Montana, Oregon, and Tennessee.

In developing loan programs, the states have sought to overcome one or more of the following three perceived financial obstacles to rapid solar adoption:

- the high initial down payment on a capital-intensive system;
- the high total cost (because of both high initial capital costs and accrued interest);
- the unavailability of financing for solar systems, even on commercial terms, because of the reluctance of the financial community to lend funds on unfamiliar and untried technologies.

The major loan programs have tended to address the first two obstacles, while the more symbolic activities have been targeted primarily at the third perceived obstacle. As has already been noted, we have not found any evidence that commercial lenders have been unwilling to provide funds at prevailing rates for lenders with good credit ratings who are seeking to build well-designed solar units. Several major private lending institutions (the Bank of America and San Diego Federal, for example) have initiated their own programs of reduced-interest loans for energy-conservation measures or for solar systems.

2.4 THE EXPERIENCE OF IMPLEMENTING FINANCIAL INCENTIVES IN SELECTED STATES

2.4.1 The Choice of Cases

As shown in Appendix 2-A, 37 states have enacted some form of solar financial incentive. However, initial background research indicated that the universe of states with major solar incentives was in fact much smaller. Many states had enacted a single symbolic incentive or, most commonly, a solar property exemption. Time limitations and the pilot nature of this study also dictated that we focus on a few carefully chosen programs. After internal discussions and consultation with outside state solar leaders, we selected six states to examine in detail. These states' solar financial incentive programs shared some or all of the following characteristics:

- they contained substantial incentive packages, capable of giving sizable reductions in solar market prices to buyers;
- they were innovative, serving as models for other states seeking to develop solar incentive systems;
- they had been in place long enough to have developed experience on the process of implementing solar incentives.

A brief outline of the six states' programs follows. A more complete description of the details of each of the incentive packages is contained in Appendix 2-B.

2.4.1.1 California

In late 1977, the California state legislature enacted the largest state solar tax incentive to date. The law allows a tax credit of 55% (up to $3,000 maximum) on the cost of the solar system. For systems costing more than $6,000 the taxpayer can file for either a $3,000 credit or for 25% of the total cost, whichever is larger. The tax credit applies to both residential and to commercial installations, and unclaimed balances can be carried forward for five years. The credit is scheduled to terminate at the end of 1980 and recently has been revised (AB 3623) to clarify a number of points about systems and components qualifying for the tax credit and to clean up ambiguous sections in the original legislative language. As already noted, California also has a no-interest solar loan program for disaster victims. In late 1978 the legislature set up the Cal-Vet solar loan program, which allows an increase of $5,000 on the ceiling amount for the existing veterans loan program if the home is equipped with a solar energy system. This last program has not yet been implemented.

2.4.1.2 New Mexico

New Mexico has the only state financial incentive which is administered as a rebate. Passed in 1975, the law allows a 25% credit, up to a total of $1,000, for solar systems installed in a principal residence. Swimming pool heaters were added to the allowable systems in a 1977 legislative amendment. In addition, New Mexico allows an income tax credit, not to exceed $25,000, for solar irrigation pumping systems. The last credit can be carried over for three successive tax years.

2.4.1.3 Arizona

Arizona has enacted a large number of financial incentives for solar energy, starting in 1974 with an exemption from increases in property taxes resulting from solar installations. Arizona also has a tax credit of 35% (up to $1,000) for a solar system installed on a taxpayer's residence. Alternatively, a residential or commercial solar system can be amortized in 36 months against one's income for computing state tax liability. Lastly, solar devices are exempt from transaction privilege (sales) and use taxes.

2.4.1.4 Oregon

Oregon has developed a series of interlocked incentives to encourage the installation of alternative energy devices. In 1977, a 25% (up to $1000 limit) tax credit for installing a solar system during the period between the beginning of 1978 and the end of 1984 was enacted. The credit can be carried forward for five years. To qualify, systems must provide either 10% of the total energy requirements of the home or 50% of the total hot water heating needs. There is also a property tax exemption for solar systems which will last through the end of 1997. Finally, veterans can receive a 5.9% interest

loan of up to $3,000 above the maximum allowable loan amount (currently $42,500 on non-farm loans) if the additional funding is used for installing a solar system on the veteran's home. This system must provide 10% of the energy requirements of the house.

2.4.1.5 Massachusetts

Massachusetts has passed a number of small but innovative financial incentives for energy in addition to its major emphasis on energy conservation. The first provides for an income tax deduction for corporations only which allows them to subtract the total cost of a solar system from taxable income in the year the system is installed. Solar systems are exempted from property taxation for ten years and from state sales taxes as well. In addition, Massachusetts has two loan programs. The first allows banking institutions to make extended loans with higher total values for solar systems. The second is the voluntary program, already outlined above, in which 115 banks agreed to offer home-improvement loans with lower interest rates for solar installations and for energy conservation measures.

2.4.1.6 Maine

Maine recently conducted a successful state solar grants program to encourage the installation of solar equipment. Forty grants of $400 each were given to individuals throughout the state to install solar domestic hot water heaters. The state also exempts solar devices from property taxation and rebates sales tax to purchasers of solar equipment. Both of the latter incentives run through the end of 1982.

2.4.2 The Method of Analysis

Each of these six states was visited by one or more of the SERI project team. In the case of the larger, more complex solar incentive programs, three to five project members spent several days with local officials discussing problems of implementation, rule-setting, and institutional coordination. Whenever possible, in-depth interviews were held with three groups of individuals:

- the legislators and/or legislative staffers responsible for drafting the enabling legislation;
- the individuals charged with creating rules, regulations, and qualifications, and with processing claims for incentives;
- local solar energy activists, solar manufacturers, builders, and architects involved in solar design.

The focus of the discussions was implementation. Specifically, we were interested in ascertaining the role of the rule-setting agency in actually formulating policy; the basis on which the rule-setting and administering

agencies made their implementation decisions; the way in which the more difficult policy questions were dealt with; and the effects these implementation decisions had on the promotion of different solar technologies and on the population segments within the state able to take advantage of the financial incentives.

In the following subsections, we will differentiate between rule-setting and administration. Rule-setting for these financial incentives includes the creation of eligibility criteria for solar systems, the development of standards and codes, and the interpretation of the portions of eligible systems allowable for state incentives. Administration deals with handling of applications for the state incentive once eligibility criteria have been determined and includes the development of forms, the requirement of supporting documents (receipts, certificates of residency, etc.), and the interpretation of the eligibility criteria in particular cases.

2.4.3 The Location of Rule-Making

The state legislatures have delegated authority for rule-setting and administration in solar financial incentives to a number of different types of state agencies: tax departments, building code authorities, state energy and natural resource departments, consumer affairs departments, banking regulatory bodies, and specialized constituent service agencies. In some cases (such as Oregon), a number of different programs have been developed, each with a different rule-setting and administering agency. In other instances, the enabling legislation has made no delegation at all, leaving it for interested agencies to determine among themselves who should interpret the legislative intent. In more than one case, the agency that wrote the rules and regulations was not the one specified in law but the one with the most interest and expertise in solar energy and energy conservation.

Each of these patterns will be considered in turn as an option. For each of these locations of rule-making, we will enumerate a number of potential advantages and drawbacks that individuals active in the solar field have expressed during our interviews. Then the actual impact on the implementation process of the different types of rule-setting and administrative institutions will be examined, based on the experience of the limited number of states visited during this survey. In a subsequent part of this section, the lesson learned from each state will be sketched to provide information to officials in other states contemplating solar financial incentives.

A word of caution is in order. The universe of cases in some of these categories is extremely small, making generalizations difficult and potentially misleading. As the sample size diminishes, the influence of extraneous outside variables increases. Nonetheless, we feel it may be useful for state officials planning incentives or for researchers considering the evaluation of incentive programs for this report to indicate which of the common concerns about implementation have been justified in a select sampling of states.

2.4.3.1 Rule-Setting by the State Solar Energy Office

The most common pattern encountered in this study was for the solar office within the State Energy Department or within the State Department of Natural Resources to write the rules and regulations governing the enacted state financial incentives. This usually took place at the direction of the legislature, but there were cases (e.g., the Massachusetts tax credit for commercial installations) where the local solar office volunteered to undertake the task for the agency legally responsible for rule-setting.

Rule-setting by the state solar office has several potential advantages. First, the individuals writing the regulations are generally familiar with the range of solar technologies and with the problems being confronted by local solar manufacturers and installers. This is particularly important for passive solar systems. The complexity of passive configurations can present major difficulties even to an experienced solar engineer when determining system eligibility for financial incentives. Second, members of state solar offices tend to be aware of the approaches attempted by other states. The solutions developed by the pioneering states (particularly New Mexico but now also California) have been adopted selectively by other state energy offices as models for their own programs. Third, solar advocates argue that state energy offices will promulgate rules and regulations which will be more inclusive of the broad spectrum of solar technologies than those developed by other institutions. The energy office officials are more familiar with and comfortable with non-standard hot water heating, space conditioning, and energy conservation systems than are other state officials. This is particularly important for passive design and for low-cost, low-efficiency units (greenhouses, window hot-air heaters, "bread-box" water heaters, etc.).

The main concern voiced by solar advocates and by solar builders interviewed was that the state solar energy offices tend to take a highly technical engineering approach. This means writing rules and regulations which are very detailed and complex, sometimes difficult to understand, and inflexible. There is also concern that solar energy office rules are biased toward efficient units, requiring that many energy-conserving but capital-intensive supplements (mandatory conservation devices) be added along with an installed solar unit.

In California, Arizona, and Oregon, the state energy agency was the lead institution for the determination of eligibility for state financial credits and the formulation of implementating regulations. In Maine, the State Office of Energy Resources was responsible for rule-setting and administration of the state-funded solar hot water initiative. State energy offices or state solar offices played lesser but still critical roles in the determination of eligibility for the Oregon V.A. loan program and the Massachusetts corporate tax deduction. In every case, the drafting of the rules and regulations was the work of one or two individuals (although in California an extensive

coordinating system was set up for comments both from within the Energy Commission* and from other interested agencies). These individuals normally devoted a major portion of their work time to solar energy, alternative energy technologies, and/or energy conservation. They were familiar with solar concepts and solar hardware. This acquaintance with solar technology and with developments within the solar community led them to share several common perceptions. All were strong advocates of passive design. All were concerned that the state government should encourage the installation of low-cost, home-built systems. These common perceptions were reflected in the rules and regulations which were drafted. In five of the six states, the rule-drafting individuals devoted considerable attention to passive design concepts (with the exception of Maine, which was by legislative edict only concerned with manufactured hot water systems). All allowed some credit for home-built or backyard systems, although they varied considerably on the question of installation costs.

All the energy office staff members who drafted implementation procedures for solar tax incentives were aware of the procedures adopted by other states. The imprint of the New Mexico eligibility criteria, in particular, can clearly be seen on the programs that were developed in 1977 and 1978. But energy office staff members were not aware of how the implementation process had worked in other states and what problems had been encountered using the criteria and regulations that had been developed. They also displayed a general lack of knowledge about what local political, demographic, and climatological factors led to specific choices of rules and regulations in other states. There is, therefore, some danger of the transfer of inappropriate implementation procedure, but thus far it has not been a significant problem.

One obvious question that arises is: is there a conflict between being a solar energy specialist and being the impartial administrator of legislative intent? Are the rules developed by the energy office staff members more liberal toward solar energy than those developed by the staffs of other agencies? The tentative conclusion we have reached is a mixed one. Because they are aware of the broad spectrum of currently available or evolving solar technologies, state energy offices tend to issue guidelines or adopt procedures which include in detail virtually every conceivable solar configuration. This is particularly true of the California guidelines, which are a virtual encyclopedia of possible combinations of active and passive components, storage mechanisms, heat transfer systems, and controls.

The breadth of the analysis does not mean that all of these components are considered to be totally eligible for the tax credit. Rather, the broad analysis is introduced precisely so that differentiation can be made between

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*The formal title of the Energy Commission is the Energy Resources Conservation and Development Commission. It will be referred to in this report by its popular name, the California Energy Commission or CEC. It should also be noted that the solar office staff does not actually engage in rule-setting. Rather, it makes recommendations to the commissioners, who then approve, modify, or reject the recommendations.

similar components, some providing useful energy and others not. The detailed criteria are often designed to exclude bad systems as well as to include new and innovative technologies. For example, the California Energy Commission (CEC) established three separate climatological zones (Heating, Heating/Cooling and Cooling), and then spelled out separate eligibility criteria for each. For example, a thermal mass wall must be fully shaded for the entire day on August 21 in the Cooling climate zone and in the Heating/Cooling climate zone to qualify for the tax incentive. No more than 75% of the thermal wall cost will be eligible in the Cooling climate zone (100% in the other two zones).

At the other end of the spectrum, the Oregon Department of Energy has adopted virtually no rules and regulations, other than ones to insure that the solar system is safely constructed. The basic eligibility criteria are the ones established by the legislature: the solar system must provide 10% of the energy requirements of the home and must be located on or in a taxpayer's primary or second residence. There is a conscious effort to make the tax credit available even to unusual or untried designs. Only four requests have been turned down thus far, two because the systems were clearly mis-sized for the structures and two because they were submitted by builders who engaged in speculative housing. The Oregon Department of Energy screens and evaluates each system before it is built, allowing its staff to suggest modifications which will make the system work better or which will bring down the estimated cost. In this capacity, the Oregon Department of Energy serves not only as an eligibility adjudicator but also as an energy extension service.

2.4.3.2 Rule-Setting by the State Taxing Authority

In a few states, the Department of Revenue has been instructed by the legislature not only to administer a solar financial incentive but also to write the rules and regulations that determine the systems and components which qualify. The concept of such an approach elicits strong but mixed reactions from state officials and solar advocates. On the positive side, the taxing authority can be expected to write regulations which are relatively uncomplicated and therefore easy to administer. As the author of the New Mexico solar tax incentive rules and regulations explained his approach,

> . . . You can make regulations just as complicated as you want or as simple as you want. My experience over the years has been that every set of state or federal regulations that I have run into has been so complicated with governmental gobbledygook that John Doe on the street could not understand it. Our approach in the very beginning was to develop regulations that would be easily understood by anyone and that would be readily administered by the Bureau . . . [and] by a person who was not necessarily of a technical or professional background.*

*Interview with M.L. Morton, August 18, 1978.

Second, as part of the drive to ease administrative burdens, the taxing authorities tend to write regulations which are unambiguous. The line between systems which qualify for the incentive and those which do not is clearly drawn. This helps reduce the uncertainty of the consumer over whether or not a system he or she is considering will qualify for the financial incentive.

Other officials and private individuals interviewed in the course of this study expressed concern over whether taxing authorities should be in the business of writing solar rules and regulations even if they were to be implementing those rules. The major worry is that the taxing and revenue departments will write restrictive regulations in order to limit the impact of the incentive on the state treasury. A narrow interpretation of the legislative intent or the inclusion of restrictive performance standards could well blunt the effectiveness of even a large solar financial incentive. There is also concern that the taxing authorities will restrict eligibility to the proven designs (generally manufactured active systems) because of their lack of familiarity with solar design and because they wish to insure that the systems supported by state funds will definitely work. Thirdly, there is apprehension that state treasury officials will be opposed to using the state taxing structure to provide incentives for anything, and will not provide adequate staffing to handle the solar tax incentive load. Slow processing will, in turn, discourage citizens from applying for the incentives.

In the six states that were surveyed for this section, the state tax departments were involved to different degrees in the implementation of the financial incentive legislation. In New Mexico, the Department of Revenue and Taxation both drafted the eligibility criteria and administered the certification and approval of solar systems applying for the 25% tax credit. This case will be discussed below under "Lessons Learned from the Individual States Implementation Experiences." In the other five states, the taxing authority developed the regulations for the administration of the financial incentive and acted in an advisory capacity to the energy office in the creation of the eligibility criteria and in the interpretation of the legislative intent.

The disparities among the state taxing authorities and among the state solar incentive packages makes it difficult to formulate generalizations. But, from discussions with officials in the states visited for this project and from examination of the transcripts of the state public hearings on proposed solar rules and criteria, several common threads do emerge.

First, taxing authorities generally insist on a stricter interpretation of legislative mandate than do state energy offices or specialized state solar offices. Taxing and revenue officials are generally less willing to stretch the language of the statute to accomodate solar technologies if they have not been specifically addressed.

Second, state taxing authorities are leading advocates of simplicity within the state government in implementing regulations. They are willing to sacrifice some technical rigor in the enumeration of all possible solar configurations in exchange for a simple codification of system types and all allowable incentive amounts.

Third, state tax officials are strong supporters of labeling programs, such as the Cal-Seal program.* Such a program, run either by a state agency or by the industry itself, would simply indicate whether or not the system qualifies for the financial incentive. The state tax auditor then would have only to look for the certificate of eligibility; those with a certificate would automatically qualify and only the unusual or non-standard systems would have to be dealt with on an individual (and time-consuming) basis.

Fourth, there are officials within the various state taxing offices (and within other agencies as well) who are philosophically opposed to the use of the taxing system for any other reason than the collection of revenue. They are not anti-solar. Indeed, many think that the encouragement of solar energy is a correct public policy choice. Rather, they are against using the tax mechanism to provide incentives or subsidies of any kind. They argue that this practice makes the tax system more complex and more difficult to administer. The income tax system may become less equitable by granting tax exemptions not on the basis of income but by some extraneous criteria (the installation of a solar device). The effect these feelings have on the implementation of solar financial incentives is unclear. There does not appear to be, in any of the states visited, any effort by the tax department to adopt restrictive practices or to institute requirements which would make it difficult to apply for the incentives.

Tax departments have shown some initial reluctance to provide additional services for the energy policy planner which are clearly outside the tax field. For example, the California Energy Commission staff originally proposed that the Franchise Tax Board (FTB) request the attachment of a solar questionnaire to those returns seeking to claim the California 55% tax credit. The Franchise Tax Board staff strongly objected, arguing that it was not its function to do so and that the FTB did not even have the legal right to request this from taxpayers. After lengthy negotiations, the Research and Statistics division of the Franchise Tax Board agreed to provide to the CEC a sophisticated analysis of the returns of those individuals claiming the solar credit for the 1977 tax year. What will be needed for other states is the creation of institutional mechanisms for gathering data useful to program evaluation, such as the information the California Franchise Tax Board is currently developing or that the New Mexico Department of Taxation and Revenue has already prepared (see Table 2-3 below). This may require the transfer of funds or personnel from the energy office to the taxing authority, since revenue officials may see this function as an unnecessary burden and a waste of scarce resources.

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*The Cal-Seal program (officially the California Tax Credit Labeling Program) is a joint government-industry project designed to assure the consumer that the system he is purchasing meets state-established criteria for the state financial incentives. The program is being developed by the California Solar Energy Industry Association, with the label being affixed by the installer. This program is described in detail in Section 4.0 below.

2.4.3.3 Rule-Setting by an Independent State Authority

The third alternative is to delegate the power to implement a solar financial incentive to an agency whose primary function is neither energy nor taxation. For example, the law establishing the corporate income tax deduction for solar or wind systems in Massachusetts delegated the implementation to the Bureau of Building Construction. The Oregon state legislature authorized the state Department of Veterans Affairs to grant up to $3,000 above its maximum lending limit for single family homes for the addition of solar systems.

Most of the same potential problems foreseen with state taxing authorities can also be encountered with independent agencies. The promotion of solar energy and/or energy conservation is not the primary institutional objective of such an agency. Its officials are not necessarily familiar with the alternative energy technologies, with the development of incentives in other states, or with the potential impacts of certain types of rules and regulations on the level and direction of solar activity. But the primary uncertainty stems from the high degree of autonomy enjoyed by such organizations, particularly if they are not dependent on the state legislature for annual appropriations. Such an organization can with impunity virtually ignore legislation which enables it to do something that it does not wish to do. The resistance to change, and to outside pressure of some large state agencies (such as the New York Port Authority or the highway departments of most states) is legendary. However, this autonomy can also work to the advantage of a state solar incentive. Such agencies are quite free to interpret their legislative mandates liberally, and to write general guidelines rather than strict sets of rules and regulations. They are also free to change their internal working procedures, as they gain more experience with solar technologies, without recourse to extensive public notice and hearings. They can engage in multi-year planning. We will return to the question of institutional autonomy at length below, both as a general question and in the context of the solar incentive administration by the one state independent agency that we examined in depth.

In the states covered by this analysis, there was only one significant example of the creation of rules by an autonomous state agency: the solar loan program of the Oregon Department of Veterans Affairs (DVA). The program is unusual in both its concept and implementation. The program's success in both promoting solar installations and encouraging innovative designs results from a number of factors which are difficult to separate. The size and importance of the Oregon Department of Veterans Affairs within the state's housing market must be emphasized. It provides financing for one out of every four single family dwellings in the state of Oregon, making it the largest originator of mortgages on such units in the United States. The total dollar volume of these new mortgage loans is currently over 75 million dollars a month or close to a billion dollars a year. All this activity (including the maintenance of fourteen field offices) is accomplished without appropriations from the state treasury. The DVA sells tax-exempt bonds, and charges the veteran loan applicants a rate which covers the bond service and all operating expenses (currently 5.9% interest). Thus, the DVA is both large, providing a major portion of the state's residential housing financing, and it also has considerable policymaking flexibility.

The DVA is authorized by a 1977 law to increase the maximum amount allowed for a loan by up to $3,000 in order to cover the cost of solar system. The enabling legislation has only one requirement, that the alternative energy system provide 10% of the energy requirements of the residence. In implementing the law, the Oregon DVA consciously has chosen not to write an extensive set of rules and regulations to interpret and codify the legislative intent. Instead, it has added only two common-sense qualifications to the 10% requirement:

- "Minimum expected operating life of alternative energy systems must be at least 10 years."
- "Alternative energy devices must be installed in a location and in a manner that will optimize their operation."

These internal guidelines are designed primarily to insure consumer protection rather than to dictate the choice of a solar system. As the chief reviewer for solar applications in the central DVA office put it, "To summarize our requirements for our solar program, it's like a loose set of pajamas that most anyone can fit into." The lack of specific guidelines could provide some difficulties for the individual loan officer, particularly because the loan approval authority is decentralized to the fourteen DVA field offices. This has not been a problem thus far. Each loan office has local consulting architects and engineers on call for assistance. Where the local consultants are uncertain about the feasibility of a proposed system, the central office provides a technical review.

Because of the decentralized nature of the DVA review process, it is difficult to obtain estimates of the number of loan applications which have taken advantage of the solar provisions. This is particularly a problem with passive solar systems, since some loan officers have not interpreted new homes with mass walls and/or large south facing windows as solar homes but as regular houses. If the individual does not require the additional $3,000 for the loan principal, no notice is taken. A best guess of the central DVA office is that there had been 50-60 approved solar loan applications through the end of July 1978, but there is currently no way to verify this figure.

Although administration of the DVA solar loan program is decentralized, rule-setting is not. It resides with the director who is responsbile for day-to-day operations. He does not have to go through the normal notice and comment procedures required of other state officials. When there is a perceived need to change internal procedures to facilitate administration, these changes are simply promulgated and distributed to the field offices. Such flexibility is unusual for a state governmental agency, reflecting the traditional autonomy from political direction that the Oregon DVA has enjoyed. As experience with the solar loan program grows, this administrative adaptability will enable the DVA to rapidly fine-tune its programs and procedures to increase public participation and acceptance.

2.4.4 The Role of Inter-Agency Committees

In the six states surveyed for this section, none had formal rule-setting or administration by a joint agency task-force. In each case, one agency was charged with that responsibility by the legislature. In many specific programs the enabling legislation did require coordination between agencies either to insure compatibility between the rules promulgated and the administrative practices or to make certain that rules and regulations were technically correct. The Oregon Department of Veterans Affairs was required to adopt minimum performance criteria for alternative devices "with the advice and assistance of the Department of Energy." The law mandating the California 55% tax credit stated:

> On or before January 1, 1978, the Energy Resources Conservation and Development Commission shall, after one or more public hearings, establish guidelines and criteria for solar energy systems which shall be eligible for the credit provided by this section. The Franchise Tax Board should describe such regulations as may be necessary to carry out the purposes of this section.*

In the smaller state governments examined in this study, such mandated cooperation has been largely unnecessary. Effective coordination during the rule-drafting stage is usually assured by the interpersonal contact between officials working in the same issue areas. A shortage of personnel in the offices charged with writing regulations and criteria also has necessitated drawing upon the time and expertise of individuals from various interested governmental offices.

In the larger state governments, coordination and consensus-building are major problems. Each large organization has its own internal objectives and operating procedures. The California Energy Commission, for example, has 600 employees, while the Franchise Tax Board has a staff of over 2000. Reaching a consensus within such large organizations, much less between them, is often difficult. The difficulty increases when the legislative mandate is ambiguous or when a great deal of discretion is delegated to the rule-setting agency. During the drafting of the eligibility criteria for the California 55% tax credit, a dispute arose within the CEC between the Solar Office and CEC's Conservation Division over the inclusion of mandatory conservation practices within the interim guidelines to be published at the end of 1977. The Conservation Division wanted to require a large number of conservation steps in order for a solar system to qualify for the tax credit, while the Solar Office felt that these were not within the legislative mandate and would discourage taxpayers from applying for the credit. The Conservation Division published its results separately, rather than trying to integrate them with the Solar Office draft, and this caused further difficulties in building

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*California Revenue and Tax Code, Chapter 1082:17052.5.

consensus in the public hearings that followed. By contrast, the Franchise Tax Board, the CEC Solar Office, the CEC legal staff, and the Office of the State Architect worked together informally to go over numerous drafts of the proposed regulations, so that institutional concerns over implementation and administration could be accommodated before the rules were filed as administrative regulations (thereby giving them the force of law).

Finally, the term "inter-agency cooperation" can be considered a euphemism for the transfer of effective rule-formulation from one agency to another. For example, the Massachusetts state legislature delegated to the Bureau of Building Construction the responsibility of identifying which systems would be eligible for the 1976 corporate alternative energy tax credit. Each solar or wind system would have to comply with "applicable provisions of regulations and standards issued by him [the director of the Bureau of Building Construction] pursuant to law." This rule-setting responsibility was given to the BBC because it had been the implementing agency for earlier legislation on life-cycle costing and because, as one legislative aide put it, it "had the technical staff." At the time that the Solar Action Office came into existence in mid-1977, no eligibility criteria had yet been developed or administrative procedures set up. In part, this resulted from the requirement in the law for the submission of a "manufacturer's British Thermal Unit impact statement" to the BBC as part of the certification process. No one involved had any concept of what this impact statement meant or what it was supposed to accomplish. Members of the Solar Action Office volunteered to assist in the formulation of implementing rules and regulations for this tax credit, in part because of their interest in insuring that the credit was applied to a broad range of solar technologies (including passive) and not just high efficiency manufactured active systems. The Solar Action Office staff developed a comprehensive set of eligibility criteria, based heavily on the New Mexico rules and regulations, and gave them in draft form to the BBC for its use.

By the end of August 1978, no final eligibility criteria had been established. Both the BBC and the Solar Action Office have been pre-occupied with other more pressing matters, so implementation rules or administrative practices have yet to be formulated. Responsibility for writing rules and regulations was de facto transferred to another agency, but without the transfer of administrative power to insure that the program was in place, running, and accessible to the public. Whether the lack of momentum in implementing this particular incentive was the result of a lack of applicants for the credit or, alternatively, whether the lack of applicants was the result of the lack of administrative procedures and outreach efforts is difficult to ascertain.

2.4.5 The Role of the Implementing Agency in Setting Policy

Virtually all the legislation enabling state solar energy financial incentives to date has been vaguely worded. A typical solar bill establishes the size and duration of the incentive program and usually indicates who is to undertake the administration. Few laws address in detail the issues of which systems or parts of systems qualify. In resolving these issues, the implementing body is in fact setting policy. The experience of the states examined in this study indicates that the delegation of policy-setting, as

well as policy-implementation, has been substantial. Solar energy is a technology which state legislatures support but in which they have little accumulated experience. Therefore, there has been even more of a tendency to delegate authority in this field than in other more traditional state governmental activities.

There have been several major issues which have arisen in virtually every state during the implementation process. If they were not specifically addressed in the enabling legislation, they were resolved either by the enabling agency or by a ruling of an outside arbitrator. The treatment of these core issues, as much as the size and form of the incentive, will determine who will take advantage of the state incentive and what types of systems will be favored. These major issues are:

- the treatment of passive solar energy systems;
- the applicability of the incentive to installation costs;
- the eligibility of builder-financed (speculative building) residential units for a tax incentive; and
- the inclusion of mandatory conservation measures as part of the requirement for qualifying for the solar financial incentive.

To assess the actual impact on policy outcomes of the implementation process, we have attempted to examine systematically the experience of the major programs for direct grants, tax rebates, tax credits, or major loan programs among the six states we visited in the course of this study. In each program, we have determined whether these four issues were resolved in the enabling legislation, by the rule-setting (regulatory) body, or by appeal to some outside arbitration agency for a ruling. When an outside agency was consulted, in each case it was the legal counsel for the energy agency or the legislative council who was asked to provide a legal opinion on the agreement of some proposed rule with the intent of the law. In Table 2-1 below, the results are shown in tabular form. As can be readily seen, the original legislation provided sufficient guidance in only a small minority of the cases. In those cases, this guidance usually was explicitly to eliminate an item from inclusion in the credit--installation costs in the case of Maine and New Mexico and nonactive systems in the case of the Maine property tax exemption. Otherwise, it was up to the energy office, taxation and revenue department, or legal counsel to determine just what the legislature intended to include. At times these decisions seemed to bear little resemblance to the original law. The best examples, perhaps, are the inclusion of swimming pool covers in California and swimming pool heaters in Oregon.

Most of the controversy in the development of implementation procedures has focused upon passive solar devices. In particular, much of the rule-setting effort and much of the public hearings and comments that followed the promulgation of rules has dealt with the treatment of four passive components: south-facing windows and skylights, trombe walls, greenhouses, and pool covers. As Table 2-2 below shows, the inclusion or exclusion of these four components in the computation of the major state financial incentives we have

Table 2-1

Summary of Decision-Points for Core Issues

In State Solar Financial Incentive Programs

	INCENTIVE TYPE							
	Direct Grants	Tax Rebate	Tax Credit			Loans		
ISSUE AREA	Maine	New Mex.	Cal.	Ariz.	Ore.	Mass.	Cal. Disaster Victims	Oreg. V.A.
Passive Systems	Non-Applicable	Yes Implem	Yes Implem	Yes Implem	Yes Implem	Yes Implem	Yes Implem	Yes Implem
Installation (Labor Costs)	No Legisl	No Legisl	Yes Implem	Yes Implem	Yes Implem	Yes Implem	Yes Implem	Yes Implem
Mandatory Conservation	No Implem	No Implem	Yes Implem	No Implem	No Implem	No Implem	No Implem	Yes Legisl
Speculative Housing	No Legisl	No Legisl	Yes Legisl	Yes Implem	No Arbitr	No Legisl	No Legisl	No Legisl

Code: Legisl = determined by legislation
Arbitr = determined by outside arbiter
Implem = determined by rule-setting agency

Yes = is eligible in part or in entirety for financial incentive
No = is not eligible for financial incentive

examined was determined almost exclusively by the agency writing the regulations, with some assistance from outside legal counsel. In virtually every case where the legislature has not predetermined the outcome, the rule-setting officials have opted for a partial or complete inclusion of the passive technology among the systems eligible for the financial incentive. The one exception was swimming pool covers, which straddle the line between solar systems and energy conservation devices.* Pool covers have caused a disproportionate amount of both political and public policy problems for the rule-setting agencies. They are only marginally solar devices, serving primarily to lower the energy necessary to heat the pool by other means (often natural gas). They also conserve water by limiting evaporation. They are normally purchased by individuals in upper income groups, which leads to the question of whether the state legislature intended to provide a financial incentive which would only apply to the affluent. However, the pool cover industries are well-organized lobbying groups in certain states (particularly in California and Arizona). They have provided extensive testimony in public hearings and have marshalled significant political support from their home district representatives. Given these factors, it is likely that pool covers will continue to present a difficult dilemma for agencies in the West and Southwest attempting to implement ambiguously written state incentive laws.

2.4.6 Lessons Learned from the Individual State Implementation Experiences

2.4.6.1 California

Complex and comprehensive eligibility requirements may be required if the rule-setting agency wants to insure the performance of the solar system. This is particularly true in passive or direct thermal heating systems. The Solar Energy Office of CEC chose to list all the linked components (shading, ventilation, etc.) which should be present for acceptable performance of a direct thermal heating system and for each climatic zone of the state. Without these components, the system is not eligible for the tax credit. By contrast, the New Mexico criteria simply describe each system and indicate which components are eligible for tax credit. The homeowner or architect is assumed to be knowledgeable enough to provide the other system parts necessary for optimal performance.

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*The controversy over whether pool covers provide positive solar gain is still unresolved and revolves in part around the difference in performance between clear and opaque covers. The California Energy Commission is currently considering the funding of a study to examine and compare the performance of different pool covers. For a good discussion of pool covers, rule-setting, and tax credits, see Michael DeAngelis, "The Challenge of Establishing Eligibility Guidelines for the California Solar Energy Tax Credit," Proceedings of the 1978 Annual Meeting of the American Section of the International Solar Energy Society, Inc., Vol. 2.2, 1978.

Table 2-2

Summary of Decision-Points for Core Passive Issues

In State Solar Financial Incentive Programs

	Direct Grants	Tax Rebate	Tax Credit				Loans	
Passive Issues Area	Maine	New Mex.	Cal.	Ariz.	Ore.	Mass.	Cal.	Oreg. V.A.
South-Facing Glass	No Legisl	Yes Implem	Yes Implem	Yes Implem	Yes Implem	Yes Implem	Yes Implem	Yes Implem
Trombe Walls	No Legisl	Yes Implem	Yes Implem	Yes Implem	Yes Implem	Yes Implem	Yes Implem	Yes Implem
Greenhouses	No Legisl	Yes Implem	Yes Implem	Yes Implem	Yes Implem	Yes Implem	Yes Implem	Yes Implem
Pool Covers	No Legisl	Yes Implem	Yes Implem	Yes Implem	No (except w/solar pool heaters)	No Legisl	No Legisl	Yes Implem

Code: Legisl = determined by legislation
Arbitr = determined by outside arbiter
Implem = determined by rule-setting agency

Comprehensive rule-setting will provide some consumer protection, particularly in the area of passive heating systems, by denying eligibility to incomplete systems or to systems which are inappropriate for a particular climatic area. This leverage is possible primarily because of the large size of the California tax credit. Otherwise, builders and designers might just proceed with their construction of incomplete or badly sized, but cheaper, systems and forego the tax credit.

Procedures developed by a state rule-setting agency which require action by a separate administering agency should be coordinated at the earliest possible stage in the rule-setting process. This will prevent the need for later revisions and reworkings. However, there are instances where no compromise is possible. For example, the CEC staff provided in the interim solar tax credit guidelines for the inclusion of a data form to be submitted to the Franchise Tax Board. This provision had considerable merit, since it would provide invaluable information to policy analysts on the types of systems being installed and the type of individuals taking advantage of the credit. However, the Tax Board staff was opposed from the very beginning to handling this form for a number of legal and procedural reasons. No arrangement amicable to both organizations could be worked out before the regulations were promulgated and the idea was shelved for later consideration.

Rule-setting in areas not specifically addressed in the legislation may be more difficult in large states with more comprehensive state governments and active local solar energy industry groups. Such rules and regulations are likely to be challenged in public hearings or even in litigation if they go beyond the legislative mandate or any implied intent. In California, a dispute arose because of the Energy Commission plans to require warranties and certain conservation devices. These were strongly challenged by the California Solar Energy Industries Association as being unsupported by the law and unnecessary.

The process of implementation is also one of consensus-building and compromise. Technical rigor and technical interpretation of legislative intent are sometimes discarded in the face of organized opposition. Such is the case in California for the treatment of pool covers. These devices were included within the eligibility criteria for the solar tax credit over strong objections within the Solar Energy Office. Certain staff members felt that pool covers were not proper solar devices and that their inclusion would act as a subsidy to the rich. This point of view was over-ruled, in part because pool covers are effective energy conservation devices and in part because the pool cover industry would have been a formidable political obstacle if pool covers had been excluded from eligibility.

2.4.6.2 New Mexico

The institutional location of the rule-setting individuals may be less important than their personal expertise and predilections. The fact that the creation of eligibility criteria was delegated to the Department of Taxation and Revenue did not result in a set of rules restricted to manufactured active systems or proven technologies. Instead, the rules established by the

department not only specify all varieties of passive systems, storage mechanisms, and heat transfer mechanisms but also include experimental systems (eutectic salts) and theoretical systems which have just reached the experimental level (metal hydride systems).

Clear and precise eligibility criteria can be administered readily by individuals untrained in solar engineering and design. The New Mexico tax auditor currently charged with determining eligibility of systems and system subcomponents is having no problem assessing even the complex passive systems which comprise a significant portion of that state's solar tax credit applications.

A rebate is no more difficult to administer than a credit or deduction, and may well require less administrative personnel. This is because taxpayers can apply over the entire course of the year, thereby spreading the administrative load relatively evenly. Tax credit applications, by contrast, occur between January 1 and April 15, with the actual processing load occurring between March 15 and July 1.

The initial results from the New Mexico Department of Taxation and Revenue indicate that the tax rebate is reaching the intended social and economic groups within the state. The rebates approved thus far in 1978 (for the tax year 1977) have reached a middle class constituency; there has been some participation by low-income groups as well. In New Mexico, solar energy is not just a plaything of the rich. This can be seen in Table 2-3 below which breaks down the rebate recipients by their adjusted gross income and marital status. Virtually all the single solar rebate applicants had incomes under $20,000, and 75% of the married applicants had total incomes of under $30,000. The New Mexico Department of Taxation and Revenue is currently compiling this information for the 1976 and 1975 returns as well, so that a time series description of the recipients will be available.

2.4.6.3 Arizona

The choice not to engage in rule-setting or in the development of eligibility criteria is a real option for implementing agencies. A lack of rule-setting can result from a number of factors, ranging from a lack of available manpower to write the regulations to a philosophical commitment to the promotion of innovation. The Arizona experience shows that one option for the rule-setting agency is generally to define solar systems and then leave the interpretation of the broad legislative mandate to the individual taxpayer. Those who feel they have built or purchased a system which qualifies simply indicate the cost of the system (including personal labor) in taking advantage of the tax credit.

State governmental administrative agencies can also elect not to adopt procedures for screening solar financial incentive applications. In Arizona, no forms have to be filled out nor does supporting documentation have to be submitted to take advantage of the tax credit. This lack of paperwork probably will result in an increased number of applicants taking advantage of the credit. The state does plan to require receipts and documentation if an

Table 2-3

1977 New Mexico Solar Tax Rebates (Through September 1978)

Filing Status	Low Income*	Adjusted Gross Income: Under 10,000	10,000-20,000	20,000-30,000	30,000-40,000	Over 40,000	Retired
Married	3	17	46	37	15	14	1
Single	0	7	10	1			
Unmarried Head of Household	0	1		1			
Total	3	25	56	39	15	14	1
% of Total Approved Claims	2.0%	16.3%	36.6%	25.5%	9.8%	9.1%	0.7%

Source: This information was kindly compiled by Fabiola Gonzales and Michael Seabrook of the New Mexico Department of Revenue and Taxation.

*Low income means less than $8,000 income from all sources.

application is selected for audit. The lack of extensive review procedure by the tax authorities also will lower the amount of administrative effort required by the solar credits during the peak period of state income tax processing. The maximum amount of innovation and experimentation will be encouraged, since the choice of solar technologies or configurations will not be restricted in any way.

The lack of eligibility criteria, prior certification, and administrative screening does create problems. A heavy burden is placed on the tax auditors who have no guidelines from which to work, no practical limitations on their authority, and limited experience in judging the technical feasibility or cost of solar systems. The lack of eligibility criteria also raises the questions of protection of the consumer and of protection of the state treasury from subsidy payments to useless, fraudulent, or marginal solar systems. All of these issues have been clearly identified by the Arizona state officials, and work is underway to develop eligibility guidelines and procedures by the end of 1978.

The Arizona state income tax credit will be added to any federal credits, rather than be reduced by the size of the federal credit as is the case of California. There are several advantages to initially designing a state financial incentive to complement future federal incentives. This approach will multiply the impact of each incentive on the prospective solar consumer, while sharing the total cost of the subsidy between levels of government. Structuring the credit as an additional incentive also demonstrates a concrete commitment to the solar industry and to the potential solar consumer. The state government's support for solar commercialization is shown to be long-term and not just a stop-gap measure until the arrival of federal tax credits. In contrast, in New Mexico no income tax credit can be received from the state if credit is also received from the federal government.

2.4.6.4 Oregon

Prior certification, the approval by a state official that a proposed system meets eligibility criteria for a financial incentive, works. Case-by-case approval of solar applicants for the solar tax credit thus far has not caused any difficulties for the administering agency (the Oregon Department of Energy). Prior certification has several distinct advantages when used in the proper context. It removes the necessity for writing standards and codes. In their place, a simple performance criterion (10% of household energy needs) is used. Experimental or novel systems can qualify, thus encouraging innovation and local adaptation of existing technologies. Prior certification also reduces consumer uncertainty. The consumer knows before the system is built or installed that his or her system will qualify for a tax credit. Consumer uncertainty over whether or not the system has a reasonably good chance of performing as promised is also reduced. Experienced solar engineers within the Oregon DOE quickly can identify systems which are fraudulent or questionable. If the system is overpriced for its performance, the Oregon DOE examiner can suggest (and this has been done) that the consumer consider seeking bids from other sources. The examiner can make suggestions which will increase the system performance, thereby increasing the quality of the

installations being subsidized by the tax credit. Finally, prior certification also greatly eases the administrative burden on the Department of Revenue (DOR). The applicants have already been screened, so the DOR simply has to verify that the installation was done as proposed. This does not require any solar engineering expertise on the part of the tax auditor, nor does it require extensive review for each application. On the other hand, the current prior certification process might become unmanageable if the number of applications increased dramatically. If 5,000 solar tax credit applications were received each year, a whole staff of engineers working full-time would be required just to screen them. Prior certification currently works in Oregon, but this does not insure that a similar system would work in California where the population is large and the number of solar system types quite diverse.

Independent state agencies such as the Oregon Department of Veterans Affairs can serve as powerful stimuli for accelerated solar commercialization. Institutional autonomy and administrative flexibility make the DVA an ideal choice to implement an incentive for a rapidly changing technology. Also, the DVA has an existing decentralized infrastructure for delivering information about the incentive to potential consumers. Although subsidized loans such as the DVA offers do not remove the problem of the high capital cost of a solar system, they do eliminate much of the front-end loading of that cost by spreading it over the term of the mortgage (usually 30 years). This program all but eliminates the initial down payment, thus allowing the consumer to pay off the cost of the solar system out of the saving from reduced consumption of conventional fossil fuels.

The bundling of incentive programs and of implementation procedures may be as important as the size of the individual components. In Oregon, the availability of subsidized solar loans from as pivotal a lender as the DVA may be crucial to the success of a 25% tax credit. The willingness of the DVA to provide loan capital for virtually any durable, reasonably efficient solar system enhances the impact of the tax credits.

The existence of a number of different governmental programs in Oregon, each with its own internal review process and eligibility criteria, has not proved to be a barrier to the effectiveness of the programs, either individually or collectively. The question of multiple standards is one of the chief concerns for analysts of the solar industry and has been a driving force behind the development of national standards. We have found in the case of Oregon that administrative flexibility and case-by-case treatment have lessened the need for common criteria. This is a single instance which may not be true for a large state or for the entire country.

2.4.6.5 Massachusetts

Massachusetts is a national leader in the field of energy conservation, energy-related education, and the development of consumer protection in the field of renewable resources. These concerns have taken precedent over the development of incentives for the installation of solar technologies. This may be partly the result of the placing of the Energy Policy Office within the Department of Consumer Affairs.

The two solar loan programs within the state, one voluntary within the banking industry and the other mandated by the state legislature, have been only modestly successful. Each has elicited only a small consumer response. However, the variation within the voluntary program has been quite striking. A small percentage of banks accounted for the majority of the loans made by the participating 115 banks. The key factor for consumer response to these slightly subsidized loans seems to be the eagerness of the bank management to seek out that business and to publicize it to potential customers.

Incentive programs can exist on paper, but may be too small or too complex to evoke a consumer response. They may also be considered as peripheral to the mission of the implementing agency, which will mean that they will not undergo rapid rule-setting nor will these incentives be adequately publicized. All these seem to describe the problems confronting the Massachusetts accelerated depreciation program for solar installations by corporations. At the time of this writing, no final guidelines have yet been developed and published by either the Solar Policy Office or the Bureau of Building Construction, two years after the passage of the law. No applications yet have been received or processed, despite a great deal of interest and activity in solar within the state and despite the high costs to industrial firms of fuels for space heating and process steam.

2.4.6.6 Maine

The Maine solar hot water initiative is a prime example of how an existing organization can implement a legislative mandate with a minimum amount of administrative and bureaucratic procedure. For a total of $16,000 expended, the state of Maine stimulated the installation of 40 solar systems throughout the state, distributed so that there is at least one solar installation in each county to insure public visibility.

Since the selection of recipients was by lottery, and since the number of applicants far exceeded the funds available, the eligibility criteria developed by the implementing agency were not constraints on the number of installations. In fact, only two of the approximately 125 applications were rejected, on the grounds that the proposed locations were on substandard housing or badly sited. However, the Office of Energy Resources did determine what types of systems would be considered by deciding in the rule-setting process that only manufactured systems would be considered eligible. This was consistent with the legislative intent of replicating the hot water demonstration projects that the federal Department of Housing and Urban Development had been administering in the other New England states, but it did exclude the participation of the home-builder and backyard tinkerer.

A clearly drawn legislative mandate can restrict the ability of the rule-setting agency to include a broad range of solar technologies within the systems considered eligible for a financial incentive. This is true even when the excluded systems obviously would be logical choices for the climate and for local end-use energy needs. The legislation which created the Maine solar property tax and sales tax credits restricted it to active hot water and space heating. Passive systems and multi-purposed solar units (such as greenhouses)

are ineligible by definition. This is one of the few examples of eligibility criteria encountered in this study of legislative dictation. Given the high capital-intensity of passive systems, the lack of a property tax exemption could act as a significant deterrent to the installation of passive solar systems within the state.

2.5 CONCLUSIONS AND AREAS FOR FURTHER RESEARCH

2.5.1 Conclusions

Clarity of eligibility guidelines is essential to the success of a financial incentive. It eases administrative burdens, speeds processing, and reduces consumer uncertainty. This is true regardless of the nature of the incentive, the size of the state, or the type of administrative agency.

The process of setting the eligibility guidelines for financial incentives is important. In this pilot study, we found many issue areas were not addressed in the enabling laws or in the legislative history. The rule-setting official then became responsible for determining the eligibility of types of different systems and components, or different types of consumers for the financial incentive. The decisions that the rule-setting official made were particularly important for the more intractible eligibility issues: the inclusion of passive technologies, the inclusion of labor costs, the eligibility of speculatively built housing, and the requirement of mandatory conservation. In virtually every case where the legislature did not specifically determine the applicability of the incentive to such problem systems or to such problem cost components, at least a partial eligibility was allowed by the rule-setting officials studied in this report.

The location of the rule-setting process (state energy office, taxing authority, or independent agency) is not as crucial to the final shape of eligibility criteria as expected. At the state level, taxing authorities are not necessarily overly protective of the treasury, and state energy office staff members have not necessarily produced guidelines which are more complex or overly concerned with system efficiency. Other outside variables such as the size of the state and the background of the individuals drafting the guidelines may be as important as the institutional setting in determining the type of rules developed to implement the legislation.

The ability of a financial incentive to stimulate the installation of solar systems and to reach target populations is partially dependent on the implementation and administration mechanisms selected. Some of the more innovative implementation mechanisms noted in this study may work best in small states where there are small populations, a limited number of applicants for the incentive, and an informal process of coordination among executive departments and between the executive and legislative branches of government. The best examples of this principle are the direct grants used in the Maine solar hot water heater initiative and the prior certification required for the Oregon solar income tax credit. Both programs were developed using a minimum amount of overhead expenditures and administrative procedures. In each case, one

official was charged with designing and implementing the entire program while continuing to perform other duties. In a state receiving as many solar tax credit applications as California, prior certification or direct grant lotteries could become difficult and costly to administer. The prior approval process could also become a major time bottleneck in the approval process. Conversely, there may be little need in smaller states for the encyclopedic eligibility guidelines developed by the California Energy Commission. Informal administrative discretion can substitute for complex and comprehensive guidelines so long as the discretion is based on a clear delegation of authority and on well-formulated general guidelines.

The method of implementing an incentive often has unforeseen secondary impacts which may be important to consumer decisions to take advantage of the incentive. These impacts should be considered when designing the implementation for an incentive program. Prior certification was specified by the Oregon Legislature to insure that the systems receiving income tax credits produce a certain minimal amount of the homeowner's energy needs. In practice, prior certification greatly simplifies the administrative burden on the Department of Revenue. It also directly and effectively attacks two barriers to the adoption of solar technologies: uncertainty about the quality of a particular commercial system and uncertainty over whether that system will qualify for existing market price reduction incentives.

Conventional legislative wisdom holds that state implementing agencies resist or are incapable of administering programs which vary significantly from existing practice. As a result, income tax credits and deductions have been selected as implementation mechanisms for solar financial incentives over more equitable but more unfamiliar techniques such as rebates and direct grants. The experience of the case-study states indicates that the common belief in administrative resistance does not reflect actual implementation experience in solar financial incentives. So long as the eligibility guidelines are clear and precise, the actual payment mechanisms are a minor consideration for the administering agency. The Maine Department of Revenue has indicated no difficulty with processing the hot water initiative grant checks, so long as the Department of Energy Resources certifies the systems as eligible. Similarly, the solar rebate program has created no major administrative problems for the taxing authorities in New Mexico. The rebate mechanism has in fact eased the administrative load since the processing is distributed throughout the year and not just during the peak income tax processing period.

2.5.2 Areas for Future Research

In the course of this preliminary look at state solar incentive programs, we uncovered a number of policy questions for which policymakers actively are seeking answers. Some of these questions concern how to evaluate the effectiveness of existing programs or to choose between different incentive approaches. Others are related to the effort to elicit more consumer participation without changing the size of the incentive; i.e., administrative effectiveness questions. Below is a partial listing of questions which should be addressed in the near future to aid decisionmakers at the state and federal

level in making intelligent policy choices among different mixes of incentive types and among alternative implementation mechanisms.

2.5.2.1 Evaluation Questions

- Who is taking advantage of the state financial incentive programs? What are their socioeconomic characteristics? How are they divided on a geographical (urban vs. rural) basis? Preliminary data is now available from New Mexico, and California is beginning to tabulate its funding. This data should be gathered for the other key states as well.

- What is the incentive cost for each solar installation stimulated? What are the comparative administrative costs per solar unit installed for different incentive types?

- What impacts do different incentive programs have on the choice among different solar technologies?

2.5.2.2 Administrative Effectiveness

- What impact on consumer choice does the timing of the incentive delivery have? What is the consumer's indifference curve between a front-end loaded loan or grant versus a tax credit in the following year?

- How important is consumer uncertainty about solar technology and about the reliability of incentive payments? What difference in consumer participation would the existence of prior certification make?

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New Mexico Department of Taxation and Revenue, "Solar Heating Tax Credit Regulations," Santa Fe, New Mexico, August 1977.

Sorenson, Jay B., and Greenfield, Rand. "New Mexico Nationalism and the Evolution of Energy Policy in New Mexico," Natural Resources Journal, Vol. 17, No. 2 (April 1977), pp. 283-300.

Oregon

Baker, M. Steven and Reynolds, John S. "Oregon's Solar Incentive Programs: Passive Systems." University of Oregon Solar Energy Center, Eugene, Oregon, undated.

Kiphut, Alan D. "Oregon's Solar Tax Credit Program--The First 100 Installations," Portland: ODOE, undated paper.

Oregon Department of Energy, "Something New! 1977 Weatherization Incentives for Oregon Homeowners, Portland, Oregon, 1977.

_____, "Tax Credit Eligibility for Residential Alternative Energy Devices--Solar and Geothermal."

APPENDIX 2-A

SUMMARY OF STATE INCENTIVES

(as of November 1978) 37 States

INCOME TAX: CREDIT			13 STATES
55%	California (76)		
35%	Arizona (77) declines @ 5%/yr		
25%	Kansas (76)		
	New Mexico (75)		
	North Carolina (77)		
	Oregon (77)		
	Oklahoma (77)		
	Vermont (78)		
10%	Alaska (77)		
	Hawaii (76)		
Schedule	Wisconsin (77)		
	North Dakota (77)	10%/$1000; 5%/$3000	5%/2 yrs
	Montana (77)	10%/$1000; 5%/$3000	

INCOME TAX: DEDUCTION FROM TAXABLE INCOME	6 STATES
100%/1 yr	Colorado (77)
	Arkansas (77) Residential
	Massachusetts (76) Business
100%/4 yrs	Idaho (76) Residential
100%/5 yrs	Kansas (77) Business
	Texas (75) Business

INCOME TAX: DEDUCTION FOR CAPITAL INVESTMENT	1 STATE
	Montana (77)

PROPERTY TAX: EXEMPTION FROM INCREASE	15 STATES
Arizona (74)	
Connecticut (76) (allows city/county choice)	
Georgia (76) (allows city/county choice)	
Hawaii (76)	
Iowa (78)	
Maine (77) (5 yrs from installation)	
Massachusetts (75) (20 yrs from installation)	
Michigan (76)	
Minnesota (78)	
New Hampshire (75) (allows city choice)	
North Dakota (75) (5 yrs from installation)	
Tennessee (78)	
Vermont (76) (allows city choice)	
Virginia (77) (allows city/county choice)	
Washington (77) (7 yrs from installation)	

PROPERTY TAX: EXEMPTION EQUAL TO ASSESSED VALUE OF SOLAR SYSTEM — 7 STATES

Indiana (74) Annual
Nevada (77)
New Jersey (77) Annual (till 87)
New York (77) (15 yrs)
Maryland (76) (allows city/county choice)
Oregon (75) (till 97)
South Dakota (78)

PROPERTY TAX: SOLAR HOUSE ASSESSED AS IF IT HAD A CONVENTIONAL SYSTEM — 4 STATES

Illinois (75)
Maryland (75)
North Carolina (77)
Rhode Island (77)

PROPERTY TAX: ASSESSES SOLAR SYSTEM AT 5% OF VALUE — 1 STATE

Colorado (75)

PROPERTY TAX: REIMBURSEMENT — 1 STATE

Kansas (77) (35% of total tax/5 yrs)

SALES TAX: EXEMPTION — 6 STATES

*Connecticut (77)
*Georgia (76)
Massachusetts (77)
*New Jersey (77)
Texas (78)
*Maine (77)

USE TAX: EXEMPTION — 6 STATES

Arizona (77)
*Connecticut (77)
*Georgia (76)
Michigan (76)
*New Jersey (77)
*Maine (77)
(* indicates both Sales & Use)

LOANS: AUTHORIZES SPECIAL PREROGATIVE — 6 STATES

California (78) $2000 Emergency; no interest
Massachusetts (77) increased time and amounts
Minnesota (78) Low/moderate income housing
Montana (75) 7% interest loan (public utility)
Oregon (77) increase amount on V.A. loan
Tennessee (78) low/moderate income housing

GRANTS — 2 STATES

Maine (78) 40 @ $400 hot water
Tennessee (78) 40 at $400 hot water

ACCELERATED AMORTIZATION — 3 STATES

Arizona (75) 36 months
Kansas (77) 60 months--Business
Texas (75) 60 months--Business

OTHER — 3 STATES

Michigan (76) Solar system components not to be included in Business Activities Tax
New Mexico (77) Income tax credit for solar irrigation pumps
Texas (75) Exempts corporations involved in solar from Franchise Tax

APPENDIX 2-B

FINANCIAL INCENTIVES IN CASE STUDY STATES

ARIZONA--

CH 93-75 amended CH-129- 1976
Rule-setting agency: Arizona Solar Energy Commission (ASEC)
Administering agency: Arizona Dept. of Revenue
Nature: 36 month amortization of solar devices covers all acquisition and installation costs

CH 81 1977
Rule-setting agency: ASEC
Administering agency: Arizona Dept. of Revenue
Nature: 35% tax credit in the taxable year 1978
--Decreasing tax credits by 5% per year
--Five-year maximum carry over
--$1,000 maximum credit (in lieu of other deductions)
Expiration: 1984

PL 165 1974
Rule-setting agency: ASEC
Administering agency: Local appraisers
Nature: Exemption from property taxation
--Exempts all solar energy devices from property taxation

CH 42 1977
Rule-setting agency: ASEC
Administering agency: Arizona Dept. of Revenue
Nature: Exemption from the transition and use taxes

CALIFORNIA--

CH 168 1976 amended CH 1082 1977, and AB 3623 1978
Rule-setting agency: Energy Resources Conservation and Development Commission
Administering agency: California Franchise Tax Board
Nature: 55% income tax credit
--If federal credit is created, then the total combined will be 55%
--$3,000 maximum credit--if the system is over $6,000 then the greater of $3,000 or 25% of the actual cost of the system
--Can be carried forward against "net tax"
Expiration: 1981

SB 373
Rule-setting agency: Energy Resources Conservation Development Commission
Administering agency: Housing and Community Development
Nature: Non-interest bearing disaster loans
--Deferred payment date, beginning 12 months after loan origination
--Repayment in 18 months following deferrment
--Maximum 3% front end service charge
--Covers only rebuilding on present site
--$180,000 revolving fund
--Must be located in a county declared a disaster area on or after July 1, 1977

AB 2851 1978
Rule-setting agency: Department of Veterans Affairs
Administering agency: Department of Veterans Affairs
Nature: Increases the allowable loans for veterans
--Allows DVA to expend up to $5,000 above ceiling for homes with solar energy heating systems
--Requires DVA to exclude cost of solar system in determining market value of home

MAINE--

CH 542 1977
Rule-setting agency: Office of Energy Resources
Administering agency: Local tax assessor
Nature: Five year property tax exemption and sales tax refund
--Requires certification
--Refund of all use and sales taxes
Expiration: December 1982

LD 2102 1977
Rule-setting agency: Office of Energy Resources
Administering agency: Office of Energy Resources
Nature: Grants for hot water demonstration program
--Units must be commercially available or meet the HUD intermediate minimum production standards
--Units must be installed by a certified installer or submit to inspection
--No home-built units

MASSACHUSETTS--

CH 486 1976
Rule-setting agency:
Administering agency: Commissioner of Corporations and Taxation
Nature: 100% corporate tax deduction
--Corporations only
--Subject to tangible property tax

CH 734 1975
Rule-setting agency: Solar Action Office
Administering agency: Local assessors
Nature: Ten year exemption from property taxes

CH 989 1977
Rule-setting agency:
Administering agency: Mass. Dept. of Revenue
Nature: Sales tax exemption
--Good for any equipment
--Only on principal residence

CH 28 1977
Rule-setting agency:
Administering agency: Local banks and credit unions
Nature: Extension of loan features
--Maturation date is allowed to extend an extra 10 years
--$7,000 increase in the loan amount for banks
--$9,500 increase in the loan amount for credit unions

NEW MEXICO--

CH 12 s.s. 1975 amended CH 170 1978
Rule-setting agency: New Mexico Solar Energy Commission (NMSEC)
Administering agency: New Mexico Department of Revenue
Nature: 25% tax credit
--$1,000 maximum/25% of total cost or $1,000 refund if over the "net tax" amount
--May claim only one year and only one principal residence
--Swimming pools included

CH 114 1977
Rule-setting agency: NMSEC
Administering agency: Energy Resources Board
Nature: $25,000 maximum
--Must provide a 75% reduction in the use of fossil fuels
--No refund (credit) if claimed for federal refund of balance over taxable gross

OREGON--

CH 460 1975
Rule-setting agency: Oregon Department of Energy (ODOE)
Administering agency: Oregon Department of Revenue
Nature: 25% tax credit
--$1,000 maximum credit
--Requirement for the system capacity to produce 10% of energy needs
--Five-year carry over
--Certificate required
Expiration: 1985

HB 2262 1975 amended SB 339 1977
Rule-setting agency: ODOE
Administering agency: Local assessors
Nature: Property tax calculated by subtracting the value with the solar system by the value without the system
Expiration: December 1997

CH 315 1977
Rule-setting agency: ODOE
Administering agency: Oregon Department of Veterans Affairs
Nature: Increases the allowable loans for veterans
--$3,000 increase in the allowable loan amount
--Solar system must produce 10% of the energy needs of the structure

APPENDIX 2-C

INDIVIDUALS INTERVIEWED

California

A. California Energy Commission

Michael DeAngelis, Solar Office (July 11, 1978).
Alec Jenkins, Solar Office (July 10, 1978).
Diana Waldie Rains, Solar Office (July 10, 1978).
Gregg Wheatland, Legal Counsel (July 10, 1978).

B. California Franchise Tax Board

Steven Bronson, Legal Counsel (July 11, 1978).
Allan N. Desin, Research and Statistics (July 11, 1978).
Peter Pierson, Legal Counsel (July 11, 1978).
Robert H. Smith, Technical Analysis (July 11, 1978).

C. Business and Transportation Agency

Jerry Yudelson, Solar Cal Office (July 12, 1978).

D. Department of Housing and Community Development

Joanne Terry, Division of Research and Policy Development (July 12, 1978).

E. California State Assembly

David Modissett, Administrative Assistant to Assemblyman Gary Hart (June 30, 1978).

Oregon

A. Oregon Department of Energy

Alan D. Kiphut, Conservation and Alternative Resources Branch (July 20, 1978).

B. Oregon Department of Revenue

Karen Brown, Audit Division (July 20, 1978).
C.J. Hill, Assessor's Office (July 20, 1978).
Robert Ray, Audit Division (July 20, 1978).

C. Oregon State Legislature

Charles Kensey, Staff Member, Energy, Conservation, and Planning Committee (July 20, 1978).

D. Oregon Department of Veterans' Affairs

Norm Clark, Assistant Construction Analyst (July 12, 1978).
Dennis Nelson, Information Officer (July 20, 1978).

New Mexico

A. Sandia Laboratories

Robert P. Stromberg, Supervisor, Solar Technical Liaison Division (August 17, 1978).

B. Department of Taxation and Revenue

Fabiola Gonzales, Tax Auditor, Revenue Division (August 18, 1978).
Michael R. Seabrook, Tax Auditor, Revenue Division (August 18, 1978).

C. New Mexico Solar Energy Association

Keith Haggard, former Executive Director (August 15, 1978).

D. Department of Energy and Minerals

Michael Minturn, Energy Extension Service (August 17, 1978).
M.L. Morton, Solar Energy Specialist (August 18, 1978).

E. New Mexico Energy Institute

Richard Cole, Program Manager (August 17, 1978).
James O. Dritt, Senior Program Director (August 17, 1978).

Arizona

A. Solar Energy Research Commission

Susan Court (September 8, 1978).
Richard Foreman (September 8, 1978).
Donald Osborne (September 8, 1978).
Greg Stutzman (September 8, 1978).

B. Department of Energy

Jerry Cunningham (September 8, 1978).

C. Lina K. Robinson, Consultant (September 8, 1978).

Maine

A. Office of Energy Resources

Vincent A. DiCara, Education and Consumer Affairs Specialist (July 20, 1978).
John M. Joseph, Director (July 20, 1978).

B. Joint Standing Committee on Energy

John Bailey, Legislative Staff (July 21, 1978)
Ted Potter, Legislative Staff (July 21, 1978).

C. Southern Maine Vocational Technical Institute

Carl R. Flink, Energy Testing Laboratory of Maine (July 20, 1978).

Massachusetts

A. Solar Action Office

Jefferey M. Brauer, Staff Assistant (July 25, 1978).
William C. Osborn, Director (July 25, 1978).
Henry Shir, Staff Assistant (July 25, 1978)

B. Massachusetts Energy Office

Sandy Bodmer-Turner (July 26, 1978).
Ann-Brian Murphy (July 26, 1978).

C. State Senate

Leo Allen, Administrative Assistant to Senator Leo Bulger (July 26, 1978).

D. New England Solar Energy Center

Arnold Wallenstein, Staff Lawyer (July 26, 1978).

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Section 3.0 | State Research, Development and Demonstration

SECTION 3.0

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SECTION 3.0 SUMMARY

Many states have initiated energy research, development, and demonstration (RD&D) programs, particularly solar energy RD&D programs, in response to a perceived neglect of certain energy resources, technologies, and applications by the federal government. States tend to develop low-cost, low-risk, near-term, and high-visibility solar energy RD&D projects because of limited resources and a desire not to duplicate federal program direction and emphasis. Differences between state and federal programs are often complementary. Technologies emphasized in the state programs include passive solar heating, low-cost active solar space and hot water heating, wind energy conversion, biomass energy conversion, and micro-hydro power generation.

In many instances, drawing a clear line between state solar energy RD&D activities and solar energy commercialization activities is difficult. A duplication of effort or possible conflict may result if states refuse to relinquish or compromise these commercialization-type program activities and the regional solar energy centers (RSEC's) continue in their planning to emphasize such commercialization activities.

Communication between the state solar energy RD&D program administrators and staff and their federal counterparts is poor. Thus, opportunities which could result from cooperative efforts between state and federal levels are being missed.

The limited evidence from legislative review sessions and rule-making hearings indicates that public attitudes toward the state RD&D programs examined have been generally very favorable. Legislative disposition toward these programs has also been quite favorable.

Additional solar energy RD&D program design and implementation recommendations can be made on the basis of this research project. (For supplemental information regarding these recommendations, please refer to Subsection 3.6.)

3.2 REVIEW OF AVAILABLE RESEARCH, DEVELOPMENT, AND DEMONSTRATION INCENTIVES AT THE STATE LEVEL

There are a large number of institutional arrangements and fiscal mechanisms available to a state for the creation and implementation of an internally-funded solar energy RD&D program. The choice of mechanisms and instruments is partly governed by the program emphasis preferred by the particular state. The term "Solar Energy RD&D" has been used to describe a large spectrum of activities at the state level, ranging from research on materials and experimental technologies to near-term commercialization assistance. Included in solar energy state RD&D activities have been the following:

- research on materials and experimental technologies;
- modification of existing technologies for local conditions and for local energy use patterns;
- inventories of existing renewable energy resources and of the potential applications of solar energy systems;
- cooperation with private industry for the testing of solar energy systems;
- demonstrations and monitoring of solar energy systems; and
- dissemination of results of research, product development, and demonstration monitoring.

To support one or more of these activities, each state has a number of fiscal options. The choice of funding mechanisms will have important implications for program design and continuity, stability of funding, program autonomy, and administrative flexibility. (This will be discussed for the four state study states in Subsection 3.6.) Some of the common funding mechanisms for state solar energy RD&D programs include:

- annual legislative appropriations from general revenues;
- "ear-marking" of funds from existing special revenues (primarily state mineral severance taxes);
- levying of a surcharge on energy sold by regulated utilities;
- sale of state bonds;
- solicitation of outside funds (generally from federal government sources or from private foundations); and
- cost-sharing with private industry.

In general, there are several distinct approaches that a state can take to promote solar energy RD&D. These include:

- institutional support for the creation of new research institutes at state universities and the awarding of grants to existing private organizations;
- funding of specific projects through existing state agencies including annual competition for available funds and solicited, noncompetitive proposals; and
- cost-sharing with private industry, i.e., resource assessment and governmental participation in ongoing private demonstration facilities.

Priority given to possible state solar energy RD&D activities and availability of local institutional resources will largely determine what institutional arrangements and mechanisms a state will select for the performance of solar energy RD&D.

There are also a number of project-specific choices which must be made, either by the legislature or by the implementing agencies. These include:

- size of funded projects;
- duration of projects;
- type of project emphasis (near-term, basic research, etc.);
- applicant eligibility criteria; and
- use of outside advisory groups.

These issues will be addressed further in Subsection 3.5 below.

3.3 STATE RESEARCH, DEVELOPMENT, AND DEMONSTRATION INITIATIVES, 1974-1978

Since 1974, a large number of states have enacted legislation creating energy RD&D programs, including solar energy RD&D. The variety of programs and their implementation and administrative experience is the focus of this research project. Table 3-1 contains a listing of all state energy RD&D programs, including solar energy RD&D programs.

As Table 3-1 illustrates, over the last four years states have shown an increasing interest in establishing their own energy RD&D programs. In 1974, four state programs were initiated; in 1975, seven; in 1976, none; and in 1977, six state programs were initiated for a total of 17 programs. Many other states have considered establishing their own energy RD&D programs and more states will probably establish programs in the near future.

Table 3-1

	Legislation/ Statute	Date	Funding*	Administering Agency
Arizona	Chap. 58 HB 2062	1977	Gen. Rev.	Arizona Solar Energy Research Commission
California	AB 1575 Chap. 276	1974	EUS	California Energy Resources, Conservation, and Development Commission
Colorado	SB 50	1974	Gen. Rev.	Colorado Energy Research Institute
Florida	SB 721	1974	Gen. Rev.	Florida Solar Energy Center
Hawaii	SB 1585	1974	Gen. Rev. & Bonds	Hawaii Department of Planning and Economic Development
Illinois	PA 80-432	1977	Bonds	Illinois Institute of Natural Resources
Iowa	SB 289	1975	Fed.	Iowa Energy Policy Council
Maine	PL 1558	1975	Gen. Rev.	Maine Office of Energy Resources
Montana	SB 86	1975	MST	Montana Department of Natural Resources and Conservation
New Mexico	PL 288	1975	MST	New Mexico Energy and Minerals Department
New York	A 8620	1975	EUS	New York State Energy Research and Development Authority
North Carolina	RL 911	1975	Gen. Rev.	North Carolina Department of Commerce
Ohio	HB 584	1975	Gen. Rev.	Ohio Energy & Resource Development Agency
Oklahoma	HJR 1013	1977	Gen. Rev.	Oklahoma Department of Energy
Oregon	SB 572	1977	Bonds	Oregon Department of Energy
Texas	HB 1799	1977	Gen. Rev.	Texas Energy Advisory Council
Minnesota	Chap. 455	1977	Gen. Rev.	Minnesota Energy Agency

*Funding Types:
Bonds
General Revenues (Gen. Rev.)
Energy Use Surcharge (EUS)
Mineral Severance Tax (MST)
Federal Support Funds (Fed.)

3.4 THE EXPERIENCE OF IMPLEMENTING RD&D PROGRAMS IN SELECTED STATES

3.4.1 Choice of Case Study States

One objective of this research is to provide useful information about program design and implementation issues to states both with and without solar RD&D programs. For this pilot study, a small number of solar energy RD&D programs were selected for intensive study. Criteria for the choice of case study states include: (1) length of time programs have been in existence; (2) relative degree of program activity and/or innovation; (3) type of program design; and (4) geographical distribution among regions where plausible.

Based on the above criteria, the New Mexico, Montana, California, and Florida solar energy RD&D programs were identified for detailed investigation and for on-site interviewing of program administrators and staff. These programs exhibit a variety of institutional settings, funding methods, and legislative directives and are located within states of various levels of indigenous energy resources. It should also be recognized that each state program is characterized by a variety of unique circumstances (e.g., politics, personalities, the presence of federal laboratories and research facilities) which may affect the program design and implementation experience of that state.

3.4.2 New Mexico

In 1974, an energy research and development fund was established as a state-financed program administered by the Board of Educational Finance. This fund is drawn from the Severance Tax Income Fund--an energy-related minerals severance tax. The New Mexico Legislature appropriated $2 million to the fund which by law could only support energy research and development proposals submitted by the six higher education institutions in New Mexico. Of 46 projects funded in this initial year, $225,000 was granted for seven solar projects.

In 1975 a new energy research and development program (Chapter 255, Sections 92-99, Laws of 1977) was created to supersede the above one-year-old program. This newer program, also appropriated $2 million, was administered by the newly created Energy Resources Board (Chapter 289, Laws of 1975). Chapter 288 of the 1975 legislative session also enabled the Energy Resources Board to develop its own proposals as well as to accept proposals from the higher education institutions and nonprofit research and development institutes. An energy research and development review committee was also established (Chapter 288, Laws of 1975) to assist and advise the Energy Resources Board in granting funds for specific projects.

This energy research and development program has continued to date with the following changes. In 1977 the Department of Energy and Minerals (DEM) was created and replaced the Energy Resources Board. In the same year, an additional $500,000 was allocated to New Mexico State University (Chapter 347, Laws of 1977) to establish the New Mexico Solar Energy Institute. The purpose of the institute is to:

- develop solar equipment performance standards for solar energy development;
- test solar energy heating and cooling systems;
- coordinate major research, development, and demonstration efforts within the state;
- collect and disseminate information to citizens and industry concerning solar energy research, development, and demonstration and solar energy applications and technologies; and
- coordinate the development of federal solar energy programs within the state.

Two of the above elements will be discussed in detail in Subsection 3.5.6.

The Energy Resources Board and the subsequent Department of Energy and Minerals were established as executive branch energy agencies. These agencies, respectively, were and are the lead state government agencies in the solar energy area. The Department of Energy and Minerals administers all solar-related, state-funded RD&D. The energy research and development fund, administered by the Department of Energy and Minerals, has used $6 million in state funds as "seed money" to attract over $10 million in federal and private research funds during the past three years.[1] Forty-one solar energy RD&D projects have been funded through the state program from 1975-1977 (see Appendix 3-A).

3.4.3 Montana

The Montana Renewable Alternative Energy Research, Development, and Demonstration Grant Program was first authorized in 1975 to "stimulate research, development, and demonstration of energy sources harmonious with . . . long-range ecological stability."[2] The program is administered by the Department of Natural Resources and Conservation and is supported annually through 1979 by 2.5% of the revenue received from the state's coal severance tax.

The program awards grants to any person, educational institution, or other organization with the provision that projects funded are not utilized to "commercially market electricity, heat, energy, or energy by-products."[3] Preference may be given to projects which are partially supported by federal funds, research centers unattached to existing educational institutions where several investigators can share services, and research centers which make

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[1]Department of Energy and Minerals, A Status Report on the New Mexico Energy Research and Development Program, June 1, 1978.

[2]Montana Statues, Section 84-7407, R.C.M. 1947.

[3]Ibid.

information available to individuals, small businesses, and small communities. A somewhat unique feature of the statute is that a one-time appropriation of $15,000 was committed for the purpose of publicizing information about enacted tax incentives for alternate energy applications and the Renewable Alternate Energy Research, Development, and Demonstration Program during fiscal year 1975-1976.

Total program expenditures, including personnel, accounted for approximately $562,000 in 1976 and $957,000 in 1977. Over the last three years since program inception, 110 projects have been funded at sums ranging from $600 to $100,000 (see Appendix 3-B for additional information). Up to 90% of the total grant may be advanced to the recipient. The idea underlying this approach is that projects should not be held up due to initial or "up-front" monetary needs.

Procedures and policies for the administration of the Renewable Alternate Energy Grants Program have been defined in rules adopted by the Department of Natural Resources and Conservation. During the rule-making process, the public was very supportive of the program and draft rules. Only one change was induced by this public hearing--two grant submittal periods occur in each year instead of one. The following procedures have been established for evaluating and processing applications.[4]

- The program staff reviews each application for content and compliance with the rules and regulations. If an application conforms to the rules and regulations, it is accepted. If it does not, more information is requested or it is returned to the applicant with an explanation. The applicant then has the option of correcting the deficiency and resubmitting the application within the program's established deadline.

- An ad hoc committee may review the applications for technical feasibility. The committee consists of at least two persons qualified to evaluate applications in each of the six renewable energy categories: solar, wind, wood, water, geothermal, and biomass. In general, there are two independent technical reviews. In addition, the program staff reviews all applications.

- The Alternative Energy Advisory Council (AEAC), a five-member council appointed by the Governor, then reviews and evaluates the applications considering factors other than technical feasibility. AEAC is primarily concerned with the potential for practical application and development in Montana. After conducting their evaluations independently, members meet to discuss the applications and make recommendations for funding to the Department.

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[4]Montana Department of Natural Resources Conservation, Energy Planning Division, Renewable Alternative Energy Research, Development, and Demonstration Program: Report to the Legislature, February 1977.

- The Department Director makes the final decision on which projects are funded. This decision is based on results of the evaluations and recommendations of the AEAC.

3.4.4 California

Assembly Bill #1575 (Chapter 276, 1974) created the California Energy Resources Conservation and Development Commission. The Commission is directed to perform such functions as demand forecasting, utility rate review and analysis, and energy facility siting. In addition, the Commission is authorized to develop and coordinate a research and development program for energy conservation and improvement of energy supplies. This statute explicitly states that assessment and accelerated development of solar energy resources is to be a part of the Commission's activities.

The California Energy Commission and its activities are supported by revenues from a one-tenth of a mill ($.0001) per kilowatt-hour surcharge on all electricity sold to consumers within the state. This surcharge will increase annually by one-hundredth of a mill increments over a ten-year period, thus resulting in a two-tenths of a mill charge in the tenth year of Commission operation. These revenues are in turn deposited in the State Energy Resources Conservation and Development Special Account which is established in the General Fund. These funds must then be annually appropriated by the legislature in the Budget Act.

During its initial years of operation, the California Energy Commission recognized the need to define more clearly and concisely what areas of RD&D should be carried out. To this end, commission staff drafted clarifying legislation which eventually became law (Chapter 1081, 1977).

The California Energy Commission has assessed possible RD&D areas to determine which should be pursued by the state and which should be done by other sectors. As a result of this assessment, the Commission's RD&D program focuses on:

- providing supply alternatives to nuclear and fossil fuel (primarily solar, geothermal, and biomass);
- developing and analyzing conservation techniques;
- reviewing nuclear and fossil fuel options to ensure environmental and public protection (e.g., power plant siting); and
- assessing future supply and demand for energy in California.[5]

The priorities within this broad range of activities were developed from the

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[5] California Energy Commission, Energy Research and Development Program California Energy Trends and Choices: 1977 Biannual Report of the State Energy Commission, Vol. 6, January 1977.

following questions:

- Can the development of the option contribute to meeting California's projected energy needs in the next 20 years?
- Does the option have controllable or negligible environmental effects?
- Is the option sufficiently pursued by other organizations?
- Can the Commission's support result in significant benefits to California?[6]

All of the above items are the basis for energy RD&D program planning by the Commission. Within the solar energy RD&D area, the following five areas are receiving Commission attention:

- domestic hot water heating and space conditioning (using active systems);
- space conditioning via passive solar energy design;
- industrial process heat;
- wind energy; and
- solar-thermal electric generation.[7]

3.4.5 Florida

Senate Bill #721 (Chapter 74-185), effective July 1, 1974, directed the Board of Regents of the state to develop a plan for a state solar energy center. The stipulated purpose of the center is to promote research and development of solar energy, to disseminate information on the results of such research, and to demonstrate the capability of solar energy systems to provide energy resources to the state. In 1975 the Board of Regents' plan was approved, and the legislature appropriated $1 million to support the Florida Solar Energy Center. The enabling legislation directed that the center be integrated with the existing technical and personnel resources of the state university system and coordinate their diverse activities regarding solar energy development.

The Florida Solar Energy Center is divided into three divisions: Research, Development, and Demonstration; Education and Information Services; and Energy Systems Analysis. In addition, a Technical Advisory Committee, appointed by the Center director, makes recommendations to the director concerning ongoing operations and plans. This committee includes representatives from public and

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[6] Ibid.

[7] Ibid.

private universities, energy utility companies, professional associations of architects and engineers, the solar energy industry, and others involved in the state's energy future.

For the first two years of operation, the center had a budget of $1 million annually. During the third operating year the center received $1.3 million in state funds and an additional $1,236,467 in federal and private research funds.

The Research, Development, and Demonstration Division is the center's largest section and accounts for over half of the overall budget. One of the division's major programs is the testing, certification, and labeling program as discussed in Section 4 of this report.

3.5 ANALYSIS OF CASE STUDY STATE RD&D PROGRAMS

To compare and assess the four state solar energy RD&D programs, analysis will focus on six aspects of the implementation experience and administrative setting:

- source of program funding;
- institutional and political setting;
- legislative bounds to administrative policy-setting;
- policy-setting role of the administering agency;
- level of program planning, evaluation, and information dissemination; and
- level of project monitoring, evaluation, and information compilation.

Variations in these factors help determine the viability and effect of the implementation of a state solar energy RD&D program, as well as the nature of the output of the program itself.

3.5.1 Source of Program Funding

As noted at the bottom of Table 3-1 (Subsection 3.3), there are five methods which states are using to fund solar energy RD&D programs: the sale of state bonds, appropriation of state general revenues, levying of a surcharge on energy sales, "earmarked" funds from a mineral severance tax, and use of federal funds. In the four case study states, Florida uses general revenues, California levies a surcharge on each kilowatt of electricity sales, and Montana and New Mexico fund solar energy RD&D programs from a state mineral severance tax.

The predictability of funding support for RD&D programs is important for program stability and success. Unlike many other state expenditures, RD&D programs require a multi-year time horizon and commitment. For this reason, energy use surcharges and mineral severance taxes would appear to be preferable methods of RD&D program funding since they are predictable, dependable, and stable. Annual appropriation of state general revenues, and, to a lesser extent, proceeds from state bond sales, are subject to political fluctuations in the legislature. With the growing taxpayer revolt, funding mechanisms which rely upon state income taxes or general revenues may be politically unacceptable and therefore undependable.

General revenue funding may mean that the administering agency is subjected at least annually to program review by a legislative oversight committee. This review may center around issues such as why a certain project was not funded in a certain legislators' district or may become embroiled in a partisan dispute. In short, general revenue funding may require greater accountability to the legislature and a more subjective program review.

State bond sales may also prove erratic as a program funding method. State bond sales will probably precede the initiation of an RD&D project where this funding method is used. RD&D program funding levels may become dependent on the relative success of bond sales. Economic factors at a variety of levels (e.g., national, regional, and state) may affect the sales of state bonds at various times. Incurring additional state debt may not be politically acceptable at certain times and RD&D program funds may therefore be jeopardized if they rely on bond sales as a funding method. As with state revenues, bond sales may be an unpredictable and irregular method of program funding.

Federal funds are normally used to supplement state solar energy RD&D funding or to support specific projects. As in the above examples, federal funds may be irregular and subject to federal budget priority changes. Additionally, the federal government has not generally funded RD&D efforts at the state level, but rather has managed RD&D efforts on its own, or designated this responsibility to federally contracted laboratories.

The above general observations, like any generalizations, have their exceptions. The Montana Renewable Alternate Energy Grants Program, funded with revenues derived from the state coal severance tax, would apparently have a stable program funding source. This has been exactly the case until the present. The Renewable Alternate Energy Grants Program legislative oversight committee froze funds for the upcoming year. This occurred just prior to election time and may have been meant to demonstrate fiscal restraint to the voters. This decision was recently reversed by the oversight committee. In contrast, the Florida Solar Energy Center, which depends upon annual appropriations from general revenues for the funding of its RD&D program, has consistently received budget increases and rapid legislative approval for its program. There are several explanations for this reversal of the expected relationship between funding sources and program viability. In the case of Florida, it appears that the location of the solar energy RD&D program within a respected and politically powerful university system seems to have insured dependable and regular funding. This factor will be discussed in later subsections of this analysis.

Validity of these initial generalizations is still questionable. Further analysis, based on a larger number of case study states, should help clarify this important issue area.

3.5.2 Institutional and Political Setting

The type of agency responsible for translating RD&D enabling legislation into program plans and managing a solar energy RD&D program may be critical to successful program implementation, administration, and effectiveness. Other influencing factors are the agency's overall mission, familiarity with RD&D programs, and institutional relationship to other agencies and organizations.

In Florida, the multi-layered institutional arrangement of the Florida Solar Energy Center (FSEC) gives the FSEC a relatively high degree of institutional and political autonomy. FSEC is organizationally located within the large and influential state university system. Administratively, the FSEC reports to the Florida Technological University (F.T.U.) which, in turn, reports to the Florida Board of Regents (B.O.R.). The B.O.R. reports to the Florida Legislature. FSEC staff feel that this institutional setting provides them with substantial flexibility in administering the RD&D program, as well as in maintaining program continuity, job security, and staff stability. The state university system also provides much needed equipment and technical expertise.

The FSEC's state university system affiliation and the B.O.R.'s strong influence in the state legislature has helped counteract the negative effects (e.g., irregularity, politically-motivated program review and evaluation) of using general revenues for RD&D program funding. FSEC funds have been readily approved and increased by the legislature.

The Montana Renewable Alternate Energy Grants Program is located within the Montana Department of Natural Resources and Conservation (DNRC). The DNRC has sole responsibility for all energy-related state programs and projects. This clear delegation of administrative responsibility for energy programs has mitigated against state agencies duplicating efforts and resource allocations, centralized RD&D experience and talent, and minimized inter-agency "turf-fighting." Since only one agency is responsible for energy programs, time which would have been spent coordinating inter-agency activities within the executive branch is available for program management and related tasks.

The Florida and Montana experiences indicate that a strong relationship may exist between institutional and political setting, program design, implementation, management, and effectiveness. Future research will test the validity of this hypothesis.

3.5.3 Legislative Bounds to Administrative Policy-Setting

The focus and direction of state RD&D activities, projects and grants, participant eligibility, and project duration may be explicitly stated in the enabling legislation, implicitly identified through general legislative criteria (e.g., "environmentally benign" or "renewable and cost-effective"), or determined by the administering agency. In the latter case, the

administering agency is de facto setting state policy. The focus of decisions on the scope of the RD&D program may affect program implementation and management. A legislature may be inclined toward more liberal criteria while an administering agency may be more conservative in its approach. A legislature may desire a small number of RD&D projects (for ease of review) while an administering agency may opt for a large number of projects in order to maximize research output.

In Montana, the legislature established specific criteria related to project duration:

> A grant may cover a period not exceeding one (1) year, and the Department may not commit itself to spending funds anticipated to be available more than one (1) year after the grant period begins . . . [but the DNRC] may give an applicant a statement of intent to renew its support of his work, subject to the availability of funds and such other conditions as the Department may express (Chapter 501, Section 84-7412).

This one-year grant duration has caused problems for grant recipients since RD&D projects characteristically require more than one year. The Montana program manager noted that the lack of assurance of continued project funding created a feeling of insecurity among grant recipients. In addition, the one-year duration criteria often makes a project's final report dependent upon a grant renewal.

In New Mexico, the state legislature limited the total expenditure for any one project in a given year. Chapter 255, Section 92, Laws of 1977, states that: ". . . not more than ten percent of the total funds appropriated for any one fiscal year shall be allocated for any single project."

California RD&D legislation (Chapter 1081, Section 25601) also stipulates an upper limit for large-scale alternate energy system demonstrations, allowing "not more than one-half of the total state funds appropriated for the solar energy research and development program as proposed in the budget . . . ."

3.5.4 Policy-Setting Role of the Administering Agency

The staff and administrators of the implementing agencies play a major role in the selection of the projects which will be funded by a RD&D program. By doing so, they also influence the overall direction of the program, favoring certain technologies or certain approaches. To assist in this selection process, the administering agencies in the case study states have relied upon three major guides:

- restrictions within the enabling legislation;
- internal selection criteria; and
- external advisory groups.

Several legislative restrictions on the duration and size of projects are discussed in the preceding section. In the following analysis, several examples of methods used to screen proposed projects that fit within the bounds imposed by the enabling law will be discussed.

The best example of the development of criteria for both the identification of broad areas of RD&D interest and the selection of individual projects is found in California. Responding to the mandates of a 1977 law which its own staff helped draft, the California Energy Commission in its 1977 Biannual Report to the Governor and Legislature outlined a two-year energy plan which included a major component for solar energy research. The basic components of this overall energy plan, as well as the specific solar research priorities, is contained in Subsection 3.4.4. All but one of the priority areas identified (the exception being solar thermal electricity generation) are near-term research areas which are closely linked to commercialization efforts for existing, established technologies.

Outside advisory groups have also played important roles in the selection of projects in several of the states. In Montana, the Alternative Energy Advisory Council (AEAC) and in New Mexico, the Energy Research and Development Review Committee both assist in the screening of proposed projects for state RD&D funding. Each group makes recommendations on which particular projects should be funded to the director of the state energy office. The director then makes the final selection, drawing upon the advisory group recommendations and those made by staff. By participating in the project selection process, the advisory groups play an important role in the direction of overall state RD&D policy. In general, the advisory groups have preferred small-scale commercialization and demonstration projects which would assist in the rapid movement of solar technologies into the energy marketplace.

3.5.5 Level of Program Planning, Evaluation, and Information Dissemination

There has been little systematic program planning or evaluation that has yet taken place in the four case study states. In part, this is due to the newness of these programs. This factor has been exacerbated by a general lack of staff, funds, and evaluation expertise in each of the four states. The staff of each program recognized the importance of RD&D planning, including the identification of objectives and goals. Such program guides were seen as being crucial to improving program efficiency, direction, and effectiveness. A program plan which is available to the public would also help focus public participation in the RD&D program and would facilitate in the process of grant and contract solicitation.

Program evaluation can help discover areas within the program plan requiring a shift in emphasis. Additionally, program evaluation periods may be the best time to integrate new areas of RD&D into the program plan since this will be a time of scheduled program plan modification. Sudden, unscheduled program shifts or modifications may be disruptive to program administrators, participants, and projects.

Program evaluation periods may also be an excellent time to invite the input of special interest groups and/or an advisory panel. The use of these special interest groups for program evaluation and the incorporation of their members into a program advisory panel may help foster a constituency which supports the program. This may contribute a perspective leading to greater local relevance of the program. These groups may be a significant resource to a solar energy RD&D program. Special interest groups have contributed input to program design in both Montana (Alternate Energy Resources Organization) and Florida (Florida Solar Energy Industries Association).

3.5.6 Project Monitoring and Information Dissemination

Several of the case study states have begun programs to follow the progress of individual projects and to accelerate the dissemination of research results of these projects. Montana committed $40,000 in 1978 for the first-year funding of a major monitoring effort. At the completion of each project, information on the research data and approach are compiled and made available to a broad range of potential users. The California Energy Commission routinely publishes the results of its funded research, including solar energy studies and demonstrations through a computerized central mailing list. Such information dissemination is important, since it produces a multiplier effect* by making results available to a variety of interested parties. The New Mexico state legislature, when creating the New Mexico Solar Energy Institute, recognized the importance of an integrated RD&D program and the availability of research results by directing the Institute to:

- coordinate major research, development, and demonstration efforts within the state; and
- collect and disseminate information to the citizens and industry in the state concerning solar energy RD&D efforts within the state (Chapter 347, Laws of 1977, Paragraph B).

This arrangement delegates solar energy RD&D coordination, and information collection and dissemination to an institute located within the state university system which also reports to the State Department of Energy and Minerals.

3.6 OBSERVATIONS, RECOMMENDATIONS, AND CONCLUSIONS

Certain general observations can be made on the basis of this assessment of the four states. Some of these observations are transferable to other state solar energy RD&D programs.

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*RD&D multiplier effect--the increased application of RD&D findings by groups or individuals outside the funding agency due to the availability of information on project results and problems encountered.

3.6.1 Program Design and Implementation Observations

1. Coordination and cooperation with state universities has proven beneficial and important for program autonomy, stability, and continuity. The state universities represent a resource with relevant talent and equipment. Because of the technical talent located at many state universities, RD&D program association with these individuals can yield a more credible program. New Mexico's Solar Energy Institute and Florida's Solar Energy Center are good examples of institutional arrangements for facilitating university contributions, cooperation, and coordination (see Subsections 3.5 and 3.6).

2. Program planning, including the identification of objectives and goals, has been largely neglected in state RD&D activities. This oversight or neglect has been due to a lack of time, staff, legislative mandate, and/or administrative directive. All four case study states have neglected this area of their RD&D programs to some degree (see Subsection 3.6).

3. Program evaluation has been underemphasized and/or overlooked in the solar energy RD&D programs in the four states examined (see Subsection 3.6).

4. The monitoring and evaluation of specific projects was recognized by several state officials as a neglected area. Without this review, it is difficult to assess what benefits are being realized by a given program. The failure to disseminate project information and results is also a critical shortcoming in state RD&D program follow-through. Without this process, the RD&D multiplier effect is minimized. States have begun to recognize this need. Montana recently committed nearly $40,000 for project evaluation of those projects funded during the initial phase of their Renewable Alternative Energy Grant Program (see Subsection 3.6).

5. In most cases, there is no functional or definitional difference between RD&D activities and commercialization activities. Since many of the RD&D projects are near-term, they become associated with commercialization activities. The California and Florida programs exhibit this characteristic (see Subsections 3.1 and 3.4).

6. Special interest groups have played important roles in facilitating the implementation of RD&D programs and in furthering public awareness of solar energy in general. In certain cases, they have been important in program design (Montana and Florida). The New Mexico Solar Energy Association has been a key actor in New Mexico due to its broad constituency and advocacy of solar energy. Many of these groups are excellent resources which should not be ignored in RD&D planning and evaluation (see Subsection 3.6).

7. Advisory groups have been a positive and constructive force behind program design, implementation, direction, and emphasis. They have proven to be an excellent mechanism for special interest group and public participation. Advisory groups of this nature are contributing to RD&D programs in Montana, Florida, and New Mexico. The balance of interests and professions represented on the advisory group will help determine the course and direction of the program. These groups, removed from program administrative responsibility, and not accountable to program administrators, can offer valuable, timely, and

critical input to the program (see Subsection 3.6).

8. Many RD&D projects and program emphases have been initiated in order to address areas of near-term potential neglected by federal government programs. Low-cost, decentralized, and "low-tech" solar applications have been a major emphasis in the Montana program. Passive design options and potential have been the focus of research in California. By filling these RD&D gaps in federal programs, these state programs complement federal efforts. This program emphasis may also help establish immediate program credibility, demonstrate accountability, and provide valuable experience quickly (see Subsection 3.5).

9. Unclear legislative intent and direction has contributed to problems associated with ambiguous program emphasis and direction, administrative responsibility and accountability, and inattention to many of the previous eight points. Clarity of specific program directions or desired accomplishments will aid program administrators during budget review sessions. For example, the California Energy Commission sought to clarify RD&D program elements and directions by drafting AB 1512 (Chapter 1081) in 1977 (see Subsections 3.5 and 3.6).

3.6.2 General Observations

1. Public attitudes, as evidenced in rule-making hearings or legislative review sessions, have been favorable and supportive of these programs. The Montana program seems to stand out as the best example of a program administered with considerable public support. The California program received a vote of confidence and approval for its strong solar energy advocacy role and progressive manner during public hearings on utility involvement in the commercialization of solar energy in California.

2. As already mentioned, program emphasis has been on the near-term, lower-cost, lower-risk projects (e.g., water heating, greenhouses, passive designs). This emphasis as opposed to the federal RD&D program emphasis on relatively longer-term, higher-cost, higher-risk projects (e.g., photovoltaics, large wind machines, and "power towers") may be the most effective working niche for the states. It is a common argument within state legislatures which are considering energy RD&D program enabling legislation that the federal government is already engaged in this area. A nonduplicative, appropriate, and hopefully complementary state energy RD&D program is most desirable.

3. There is potential conflict and duplication of effort inherent in the nature of state RD&D programs since they are similar to commercialization activities. The regional solar energy centers (RSEC) have been directed by DOE to perform commercialization activities. However, it was expressed by several interviewees that it is unlikely that their states would cease their activities in this area.

4. The program funding mechanism, its predictability and stability may have an impact on the program over time. This issue is discussed at length in Subsection 3.5.

The following recommendations can be made regarding state-level solar energy RD&D program design and implementation.

1. Efficient and effective program implementation will be greatly facilitated by a clear delegation of administrative responsibilities. These factors can be addressed within the enabling legislation itself or in subsequent rule-making hearings. Clarity regarding program responsibilities will mitigate inter-agency and intra-agency conflict.

2. Solar energy RD&D program planning and identification of goals and objectives have been neglected to some extent in every case study state. This is also true of the case study states' energy RD&D programs in general. Program planning, including identification of goals and objectives, would assist in determining the best use for limited resources and in the coordination of projects around program goals or desired outputs.

3. It is desirable to coordinate state RD&D activities with state universities. Overall program success may be a partial function of the degree of cooperation and coordination that exists between the program administrators and staff and the state universities. A more effective use of limited program funds may be realized through the use of state university equipment, facilities, and personnel.

4. Influential special interest groups that are recognized as competent within the solar energy community can be a valuable resource to state RD&D programs. These groups can assist administrators and staff in program planning, project monitoring and evaluation, program evaluation, and program information dissemination. They can also be valuable allies during legislative review or budget sessions.

5. Program advisory groups can greatly facilitate the flow of valuable information to program administrators and staff. As neutral and objective entities, program advisory groups may be the most appropriate bodies to bring about the realization of many of the above recommendations during program evaluation. Program advisory groups should be composed of representatives from the variety of interests within the state solar energy community.

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7. The New Mexico State University Solar Heated and Cooled Demonstration Home
8. Thermal Trap Solar Energy Collector
9. Instrumentation System for the New Mexico Department of Agriculture Solar Heated and Cooled Building
10. Initiation of Wind Power Technical Center
11. Solar Collector Test Facility
12. Solar Ponds for Residential Heating
13. Completion and Evaluation of the Performance of the New Mexico State University Solar House
14. Instrumentation for the New Mexico Department of Agriculture Solar Heated and Cooled Building
15. Solar Ponds for Residential Heating
16. An Economical Solar Heated and Cooled Residence for Southern New Mexico
17. Information Dissemination
18. The New Mexico Solar Energy Resource
19. New Mexico Solar Business Potential
20. Proposal for a Solar Heated and Cooled New Mexico Welcome Station
21. The New Mexico Wind Potential
22. Solar Energy and Energy Conservation
23. Application of Solar Energy to Night Heating of Greenhouse
24. Instrumentation of the New Mexico Department of Agriculture Building
25. Pyranometer Station for the Assessment of Solar Energy Influx in Eastern New Mexico
26. Performance Evaluation of the New Mexico State University Solar Home
27. Addition of an Air-Cooled Collector Test Capability to the Solar Collector Test Facility
28. Information Dissemination of Wind Energy
29. Solar Irrigation Pumping Demonstration Project
30. Evaluation of Solar Heating and Cooling in New Mexico and Priorities for Solar Energy Development
31. Comparison of Solar-Assisted Heat Pump with Other Techniques Used in Solar Heating and Cooling

NEW MEXICO SOLAR ENERGY PROJECTS (cont.)

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33. Dielectric Development for GaAs Solar Cells

34. Solar Thermal Test Facilities Users Association

35. The Air-Cooled Thermal Trap Solar Energy Collector

36. Performance Evaluation of the New Mexico State University Solar House

37. Ejector-driven Open Air Brayton Cycle with Non-tracking Solar Collectors for Water Pumping

38. New Mexico Solar Radiation Networks

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40. Preparation of High Efficiency Solar Cells and Corrosion Studies on the Solar Cell Materials

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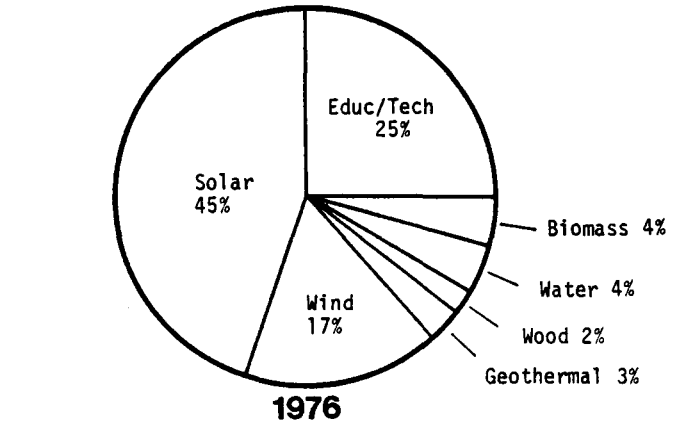
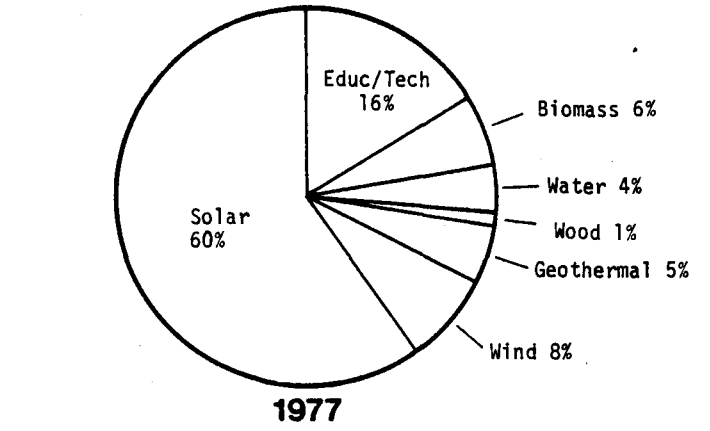
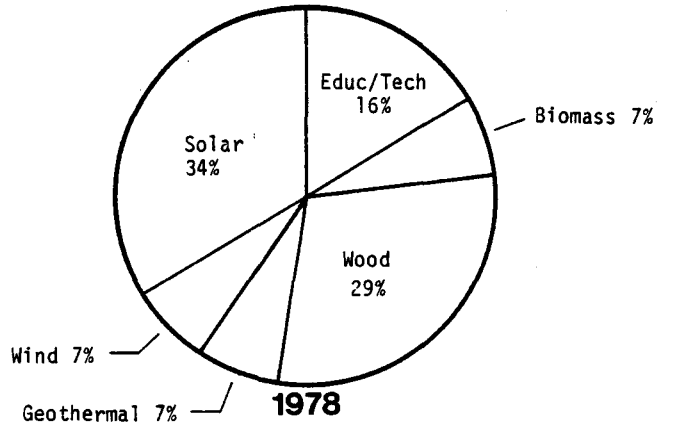
SOURCE: New Mexico Energy and Minerals Department, A Status Report on the New Mexico Energy Research and Development Program, June 1, 1978.

APPENDIX 3-B

MONTANA RENEWABLE ALTERNATE ENERGY GRANTS PROGRAM







APPENDIX 3-C

INDIVIDUALS INTERVIEWED

California Energy Commission
July 10-12, 1978

Don Carner, Energy Conservation Specialist

Mike DeAngelis, Manager, Solar Technology Development

Bob Farley, Manager, Policy Analysis Program

Bruce Gilland, Builders Outreach Program

Matt Ginisar, Wind Energy Specialist

Bob Hodam, Manager, Biomass Program

Marshall Hunt, Manager, California Passive Program

Alec Jenkins, Solar Program Specialist

Stan Kaplan, Policy Analysis Program

Dr. Lawrence Murphy, Office Manager, Solar Office

Florida Solar Energy Center
September 21-22, 1978

Dr. Charles Beach, Director, Research, Development and Demonstration Division

Dr. David Block, Director, Florida Solar Energy Center

Dr. Stuart Gleman, Research Associate

Omar Hancock, Research Engineer

Dr. Ross McCluney, Research Associate

New Mexico Department of Energy and Minerals (P.O. Box 2770, Santa Fe 87501)
July 31 - August 1, 1978

Roger Easley, Director, Energy Conservation Division

M.L. Morton, Solar Energy Specialist

Tom Ortiz, Director, Energy Resource and Development Division

Charles Wood, Assistant Director, Energy Resource and Development Division

New Mexico Solar Energy Association (P.O. Box 2004, Santa Fe 87501)
July 31 - August 1, 1978

Mary Beth Bliss

Keith Haggard, former Executive Director, presently Communications Branch Chief, SERI

Larry Sherwood

Tom Zeller

Montana Department of Natural Resources and Conservation
August 14, 1978

Dana Gunderson, Staff Physicist

Gerry Knudsen, Manager, Alternative Renewable Energy Grants Program

Randy Moy, Chief, Energy Planning Bureau

Jan Konigsberg, Solar Energy Coordinator

Section 4.0 State Testing and Certification

SECTION 4.0

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SECTION 4.0 SUMMARY

Only Florida and California have established conventional-type testing and certification programs for solar collectors. These are programs in which a state acting through an independent testing laboratory certifies that the collector has been tested in accordance with a referenced standard. Other states have established criteria to accompany incentive programs such as state income tax credits. These state statutes may be worded in terms of "certification," but their meaning is that some state agency certifies that the equipment meets the state-established criteria for eligibility for the incentive.

The two testing and certification programs deal only with flat plate collectors at the present time. Both Florida and California plan to expand the programs to other components and to some systems in the future. The equipment covered by the criteria for use with state incentive programs depends upon the language of the statutes; in most cases, active and passive heating and cooling systems are included. In some states, equipment such as windmills is included as well.

The federal government is playing a very active role in standards development, equipment testing, and certification. With the recent passage of federal energy legislation, federal agencies also will be involved in establishing criteria for federal tax credits. The federal involvement plus the activities of many states raises issues of intergovernmental relations. The desire of many states to protect the health, safety, and welfare of their residents may conflict with the desire on the part of the solar industry and others to establish a consistent program to encourage a national market for solar equipment and systems.

The activities of Florida, California, Minnesota, and Oregon are examined. As noted above, Florida and California have testing and certification programs. Both currently are voluntary although certification in Florida will be required after January 1, 1980, and certification in California may be made a condition of their state income tax credit. Minnesota has a system whereby the characteristics of solar equipment are to be disclosed to the buyer; the manufacturer is charged with developing the necessary information. Oregon has several programs which require "qualifying standards" or criteria to be developed. One Oregon program requires "certification" by a state agency.

A major issue with state testing and certification programs is their possible proliferation. A national program, involving the participation of many interest groups, is nearing completion. The costs and the dangers of multiple certification systems should make other states hesitant about developing their own programs. States will continue to have an interest in the eligibility criteria for their tax and other incentive programs. To the extent that these criteria use specific standards, the standards should be consistent with those used by other states.

Design and implementation of state testing and certification programs depend largely upon the uses to which the programs are put. The output of conventional testing and certification programs is test information. There are

considerable differences in the amount of information and the way it can be made available. Enforcement of legislation and regulations may be an issue in other types of programs.

The "qualifying standards" used for state incentives vary considerably. Some are very general guidelines while others approach the complexity of formal equipment specifications. The use of conventional certification as a condition of a state incentive is expected to increase.

The amount of administrative discretion varies from state to state. A complex and evolving subject such as this may better lend itself to increased administrative discretion because of the technical expertise needed and because of the need to accomodate frequent changes. If this approach is taken, clear policy guidelines are needed in the legislation to avoid legal and administrative problems.

Testing and certification of solar collectors are here to stay and similar programs for other components and solar systems probably will be developed. Testing serves a very important function for manufacturers as well as consumers. Certification provides the mechanism for reporting testing results. State involvement, however, in testing and certification probably will decrease as national programs involving the solar industry become further developed. State involvement in developing criteria used for qualifying equipment for state incentives will parallel the activity in the incentives programs themselves.

Although the study was directed toward the state level, much of the analysis is also applicable to the local level.

4.1 INTRODUCTION

This chapter examines the implementation experiences of several states with testing and certification programs. The primary purpose is to provide information to other states and local governments that are contemplating the adoption and implementation of such programs. A secondary purpose is to provide information to the federal government for their use in formulating national policies which recognize and accommodate regional diversity.

No attempt was made to survey all of the states that have adopted some type of testing and certification program. Only four states were examined; the reasons for their selection are contained in a later subsection. Also, local programs are not included in this analysis. The small number of states and the diversity of the programs make generalizations difficult. Nevertheless, the information contained herein should be helpful to any state or local jurisdiction contemplating action in testing and certification.

4.2 REVIEW OF AVAILABLE TESTING AND CERTIFICATION INCENTIVES AT THE STATE LEVEL

A certification program consists of a process in which an independent testing laboratory or a governmental agency relying on an independent testing laboratory certifies that a product or a system has been tested in accordance with a referenced standard (one prepared by an organization with recognized authority and credibility). The fact of certification usually is transmitted to the public by means of a label on the equipment. The label may simply state that the equipment has been certified or it may contain specific information derived from the testing process. "Certification" is often used interchangeably with "listing," although the two have somewhat different technical meanings.

In order to understand state testing and certification programs adequately, the role of standards as well as the role of the federal government in their development need to be considered.

4.2.1 Standards

The basis for a certification program is a set of standards. Standards are an agreed-upon language used by producers, consumers, governmental agencies, and others in communicating the characteristics of materials, products, and systems. Several kinds of standards exist. Those relevant to this discussion include definitions, specifications, and methods of test. A standard definition, for example, would differentiate a flat-plate air collector from other types of collectors or even from other types of solar approaches which are not defined as collectors. A standard specification is a set of requirements that must be satisfied by whatever is being tested. A standard method of test covers sampling and describes the testing procedures for determining properties, composition, or performance.

Standards used in certification programs normally are developed in the United States through the voluntary consensus system. The underlying principle in this system is that all who have an interest in the standard should have a voice in its development. This usually includes at least producers, users, consumers, and regulatory agencies. The system works through committees established under the auspices of some private organization interested in developing standards. Examples of such organizations are the American Society for Testing and Materials (ASTM) and the American Society of Heating, Refrigerating, and Air Conditioning Engineers, Inc. (ASHRAE).

Overall coordination of this voluntary consensus system is the responsibility of the American National Standards Institute (ANSI), whose membership consists of over 400 organizations, many of which write standards. In order for a standard to be referenced as an American National Standard, the procedures of the standards writing organization must be approved by ANSI. Because of the considerable interest in solar technologies, ANSI has established the Solar Standard Steering Committee to oversee solar activities. The committee initially dealt only with standards for solar heating and cooling as well as for solar hot water. The committee's scope has since expanded to include photovoltaics.

Not all standards are developed through the voluntary consensus system. Government agencies may develop standards for their own use in purchasing equipment. Often, however, they use standards developed through the voluntary consensus system. The government also may develop standards to effectuate policies in energy, housing, and urban development. For example, the Federal Housing Administration (FHA) has developed solar standards that have been integrated into their Minimum Property Standards (MPS).

The government, especially the federal government, has become very involved in standards activities related to solar technologies. The primary reasons are to assist in the implementation of governmental policies (noted above) and the push to accelerate the commercialization of solar technologies. Public Law 93-409, the Solar Heating and Cooling Demonstration Act of 1974,[1] called for the development of both interim and definitive "performance criteria" for solar heating and cooling. The National Bureau of Standards has prepared and ANSI has adopted a "Plan for the Development and Implementation of Standards for Solar Heating and Cooling Applications."[2] This plan identifies needed standards and defines priorities, responsible organizations, and schedules. The standards will be developed through the voluntary consensus system.

A good deal of confusion exists between the types of standards discussed above and the standards that are called for in legislation dealing with tax incentives and loan programs. These may or may not be standards in the

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[1]Solar Heating and Cooling Demonstration Act of 1974, U.S. Codes Annotated §§ 5503-5517.

[2]National Bureau of Standards, Plan for the Development and Implementation of Standards for Solar Heating and Cooling Applications, NBSIR 78-1143A (1978).

conventional sense; they will be identified as "qualifying standards" in this discussion. Likewise, legislation sometimes calls for equipment to be "certified" by an agency as being eligible for the incentive program. This usually, but not always, means something other than the conventional certification process discussed below.

Another type of standard that adds to the confusion is the standard adopted by a regulatory agency. Examples are water and air-quality standards administered by the Environmental Protection Agency or a state agency. These particular "regulatory standards" deal with the side effects of equipment and systems. Regulatory standards are expected to be particularly important in biomass energy conversion systems.

The discussion in this report primarily addresses solar heating and cooling because most of the activity has been in this area. Increasing interest has been shown in standards and certification of wood-burning stoves; testing currently is being done by such institutions as the Southern Maine Vocational Technical Institute. Work has commenced on developing standards for wind-energy systems and photovoltaic cells. The experience with testing and certification for solar heating and cooling should prove exceedingly useful in developing certification programs for the other solar technologies.

4.2.2 Certification Programs

Certification programs have several general purposes:

- to protect the consumer;
- to assist the industry;
- to protect the value of public subsidies; and
- to contribute to improvements in the state of the art.

These first two purposes are very much related. By protecting the consumer, consumer confidence in solar systems is increased. The increased confidence results in greater consumer acceptance which translates into increased sales. Certification also assists the industry by imposing a consistent set of requirements and by facilitating governmental acceptance of equipment; for example, building officials are much more likely to approve a solar installation if the equipment is certified.

A tension often exists in spite of the close relationship between these general purposes. If standards are not rigorous, business may get a short-term boost because more equipment will be certified and the cost of production will be kept down. Consumers will benefit from the lower prices but may not be adequately protected. (Note that additional methods, such as warranty programs, also could be used to protect consumers.) More rigorous standards probably mean higher costs of production, higher costs of testing (which is usually paid by the manufacturer), and fewer equipment models being certified. This tension is exacerbated by other standards and certification issues.

- Timing: If the program is established too early in the developmental stages of the technology, it soon will be outdated and probably will discriminate against newer technologies because the mechanism for review and change is so slow.

- Small Businesses: The initial cost of certification may be a hardship for small businesses. Also, small businesses may be producing unique equipment which does not fit into the certification scheme.

- Innovation: The impacts of certification programs on innovation are related to timing issues as well as to the impacts upon small businesses. In addition, the cost and effort involved in testing and certifying improved models of already-certified equipment can discourage product improvement. Also, many independent innovators may be philosophically opposed to participation in a certification program.

- Passive vs. Active: Certification programs, if not well designed, may discriminate against passive solar systems. This can happen because of ignorance, because passive is difficult to define, or because passive is not oriented toward equipment. Passive systems generally include conventional materials in conventional configurations which do not have significant reliability, durability, and safety problems which cannot be resolved through the local building permit and inspection process.

- Low Cost Alternatives: Certification programs may preclude or discriminate against shorter-life, lower-cost systems that may be as cost effective as longer-life, higher-cost systems. Consumer choice must be balanced against consumer protection and potential adverse public reaction due to system failures.

- Relevance: Existing programs may not be addressing the most significant consumer protection issues. Poor installation and system integration practices as well as unreliable electronic controls account for a large share of system failures.

- Proliferation: Perhaps the greatest danger of certification programs is that multiple certification requirements will frustrate the emergence of a national solar industry with its alleged economies of scale.

Certification programs normally are established by a private organization. Government involvement, however, has increased in the area of certification of solar equipment and systems. The Solar Heating and Cooling Demonstation Act of 1974[3] addressed certification as well as equipment standards. At the time this report was written, the Solar Energy Research and Education Foundation

[3]Solar Heating and Cooling Demonstration Act of 1974, U.S. Codes Annotated §§ 5503-5517.

(SEREF), an organization affiliated with the Solar Energy Industries Association, was under contract with the U.S. Department of Energy (DOE) to design a program for the testing, certification, and labeling of solar collectors. SEREF is not charged with the actual testing or certification. This program will be presented to the ANSI Solar Standards Steering Committee for approval. In addition to SEREF activities, the Air Conditioning and Refrigeration Institute (ARI) has developed a certification program. This program, funded by ERDA through the National Bureau of Standards, was ready for implementation in January 1978. Also, DOE has a program for testing flat-plate collectors.

4.2.3 Potential State Programs

The timing issue is very critical in discussing potential state responses. Solar standards and certification activities at the national level began relatively recently. The ANSI Solar Standard Steering Committee was established in 1977 and the SEREF certification effort was launched in that same year. The ARI certification program and ASHRAE Standard 93-77, "Methods of Testing to Determine the Thermal Performance of Solar Collectors," also were issued in 1977.

In the past, if a state wanted to have a testing and certification program in effect within its jurisdiction, it had to establish the program. The state could use national standards, if available; if not, or if it felt the national standards were unsuitable for its purposes, the state could develop its own. The state could establish its own testing facility or could accredit private laboratories using standard criteria (if available) or its own criteria. The state had wide options on the content of the label, and it had several options on the use of certification: voluntary, necessary for tax or other incentives, or mandatory for sale of equipment within the state.

In the future, a state could exercise any of the above options. But most important, it could choose to reference or rely upon a national certification program. Assuming that the national program was well conceived and implemented, the state would benefit from not having the significant expense of maintaining a certification program and from the lower cost to its residents for solar equipment as a result of the emergence of a national industry. Also, administrative confusion resulting from different federal and state testing and certification programs would be avoided.

4.3 STATE TESTING AND CERTIFICATION INITIATIVES

The state response to the testing and certification issue is related to the level of solar activity within the state. Florida and California, two of the most active states, have developed formal certification programs. Other states have been involved in standards development, usually in conjunction with an incentive program or with some effort to modify the building codes to facilitate solar applications.

This report focuses on Florida and California because of their extensive efforts in this area. Several other states, primarily Minnesota and Oregon, are addressed in less detail. Minnesota was chosen because of the many unique features of the legislation while Oregon was chosen because of the use of "qualifying standards" in multiple incentive programs.

As noted before, states or other levels of government normally are not involved directly in the certification process: the Florida and California programs are exceptions to this general rule. These certification programs involve several types of testing. Some are pass-fail tests (such as stagnation) where the laboratory tests the collector against a standard specification. Others are more like a rating (such as thermal performance) where the laboratory tests the collector in accordance with a standard method of test to produce information on collector characteristics.

4.3.1 Florida

The Florida program was initiated with the enactment of the Florida Solar Energy Standards Act of 1976.[4] This law, effective October 1, 1976, directed the Florida Solar Energy Center (FSEC) to:

- develop standards for solar equipment sold or manufactured in the state;
- establish criteria for determining the performance of solar energy equipment;
- maintain a testing facility for evaluating solar energy equipment performance; and
- allow for the acceptance of test results from other testing organizations.

In response to the above legislation, the FSEC prepared FSEC 77-6, "Operation of the Collector Certification Program."[5] This provided the procedure whereby solar collectors are to be rated for performance, examined for compliance to minimum standards, and approved to bear a certification label. A companion document, FSEC 77-5, "Test Methods and Minimum Standards for Solar Collectors,"[6] contains the testing and rating methods as well as the equipment specifications.

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[4] Florida Statutes Annotated § 377.705.

[5] Florida Solar Energy Center, "Operation of the Collector Certification Program," FSEC 77-6, November 1977.

[6] Florida Solar Energy Center, "Test Methods and Minimum Standards for Solar Collectors," FSEC 77-5, November 1977.

The program as originally conceived and implemented was voluntary on the part of manufacturers. A recent amendment provides that all solar energy systems manufactured or sold within the state after January 1, 1980, shall meet the standards established by the FSEC and shall display the results of the performance test.[7]

4.3.2 California

The California program was authorized by legislation adopted in 1977 requiring the California Energy Commission (CEC) to develop regulations governing solar devices.[8] Such regulations could include "standards for testing, inspection, certification, sizing, and installation of solar devices," procedures for the accreditation of laboratories to certify solar devices, prohibition of the sale of solar devices not meeting minimum safety and durability requirements, and several other measures.[9]

The CEC developed the Testing and Inspection Program for Solar Equipment (TIPSE) to implement this legislation. At the present time, the program consists of the following tasks:

- laboratory accreditation;[10]
- collector testing and certification;[11]
- information dissemination; and
- system design and installation guidelines.

The CEC plans to extend its certification program to include a variety of solar devices in addition to collectors--solar tanks, controls, and packaged solar systems. Currently, only flat-plate glazed collectors are being certified.

The regulations incorporated ASHRAE 93-77 as the thermal performance test standard. Because standards for durability, reliability, health, and safety did not exist, the CEC developed their own in consultation with the National

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[7] 1978 Florida Laws, Chapter 309; Florida Statutes Annotated § 377.705(4)(d).

[8] California AB 1512; Statutes of 1977, Chapter 1081.

[9] California Public Resources Code § 25605.

[10] California Energy Commission, "Standards and Procedures: Accreditation of Testing Laboratories for Solar Components and Systems," May 31, 1978.

[11] California Energy Commission, "Guidelines for Certification of Solar Energy Equipment," June 15, 1978.

Bureau of Standards, the Department of Housing and Urban Development, and the Florida Solar Energy Center. A major difference between the California and the Florida programs is that California does not operate a state testing and certification facility. The impact of this distinction on the industry is minimized by the provision in the Florida statutes that allows private laboratories to test equipment in addition to the FSEC facility. In addition, Florida and California have a reciprocity arrangement dealing with testing and certification.

Currently, the California testing and certification program is voluntary. Within a very short period of time, the CEC is expected to consider whether certification will be a prerequisite for eligibility for the state 55% income tax credit incentive. Criteria for the tax credit already have been adopted.[12]

In order to provide guidance to consumers on which equipment meets the tax credit criteria, the CEC is developing a second program known as the Tax Credit Labeling Program.[13] This program will be administered through the California Solar Energy Industries Association (Cal-SEIA). Cal-SEIA will provide system labels to registered installers. The label indicates to the consumer that the system meets the requirements for the state income tax credit. Both "passive" and "active" systems are included in the labeling program. If the system is installed by a homeowner or a tenant, he or she also can request a label. All participating installers will be required to complete a form describing the type of each installation. These forms are to be returned to Cal-SEIA and would be available to the CEC.

4.3.3 Minnesota

Minnesota adopted a provision in 1976 that directed the Building Code Division of the Department of Administration to promulgate rules on the quality and performance standards for solar energy systems.[14] The standards were to insure that the solar energy systems "are effective and represent a high standard of quality of material, workmanship, design, and performance." The standards were to be developed "in consultation" with the Minnesota Energy Agency. They were to be "in reasonable conformance" with the interim performance criteria required under the Federal Solar Heating and Cooling Demonstration Act of 1974. The state standards are to be modified as more definitive standards are developed at the national level.

The use of the standards is that:

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[12]California Administrative Regulations, §§ 2601-2608.

[13]Pierson, Richard, California Energy Commission, conversation with the author, July 10, 1978.

[14]Minnesota Statutes Annotated § 116H.127.

> "manufacturers or retailers of solar energy systems shall disclose to each bonafide purchaser of a system the extent to which the system meets or exceeds such quality standards."

In response to the legislation, the Building Code Division promulgated rules entitled "Standards of Performance of Solar Energy Systems and Subsystems Applied to Energy Needs of Buildings."[15] These rules are to be used in conjunction with existing building codes. Enforcement is effectuated by prohibiting any local building official from issuing any permit required for the installation of a solar energy system or subsystem until the seller has provided a disclosure form. The building official is not required to determine the accuracy of the disclosure or to determine if the system or subsystem meets the standards. The standards themselves reference several nationally developed standards as required by the statute.

4.3.4 Oregon

Oregon adopted two statutes in 1977 that involved "certification" of solar equipment. The first, SB 339, established an income tax credit for the installation of an "alternative energy device" which uses solar radiation, wind, or geothermal energy.[16] The bill directed the Oregon Department of Energy to adopt rules prescribing minimum performance criteria for alternative energy devices for buildings. In doing so, the department was directed to "take into consideration" federal performance criteria developed pursuant to the Solar Heating and Cooling Demonstration Act of 1974. The bill provided that the alternative energy device must be "certified" by the Oregon Department of Energy.

In response to SB 339, the Oregon Department of Energy promulgated Chapter 330 of its regulations.[17] The standards for solar equipment are quite general and do not reference national standards except for mention of the ASME Boiler and Pressure Vessel Code. The range of items that qualify as a solar device is broad. The regulations contain an exemption from the standards for "innovative and creative projects" and especially encourage home-built systems.

The other piece of legislation in 1977, SB 477, permitted eligible veterans to obtain up to an additional $3,000 as a loan from the Oregon War Veterans' Fund.[18] This bill uses virtually the same definition of "alternative energy device" as SB 339. SB 477 required the Director of Veterans' Affairs, with the advice and assistance of the Oregon Department of Energy, to adopt rules

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[15] Minnesota Code of Agency Rules §§ 1.16101-1.16108, "Standards of Performance for Solar Energy Systems and Subsystems Applied to Energy Needs of Buildings," 1977.

[16] Oregon SB 339, 1977; Oregon Revised Statutes §§ 469.160-469.180.

[17] Oregon Administrative Rules §§ 330-80-010 - 330-80-080.

[18] Oregon SB 477, 1977; Oregon Revised Statutes § 407.048.

prescribing minimum performance criteria for the alternative energy devices. The Bill also provided that the Director of Veterans Affairs could contract with the Oregon Department of Energy for certification of the devices which complied with the performance criteria.

The performance criteria adopted by the Department of Veterans' Affairs read as follows:[19]

- Alternative energy devices must supply at least 10% of the total energy requirements for a home.
- Minimum expected operating life of alternative energy systems must be at least ten years.
- Alternative energy devices must be installed in a location and in a manner that will optimize their operation.

The Department of Veterans' Affairs has not contracted with the Oregon Department of Energy for certification of alternative energy devices.

Another bill was passed earlier (1975) to grant a property tax exemption for solar energy equipment.[20] No provisions were made in the legislation for standards or certification. Most tax assessors are using the income tax credit criteria to determine if the solar equipment is eligible for the property tax exemption.[21] The Department of Revenue is expected to ask the legislature for statutory guidance on qualifying standards during its next session.

4.4 ANALYSIS OF TESTING AND CERTIFICATION PROGRAMS IN SELECTED STATES

The analysis of state testing and certification programs is divided into four sections:

- standards;
- testing;
- certification; and
- criteria for state incentives.

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[19] Oregon Administrative Rules § 274-20-345.

[20] Oregon HB 2202, 1975; Oregon Revised Statutes § 307.175.

[21] Hill, C.J., Oregon Department of Revenue, telephone conversation with the author, September 22, 1978.

This analysis will provide information useful to states (and local governments) considering the adoption of a testing and certification program.

4.4.1 Standards

This section discusses standards which are developed primarily for the purpose of quality assurance. Although these standards may be used in state or local incentive programs, this use is secondary. "Qualifying standards" or criteria are addressed later.

The state with lead involvement in equipment standards development is Florida. Other states such as California and Minnesota have used standards developed by others as their starting point. Florida became involved because needed standards were lacking at the time its testing programs were being developed.

A state's response to solar standards setting should be tailored to the use it expects to make of standards. Possible uses include:

- prohibiting manufacturing within the state of equipment not meeting prescribed standards;
- prohibiting sale within the state of equipment not meeting prescribed standards;
- purchasing only equipment which meets the prescribed standards;
- offering tax and other incentives only to equipment which meets the standards;
- incorporating standards into building codes; and
- making information available on equipment meeting the standards.

As noted before, equipment standards normally are not developed by states. Several reasons exist:

- the process is expensive;
- if standards already exist, the process may be duplicative;
- state standards may be of poorer quality than national standards because of limited involvement and perspective of interest groups;
- industry may ignore the standards;
- standards development may be untimely; and
- problems associated with proliferation will increase.

The proliferation issue is perceived by the solar industry to be of extreme importance. Businesses operating in several states feel that they cannot operate effectively if they must meet multiple standards. Businesses

operating entirely within a state may find that they are not able to expand to other states with different standards or that they cannot take advantage of federal programs within their state which use national standards. One firm which recently shut down its solar branch stated:[22]

> Multiple and conflicting product performance criteria and warranty requirements are either being imposed or recommended by just about every local, state and federal government agency, industry association, trade association and so forth. This makes it virtually impossible for manufacturers to forecast the ground rules and eventual economic outome of their solar program.

A major challenge for all levels of government is to develop a system for standards (and testing and certification) which addresses the concerns of the industry but at the same time preserves flexibility at the state and local level for unique, innovative, and low-cost solar systems. The system also must protect the health, safety, and welfare of the public.

The first question a state needs to answer, given the problems of developing standards and their potential uses, is whether any activity is needed at the state level. National standards have been or are being developed for solar heating and cooling systems, subsystems, components, and materials. A state may be concerned about several potential problems with the national standards including:

- the accommodation of regional variations; and
- the accommodation of equipment not meeting national standards.

The regional variations include special problems of high or low temperatures and solar radiation levels, high winds, blowing sand, snow loading, or hail. The recommended approach appears to be to work with existing standards development groups to accommodate those regional variations. A well-designed standard should do this. This would enable a state to choose standards applicable to its regional needs if it determined that the national standards were not appropriate.

A state may wish to reject for use a standard that is preventing or inhibiting the sale of equipment which it feels should be allowed to compete. Or, as will be discussed later, a state may adopt a standard but provide variances for innovative equipment. Standards should not preclude the construction and use of home-built solar systems, although criteria may be appropriate to determine if they qualify for government incentives.

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[22] Burke Industries, San Jose, California, as quoted in editorial in Solar Engineering, p. 5, May 1978.

Care must be taken in drafting legislation to define what is covered. For example, the recent amendments to the Florida standards statutes appear to require that all solar systems sold after a certain date must meet the prescribed standards.[23] This appears to cover used solar systems, installed before the effective date and sold later separately or as part of the building, as well as home-built solar systems that are later sold. It is doubtful that this was the intent of the legislation.

Standards have not yet been developed for many of the other solar energy technologies although they may exist for certain components of those systems. (Systems standards may not be feasible for some technologies because of the variations in components and variations in applications.) Rather than have the states become involved in the development of standards for other technologies, their most sensible approach appears to be to maintain a hands-off position except for making their concerns known to DOE and the standards-writing bodies and providing participants in the process.

Standards were developed in Florida and California by a governmental agency which dealt with energy and in Minnesota by the agency which administers building codes. No conclusion can be drawn as to the effectiveness of one approach over another in terms of the quality of the standards that were developed. However, there is a significant difference in the implementation of the standards. Part of this may be the product of the organizational structure, but a larger part probably results from the use of the standards themselves.

Florida and California use their standards in their testing and certification programs. Minnesota uses their standards in a disclosure program administered by local building officials. There are some indications that the Minnesota program is not working effectively. The disclosure statements may or may not be accurate; one reason for this is that many manufacturers do not have good information on their products. Information on home-built systems usually is nonexistent. Building inspectors are often more concerned with obtaining a form than in its substance. Buyers may not be seeing the forms. Furthermore, the information on the form is not checked on a systematic basis. There are likely to be several reasons for these problems:

- The state energy agency has no role in implementation.
- The statute, under the best of conditions, appears to lack any effective enforcement mechanism.
- A mechanism to provide equipment testing is lacking.
- A better education program for building inspectors is needed.
- A better public information program is needed.

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[23] Florida Statutes Annotated § 377.705(4)(d).

Another issue is whether the "purchaser" of solar systems installed on a house is the builder or the subsequent owner/occupant of the home. This should be clarified.

In defense of the Minnesota system, the implementation phase is very new. There is no reason to expect that the existing problems will not be corrected. An interesting issue, however, is raised. A state can implement a system and work out the problems as they develop. Alternatively, it can delay the effective date to give it time to address in advance the problems that can be expected to occur.

4.4.2 Testing

A state would normally become involved in testing for one or both of the following reasons:

- as a necessary component of a certification program; and/or
- to provide feedback to manufacturers.

Certification in the conventional sense requires testing; this factor differentiates the certification programs in Florida and California from those of other states.

The function of providing feedback to manufacturers is very important. Manufacturers, especially smaller ones, usually do not have adequate test facilities. Therefore, they often do not know how their collectors perform under a variety of conditions. Manufacturers can use the test results to correct deficiencies and improve performance. Manufacturers also can use the test results to compare their equipment with that of other manufacturers.

Florida and California have taken different organizational approaches to testing. Florida operates a test center, while California accredits laboratories to do its testing. Florida set up its own facility to work directly with the solar industries within the state. Also, at that time, not many private laboratories were in the business of testing solar collectors. California rejected the establishment of a state laboratory because of the expense and because private laboratories (and Florida's) were available.

One advantage of the Florida laboratory is the lower cost to the manufacturer of testing. The current fee for testing and certification of a flat-plate collector is $1350. The prices for private laboratories vary, but are generally $400 to $500 more. A question which could be asked but which was not analyzed was whether a state laboratory provides better feedback to manufacturers. Because the laboratory, under the Florida Solar Energy Center, has an institutional interest in solar energy, it may be more willing than private labs to work with manufacturers in product improvement. No research was conducted to see if this is true.

Another difference between the two programs is the emphasis that California places on the inspection of solar equipment specifications, design, and drawings after testing is completed. This inspection by engineers at the

Energy Commission provides information, especially on durability and reliability, not obtained during the testing process. Plans call for this information to be used in two ways. The inspection results will be given directly to the manufacturer who can use them for product improvements. Also, selected information will be presented in a common format in brochures and distributed to consumers and manufacturers so that meaningful equipment comparisons can be made.

4.4.3 Certification

As noted earlier, certification consists of having an independent testing laboratory or a government agency relying on an independent testing laboratory certify that a product or a system has been tested in accordance a referenced standard. Standards and testing were discussed in the preceding sections. The purposes of certification are consumer protection and aid to the industry through greater consumer confidence and institutional acceptance of the equipment. The latter includes the greater acceptance by building officials and lenders, lists of equipment approved for governmental purchasing, and equipment made eligible for governmental incentives.

Certification of solar collectors currently is being carried out by a very limited number of testing laboratories using test procedures adopted by California and Florida. As mentioned earlier, the Solar Energy Research and Education Foundation is developing procedures for a national certification program. Certification will be conducted by laboratories which are accredited using criteria currently being developed.

The certification programs of California and Florida are very active. As of October 1978, about 66 manufacturers with 190 models were participating in the first round of testing and certification in the California program.[24] This testing was being conducted in six laboratories. Both Florida and California worked closely with industry in establishing the programs. Meetings and public hearings were held during the development and adoption of the regulations and guidelines. Meetings were then held with manufacturers to assist them in applying for certification.

California was assisted by a consulting firm in establishing a certification program. The firm proposed criteria for laboratory accreditation, assisted in the accrediting review process, and developed the form of the documentation required from manufacturers. The laboratory accreditation process is very complex, a fact that may deter other states from undertaking it.

A major component of certification is the communication of the technical information obtained during the testing process. The amount of information that can be developed and be displayed is limited by the size of the label. The Florida label is consumer oriented--it provides the thermal performance rating based on an "assumed standard day" for Florida and also provides the

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[24] Reyneveld, Josh, California Energy Commission, telephone conversation with the author, October 5, 1978.

collector area. The California label, on the other hand, will also have information of use to installers and maintenance people.[25] As noted earlier, there are plans to augment the label with a more detailed information brochure.

Florida has a consumer data sheet which sellers hand out to prospective buyers. This sheet gives more information than is on the label. In addition, a complete test report on any collector is available from the Florida Solar Energy Center. The availability of the data sheet and the test report are noted on the collector label. Another aspect of documentation requirements is the material necessary to integrate the components into a system. California requires this information before a collector can be certified.

A complete documentation program should address these needs:

- consumer information on safety, performance, etc.;
- information for solar system designers;
- information for installers;
- information for repair persons; and
- detailed technical information.

Consumer information, in particular, needs more study. Information must be useful but not too technical. Also, attention must be paid to making the certification information usable to the people who prepare and administer building codes.

As noted earlier, certification programs may be used in a number of ways. They can be voluntary as in California or as in Florida until January 1, 1980; they can be required for a tax-incentives program (discussed in the next section); or they can be mandatory as in Florida after January 1, 1980. Manufacturers have a great incentive to participate in certification programs even if they are not mandatory. Experience in Florida indicates that manufacturers use the fact of certification as a selling point; an informed consumer soon learns to ask if a system or component is certified.[26] Similarly, if a state requires certification for tax or loan incentives, participation in the certification program will be necessary for commercial success.

Certification may be a financial burden for small businesses. The current cost of testing and certifying one model of a collector, including documentation, may be over $2000. This cost is probably reasonable because of the value of the feedback to the manufacturer and the increased salability of the

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[25] California Energy Commission, "Guideline for Certification of Solar Energy Equipment," June 15, 1978.

[26] Roland, James, Florida Solar Energy Center, conversation with Bruce Green (SERI), September 21, 1978.

product. However, if the manufacturer does not have the necessary money, such benefits cannot be realized. An approach to solve this problem was attempted in California. A program was developed for state subsidies for small solar businesses to enable them to participate in the certification program. The subsidy program died in the economy wave that recently swept the state. Note, however, that such a program does not add up to very much total expense to a state.

Another potential problem with certification is that product improvements, common in the early stages of industry, may require retesting and recertification. Some discretion to accommodate product improvements should be built into the certification programs. Someone should have the authority to say that the change is so minor that new testing is not required or that only some tests are required. Another approach, being developed in California, is to use a computer model to predict how a change in one part of a collector will affect its overall characteristics.

The use of a certification program may determine the method of adoption of the guidelines. California developed guidelines, but as of October 1978, has not adopted the guidelines as formal regulations. The reason is twofold. First, the certification program was voluntary which caused the state to determine that regulations were not required. Second, and more important, the Energy Commission felt that the lack of experience with the criteria meant that it was premature to adopt them as formal regulations.[27] A decision was made to gain experience with the criteria before they were adopted as regulations. This decision coincided with a decision to delay making certification a requirement for the tax credit. This "phasing" approach to regulation makes sense for subjects such as solar that are new and involve a substantial expenditure of funds for some businesses.

4.4.4 Criteria for State Incentives

Almost all state statutes establishing an incentive program make some reference to what equipment qualifies for such incentives (exceptions will be noted later).* The legislation itself may provide detailed criteria, it may call for some agency to establish criteria, or it may call for some agency to "certify" the equipment as being eligible. The two meanings of certification must be kept clear.

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[27] Wheatland, Gregg, California Energy Commission, conversation with the author, July 11, 1978.

*A related concept is represented by the unique ordinance recently enacted by San Diego County, California (Ordinance No. 5324, December 12, 1978). This ordinance requires the installation of solar hot water systems in new residential construction. It states that the county will consider an additional ordinance "to make provision for solar system materials and installation standards" and will consider whether to require state-certified systems to be used.

The Oregon legislation that established the state solar tax credit required the Oregon Department of Energy to certify equipment before it was eligible for the tax credit.[28] The Department can take the definitions from the statute, adopt amplifying regulations, and then determine if the equipment meets the state criteria. If it does, the equipment is certified. Similar California legislation required the Energy Commission to establish guidelines and criteria for eligible systems.[29] The Commission did so in a set of regulations entitled "Tax Credit Guidelines and Criteria."[30] Other legislation called for the development of solar standards and led to the development of the certification program.[31] Certification here means testing by an independent laboratory in accordance with a reference standard. Certification is not required for the tax credit but it may be in the future.

A good deal of discretion to the administrative body is granted by the California and Oregon legislation. The Oregon tax credit legislation provides:[32]

> "Alternative energy devices" means any system, mechanism or series of mechanisms which uses solar radiation, wind or geothermal resource as a source for space heating, water heating, cooling, electrical energy or any combination thereof for a dwelling which source meets or exceeds 10% of the total energy requirements for the dwelling.

The regulations resulting from the legislation include the following solar devices:

- solar collectors;
- movable insulation;
- Trombe walls;
- attached solariums;
- thermal mass;
- solar assisted heat pumps;

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[28]Oregon Revised Statutes § 469.170.

[29]California Revenue and Taxation Code §§ 17052.5 and 23601.

[30]See note #12.

[31]California Public Resources Code § 25605.

[32]Oregon Revised Statutes § 469.160.

- ductwork, controls, etc.; and
- south facing windows (meeting certain conditions).

The California legislation[33] used the term "solar energy system" which was defined as equipment (a) "which uses solar energy to heat or cool or produce electricity;" and (b) "which has a useful life of at least three years." The implementing regulations included a variety of active and passive systems as well as systems for swimming pools and hot tubs. The regulations also were written to include warranty requirements and mandatory conservation measures. In addition, both sets of regulations provided for administrative discretion to exempt unique systems from meeting the specific criteria. An applicant can request such exemptions and it may be granted by the administrative agency. Also, both states have provisions for including solar systems not specifically listed in the regulations.

In some situations, incentive legislation may include no provisions for criteria. An example is the Oregon property tax exemption for solar energy equipment which is silent on which equipment qualifies and does not direct the development of criteria.[34] Legislation recently adopted in California providing for solar loans simply directs the California Energy Commission to develop criteria.[35] In some states, these examples might be an excessive delegation of legislative authority. Also, questions can be raised to whether it is good policy to leave so much discretion in administrative agencies.

The detail of implementing regulations can vary considerably. The regulatory provisions for the Oregon tax credit are 15 pages long, while the regulations for the Oregon veterans' loan program consist of three short statements. Both programs use virtually the same statutory definitions of "alternative energy device."

The existence of the two sets of regulations in Oregon raises other interesting issues. Why have two sets of criteria and what are the effects of so doing? The purpose of the Oregon veterans' loan program is to provide loans to eligible veterans. The program is oriented to providing a service to as many veterans as can qualify. Also, for all practical purposes, it is financially independent from the rest of state government. The criteria are very general. The tax credit program, on the other hand, tries to balance promoting solar applications, encouraging good quality systems, and protecting the state treasury. Therefore, its regulations are more detailed. This dual system seems not to have caused problems in practice although it may be too early to make a definitive judgment.[36] People participating in both programs

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[33]California Revenue and Taxation Code § 17052.5.

[34]Oregon Revised Statutes § 307.175.

[35]California Health and Safety Code § 41261.

[36]Clark, Norm, Oregon Department of Veterans' Affairs, conversation with the author, July 12, 1978.

normally go to an office of the Department of Veterans' Affairs first where they are told about the tax credit program and that its criteria are different from the loan criteria.

In the future, states establishing "qualifying standards" for state incentives will need to consider the criteria for the federal income tax credit. States may wish to use the federal criteria (not adopted at this time). Good reasons may exist for deviations, such as when the federal provisions do not apply to a type of system the state has determined to be useful. If differences are to exist, they should be carefully spelled out to avoid confusion to the consumer.

In establishing criteria for incentive programs, sufficient time must be allotted for manufacturers to comply with the regulations. For example, in California the guidelines and criteria for the tax credit have been implemented while a decision as to whether certification is required for the tax credit has been postponed. One of the reasons for delaying the certification requirement is that manufacturers would not have had time to comply; when equipment begins to become certified, a decision presumably will be made on making it a condition of tax credit eligibility.

Criteria for state incentives probably always should be adopted as formal regulations. California again provides a good example. Although the certification program has not been adopted as formal regulations, the tax credit guidelines and criteria have been. One reason for doing this is to provide more certainty to the taxpayer because regulations generally are considered more difficult to change.[37] This difficulty, however, may be a disadvantage as implementation problems are discovered.

Linking certification to state incentives appears to be an effective way of protecting the consumer and also protecting the state treasury. If this link is made, the program should do the following:

- provide for home-built systems;
- provide for systems, such as passive, which are not certified in the conventional sense;
- provide for innovative and alternative approaches; and
- provide for the resale of equipment initially sold before the certification requirement.

The California Tax Credit Labeling Program, described earlier, is unique in that it provides assurance to a consumer that the system meets the adopted guidelines and criteria; it has no connection with the certification program. The program is administered by the California Solar Energy Industry Association and the labels (bearing the name of The State of California) are

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[37] Wheatland, Gregg, California Energy Commission, conversation with the author, July 11, 1978.

applied by the installers. The program also is unique at the state level because no enabling legislation exists and because the concept originated largely from the private sector. Several concerns have been voiced on the proposed system:

- tax credit labeling may be confused with equipment certification;
- considerable authority is being delegated to a private association; this includes placing a "State of California" label on solar systems;
- consumers may interpret the label as a state guarantee;
- labeling of passive systems will be especially difficult to monitor; and
- the Energy Commission may be liable if subsequent monitoring shows that the system does not meet eligibility requirements.

The program, if implemented, will be voluntary--a label will not be required to receive the tax credit.

The Tax Credit Labeling Program will be very useful in providing information for the analysis of the tax incentive program. A form must be submitted on every installation provided with a label. This information can be used by both the industry and the state in analyzing the specific types and locations of installations.

4.5 CONCLUSIONS

Initiation of Programs. States should begin to develop solar equipment standards and testing and certification programs only after exploring other alternatives. If the primary purpose is to provide quality assurance of solar equipment, the national programs being developed should satisfy this requirement. If they do not, the best approach appears to be to work with the organizations establishing the national programs. A good national program should produce standards suitable for all regions. If this approach is not satisfactory, and the state still feels a need for additional or different standards, such standards development should be tied in as closely as possible with national standards and should provide a mechanism for converting to a national standard should one be adopted. Another approach that may be useful is to adopt a national standard while providing an alternative path for equipment that is very new or innovative.

Focus on Objectives. The first step in implementing a testing and certification program is to determine its objectives. The type of program that is developed as well as the techniques of implementation should then be tailored to these objectives.

Evaluation. Evaluation should be built into any testing and certification program. This is needed to determine if the program is meeting its stated objectives and to determine what impacts the program is having on such issues

as equipment costs, introduction of new equipment models, and burdens upon small businesses.

Implementation Addressed in Legislation. The legislation should specify how the testing and certification program will be implemented. Any program worth adopting should be worth being made to work. The legislation should provide for implementation flexibility.

Comprehensive Approach. The implementation program should be comprehensive. This includes education, assurance of adequate equipment data, and an enforcement mechanism. Education should extend to the industry, the general public, and state and local (if used) administrators. If a program requires the communication of information about equipment, some type of testing provisions must be made to provide this information. Enforcement is necessary to provide consumer confidence in the products.

Administrative Discretion. Broad administrative discretion may be suitable in this area because of the technical nature of the subject and the need to revise the rules because of rapid advancements. Proper exercise of administrative discretion requires clear policy guidelines in the legislation.

Benefits of Testing. The testing of solar equipment is necessary for the advancement of the technology. Testing provides information used by manufacturers to improve their equipment as well as information to consumers and others who must install, use, or maintain the equipment. Many manufacturers, especially smaller ones, do not have the capability to do this testing.

Information Dissemination. The information obtained from testing and certification programs is very important. This information should be available in a variety of forms for different users. In addition to consumers and manufacturers, these include designers, installers, building inspectors, lenders, and maintenance personnel. The information should be useful to people in different geographical areas.

Criteria for Incentive Programs. The equipment "qualifying standards" for state incentive programs should be coordinated with the criteria for the federal income tax credit and with criteria used by other states. Flexibility should be provided to cover home-built, unique, and innovative applications.

Flexibility in Certification. If formal certification is made mandatory or made a condition for an incentive program, the legislation should provide for home-built systems, for approaches such as passive heating and cooling that are not oriented toward using specific equipment components, for innovative approaches, and for the resale of equipment originally sold before the certification requirement.

Advocacy vs. Regulation. The dangers of conflicting agency responsibilities must be recognized. A state energy office usually plays an advocacy role for solar energy. This role may conflict with its regulatory functions such as assuring equipment performance, reliability, and durability. If a single agency is to do both, its internal procedures should recognize the potential conflict and provide a mechanism for dealing with it.

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APPENDIX 4-A

STANDARDS AND CODES

GOVERNMENT STATUTES, REGULATIONS, AND GUIDELINES

Federal

The Solar Heating and Cooling Demonstrations Act of 1974 (PL 93-409), U.S. Code Annotated §§ 5501 et. req.

California

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APPENDIX 4-B

INDIVIDUALS INTERVIEWED

California

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Richard Piersen, Solar Energy Specialist, California Energy Commission (July 10, 1978).

Joshua Reyneveld, Solar Energy Specialist, California Energy Commission (July 10, 1978).

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Minnesota

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Oregon

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C.J. Hill, Liaison Assistant, Department of Revenue (July 20, 1978).

Alan D. Kiphut, Solar Specialist, Department of Energy (July 20, 1978).

Section 5.0 | Land-use Planning To Ensure Solar Access

SECTION 5.0

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SECTION 5.0 SUMMARY

State incentives in land-use planning to ensure solar access are examined to determine issues in program design and implementation.

The body of available incentives are reviewed to indicate their structure and purpose. These incentives include broad legislative grants of solar rights, the application of nuisance law to solar collector shading, removal of restrictive covenants or establishment of covenants to protect solar access, provision for privately-negotiated solar easements, and land-use planning and regulation to include passive solar design and provision for active solar collection in land-use development.

State initiatives in the period 1973 to 1978 are cataloged. Most incentives cover either privately negotiated solar easements or enable local solar-related land-use planning and have been instituted in the past two years. As such, this chapter deals more with program design than implementation.

Case studies in four states (Oregon, California, New Mexico, and Minnesota) are reported on, covering both the nature of the incentive adopted and issues regarding its design and implementation. Oregon is currently engaged in a statewide, mandated local comprehensive planning process which includes consideration of energy conservation and renewable energy sources. California has recently adopted two solar access related bills which address private solar easements, subdivision design, restrictive covenants, and shading by vegetation. New Mexico has established a broad legislative grant of solar rights based on water rights law. And Minnesota has authorized the inclusion of solar energy as a factor in local land-use planning and established a private easement procedure.

From the analyses of the four case study states, the following conclusions were drawn:

- Legislation should respond to an actual need or perceived barrier and not just be a demonstration of concern by the state. Some form of solar access protection should be provided, but the remedy should be appropriately scaled to meet the problem.

- Initiatives should be analyzed by each state with an eye toward their compatibility with state politics and political structure. Such choices as enabling versus mandatory or general versus specific programs will depend upon local attitudes and expertise and the level of energy savings desired from solar energy use.

- Legislation should be carefully drafted so as to clearly indicate lines of administrative authority and the basis upon which administrative rulings must be made.

- Coordination of state-level bureaucracies with jurisdiction over land use and energy should be performed early in the adoption of a particular initiative. This is especially important in the transfer of technical information from the state to the local level.

- In order to assist local jurisdictions in the implementation of state-level initiatives, technical information such as design handbooks, model ordinances and easements, and baseline energy information should be provided as early as possible.

Recommendations for further research are included later as a part of the conclusion in Subsection 5.5.

5.1 INTRODUCTION

One of the most intractable institutional problems facing solar energy utilization is assuring access to the sun's radiant energy for the purposes of heating, cooling, and generating electricity. Although property owners technically have a right to the sunlight falling on their land from directly overhead (which occurs only near the earth's equator), there is no recognized right to sunlight slanting across another property owner's land. Some form (or forms) of solar access protection for solar energy users is needed.

Various incentives related to land-use planning have been developed at the state level to deal with solar access. Solar easements, nuisance law, removal of restrictive covenants, land-use planning and regulation, and broad legislative grants of solar rights have all been proposed as solutions to the problem of solar access. However, actual experience with administration of programs is minimal. Therefore, this chapter deals more with issues of program design than program implementation.

The purpose of this chapter is to: (1) outline the legal tools that can be used to ensure solar access; (2) catalog state legislation in this area; (3) analyze solar access initiatives in four case study states (Oregon, California, Minnesota, New Mexico); and (4) elucidate several structural issues in the formulation of solar access initiatives.

5.2 REVIEW OF THE AVAILABLE LAND-USE PLANNING INCENTIVES AT THE STATE LEVEL

5.2.1 Broad Legislative Grant of Solar Rights

5.2.1.1 Prescriptive Rights

English common law contains a provision which grants a solar right based on the enjoyment of sunlight over a protracted period of time (a prescriptive right). This provision has not been recognized in this country because it was felt to be inappropriate to the development needs of a rapidly growing nation. This may still be the case. However, a transition to greater use of renewable energy flows may require consideration of such an approach to solar access.

The establishment of a system for acquiring a right to light through prescriptive use is complicated by several serious problems. How long should a solar energy system be in use before a right is established? How should notice be given that a property owner is trying to establish a right? What constitutes a legitimate interruption to the establishment of a solar right? A system which permits a potential solar user to establish a prescriptive right to sunlight only over a protracted period of time (20-27 years), which could be interrupted by their neighbor at any point, seems impractical.

5.2.1.2 Automatic Right Based on Prior Appropriation and Beneficial Use

Based on concepts contained in western water rights law, a legislature could grant a right to solar access when a solar system is installed. Prior appropriation establishes a priority in time: once a solar system has been established as being in beneficial use (i.e., a collector with some minimum efficiency) no development could take place which interferes with this right. Any obstruction would constitute a public nuisance with remedy by injunction or monetary payment. Rights can be made transferrable so that they could be purchased.

This system would expedite the use of solar energy quickly at little financial cost to the state. However, several issues make the feasibility of this approach questionable:

- Altering the balance between solar and property rights may constitute a "taking" of property without just compensation.
- Priority in time is stressed so that there may be a premature use of solar energy systems in order to establish a right.
- Development plans would be disrupted if no priorities are established (conceivably a homeowner could install a solar hot water heater that blocks development of an apartment house or hospital).[1]

5.2.1.3 Solar Use Permits

Rather than an automatic granting of solar rights, permits or licenses could be used to control their use. This granting of permits could be limited to certain areas and types of solar systems and could be contingent upon a hearing process. Although this system addresses the question of development priorities, premature use and the taking issue are still problems. Case-by-case review would be costly and, without standards and criteria, could be subject to changes of arbitrariness.

5.2.1.4 Conclusion

In sum, broad legislative grants of solar rights would seem to be questionable based on the issues of taking and inflexibility. Only one state, New Mexico, has attempted to implement such a system. The New Mexico Solar Rights Act, based on water rights law concepts, will be analyzed in the case study section.

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[1] Miller, Alan S., et al., Solar Access and Land Use: State of the Law, 1977, Environmental Law Institute for National Solar Heating and Cooling Information Center, Rockville, Maryland.

5.2.2 Nuisance Law

Although public nuisance law deals with substantial interference with public health, safety, or welfare, jurisdictions could declare the shading of solar collectors to be a public nuisance. This removes the burden from the individual solar user who might try to declare shading a private nuisance. Karin Hillhouse has pointed out that to succeed in a private nuisance suit, the plaintiff must show irreparable damage and a greater hardship than would be caused by enjoining the defendent's activity.[2] This may be a standard solar energy users could not satisfy. In addition, courts seldom call a particular use of property a nuisance if the legislature has authorized that use through zoning laws.[3]

Even after the declaration of shading as a public nuisance, several problems still exist:

- Lawsuits may be necessary in each individual case to prove nuisance.
- Owners of restricted property may deserve compensation and none may be available.
- Damages and not injunctive relief may be available in only half of U. S. jurisdictions.
- A nuisance suit before the installation of a solar system may be dismissed as being premature (or not "ripe for decision").[4]

The State of California has just instituted a public nuisance approach to controlling vegetation that may shade solar collectors. The California Solar Shade Control Act will be discussed in the case study section.

5.2.3 Restrictive Covenants

Restrictive covenants are promises involving the use of land found in deeds. Frequently they control aesthetics and, as such, can be obstacles to the use of solar energy. State jurisdictions can declare any new covenants restricting solar use void, and thus unenforceable by the courts. In addition, the state legislature can make a statement of public policy that any covenants which unduly restrict solar energy use are not in the public interest; courts may be able to declare covenants void and unenforceable retroactively, depending upon constitutional restrictions. California's Solar Rights Act of 1978 contains such provisions and will be analyzed in the case study section.

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[2] Ibid., p. 7.

[3] Ibid., p. 6.

[4] Ibid.

Restrictive covenants can also be created that guarantee solar access. They would be similar in wording to easements (discussed in the next subsection) and enforced like equitable servitudes in that injunctive relief rather than money damages would be available. In establishing such restrictive covenants, notice to all involved property owners is critical to prevent challenges on the basis of due process.

Restrictive covenants are mostly applicable to new residential neighborhoods. Large-scale developments could be required to provide such agreements; a developer's lawyer can easily add language to deeds at little cost. Even though a landowner does not directly participate in the covenant, they would have standing to sue if they were harmed by a breach of contract. Extensive legal costs and delays may then follow.[5]

5.2.4 Private Acquisition of Solar Easements

A solar easement is:

> . . . an agreement between a solar energy system owner and his neighbor that the neighbor will not use his property in a way that will shade the solar collector.[6]

This approach minimizes government involvement and does not interfere with existing property rights. Privately negotiated solar easements are probably the most politically acceptable approach to guaranteed solar access, but public requirements regarding extensive solar utilization may not be met fully through discrete private actions.

Written express solar easements are already probably valid. However, legislation authorizing privately negotiated solar easements clears any doubt, establishes standardized procedures, and gives notice to the citizenry that such a legal mechanism is available. Typical legislation includes the following provisions:

- the same conveyancing and instrument recording requirements for solar as for other easements;
- requirements that valid easements contain angles to which the easement extends and terms and conditions of granting and termination;

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[5] Ibid.

[6] Protecting Solar Access, Report of the Governor's Special Study Committee on Solar Rights, Office of State Planning and Energy, Department of Administration, State of Wisconsin, Madison, Wisconsin, April 1978.

- means of compensating the solar energy system owner in case of interference; and
- provisions for compensating the property owner subject to the easement for maintaining such an easement.

Several problems limit the usefulness of privately negotiated solar easements:

- They are voluntary in nature.
- Enforcement may involve long and costly court proceedings.
- There may be resistance among neighbors to seek legal agreements, a situation that could be critical if a new neighbor moves in.
- The cost of the easement may be an unjustified windfall to the burdened landowner who didn't plan to obstruct the solar collector anyway.
- Cost of easements to the solar energy system owner may be high, especially in cases where multiple easements are required.

Despite these difficulties, legislation authorizing privately negotiated solar easements is a relatively simple and noncontroversial measure states can take to mitigate solar access issues. Easements can effectively be used in conjunction with other implementation measures such as zoning to provide insurance against changing conditions. Two states with provisions for private solar easements, Minnesota and California, are discussed in the case study subsection.

5.2.5 Public Acquisition of Solar Easements

In order to address the issue of incomplete coverage raised previously, the legislature could give authority to local governmental units to acquire easements by negotiated agreement or, if necessary, by condemnation. The local government could act on its own initiative or upon petition by individual landowners. Condemnation proceedings are applied for reasons of public use, and solar energy utilization may not be a public use in all circumstances.

Public acquisition of solar easements can be handled on a broader scale than private easements and exercised as a part of other local land-use tools. Costs of the easements and administration may be high, however, and if a landowner contests the acquisition or amount of compensation, numerous judicial appeals could result.[7]

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[7] Ibid.

The California Solar Rights Act of 1978 enables local jurisdictions to require the granting of solar easements in new subdivision design. This provision will be discussed in the case study subsection.

5.2.6 Land-Use Planning and Regulation

In many states the legislature has granted local jurisdictions the authority to regulate land use based on the promotion of public health, safety, morals, and general welfare. Typically, this regulation is in the form of zoning and standards regarding building height, setback from streets and neighbors, lot size and coverage, permitted accessory uses, building orientation, and certain aesthetic controls. Through enabling legislation, states can grant statutory authority to local jurisdictions to regulate land use to promote solar access. Zoning has a presumption of validity which will aid in judicial acceptability of this approach.[8] Legislation enabling a zoning approach should be flexible, specific enough to give ample notice to landowners, and include a stated purpose of promoting the use of solar heating and cooling.

Promoting solar access through land-use regulation provides a broader approach than private easements (also saving private landowners the expense of easements); and creates a procedure for making tradeoffs between solar utilization and development pressures. Some potential problems with this approach are:

- One expert estimates that only 5,000 out of 60,000 jurisdictions with power over land use exercised zoning powers in 1974.[9] However, these 5,000 jurisdictions probably represent the great percentage of total population within urbanized regions where access is most critical.

- Zoning for the purpose of ensuring solar access may diminish the value of some property. Whether or not this will be considered an unjust taking of property without compensation will likely vary with state attitudes.

- There will be an expense associated with redesigning plans, especially for built-up areas.

- Local politics and special interests may create uncertainty with a high potential for variances.

- Designing land uses for solar utilization may create conflicts with other goals such as densification to reduce reliance on automobiles.

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[8] Phelps, Dennis and Yoxall, Richard, "Solar Energy: An Analysis of the Implementation of Solar Zoning" in Washburn Law Journal, Vol. 17, 1977, pp. 147-162.

[9] Miller, et al., op cit. p. 19.

- Regulations usually only apply to new development.

Oregon is presently involved in a statewide mandated local comprehensive planning process which includes energy conservation measures. Minnesota has passed legislation allowing local jurisdictions to include solar access considerations in planning. California has mandated that local governmental units include passive or natural heating and cooling in new subdivision design "to the maximum extent feasible."

5.3 STATE LAND-USE PLANNING INITIATIVES IN THE PERIOD 1973-1978

Some 14 states have enacted land-use planning provisions to ensure solar access. Table 5-1 contains a summary of state initiatives, including the year enacted and the chapter number.

Most of this legislation has been passed in the past two years. Oregon's 1973 initiative dealt generally with land-use planning and only included energy considerations in 1975. Colorado was the first state to enable privately negotiated solar easements in 1975.

The majority of initiatives have dealt with solar easements. This is due in part to their political acceptability and low cost to government. Enabling legislation to include solar access provisions in local land-use planning is the next most popular incentive. Once again, the political impact is low since localities can engage in solar-related land-use planning at their own initiative. New Mexico's solar rights law (discussed in the case study subsection) represents a significant departure from these last two approaches. As a broad, mandatory legislative grant of solar rights, it is conceptually simple but administratively complex. Another significant departure is represented by two recently enacted bills from California. In addition to a typical solar easement provision, specific sections deal with shading by vegetation, removal of restrictive covenants, and passive design in subdivisions. This use of specific implementation tools oriented to local conditions is discussed in the case study analysis.

5.4 THE EXPERIENCE OF IMPLEMENTING LAND-USE PLANNING INCENTIVES IN SELECTED STATES

5.4.1 The Choice of Case Study States

In order to develop a perspective on the implementation of solar access provisions at the state level, four case study states were selected for analysis: Oregon, California, New Mexico, and Minnesota. SERI personnel visited each state and telephone interviews were conducted with the principal implementors of the incentives. (See bibliographies.) In addition, contacts were made at the local level to determine what problems may exist in implementing legislative provisions.

TABLE 5-1

STATE INITIATIVES TO ENSURE SOLAR ACCESS

Colorado	1975	CH 326	Creates Solar Easements
California	1978	CH 1154	Creates Solar Easements Removes Restrictive Covenants Mandates Passive Design in Subdivisions
		CH 1366	Creates Solar Shading/Nuisance Provisions
Connecticut	1978	PA 314	Enables Solar Access in Planning/Zoning
Florida	1978	CH 309	Creates Solar Easements
Georgia	1978	A 1446	Creates Solar Easements
Idaho	1978	CH 294	Creates Solar Easements
Kansas	1977	CH 227	Creates Solar Easements
Maryland	1977	CH 934	Creates Solar Easements Enables Solar Access Restrictions
Minnesota	1978	CH 786	Creates Solar Easements Enables Solar Access Considerations in Planning/Zoning
New Jersey	1978	A 561	Creates Solar Easements
New Mexico	1977	CH 169	Creates "Sun Rights" Provisions
North Dakota	1977	CH 425	Creates Solar Easements
Oregon	1973	ORS 197	Mandates local comprehensive land use planning (which includes consideration of renewable energy sources).
Virginia	1978	CH 323	Creates Solar Easements

Solar Access: Access to incident sunlight necessary for solar utilization

Solar Easement: Any easement defining solar skyspace for the purpose of ensuring adequate exposure for a solar energy system.

Oregon is currently engaged in a statewide, mandated local comprehensive planning process which includes consideration of energy conservation and renewable energy sources. California has recently adopted two solar access-related bills which address private solar easements, subdivision design, restrictive covenants, and shading by vegetation. New Mexico has established a broad legislative grant of solar rights based on water rights law. And Minnesota has enabled the inclusion of solar energy as a factor in land-use planning and established a private easement procedure.

The next subsection contains an analysis of programs in land-use planning to ensure solar access. State material is used for purposes of illustration only. In the succeeding subsection, for each state, a summary is presented of their particular incentive followed by a listing of state-specific issues regarding implementation. A bibliography of materials used in this analysis is presented at the end of this section.

5.4.2 Analysis of Programs

From the analyses of the four case study states, several issues emerge concerning the design and implementation of programs designed to provide solar access protection:

- Promoting solar energy use is, in general, a popular political stance and state legislators seem willing to pass legislation. However, we found a large gap between legislative intent and action at the local level. In Minnesota, regional planning authorities were unaware of recent legislation mandating the consideration of solar access in regional plans. An Oregon provision often quoted as a pioneering effort in solar-related land-use planning (Chapter 153 of Oregon Laws of 1975) was repealed when the planning law was rewritten. Local-level planners did not know that it was once in force and that it had been removed. Legislation should respond to an actual need or perceived barrier and not just be a demonstration of concern by the state. In a rush to pass legislation, more harm than good may be accomplished in the name of solar energy. The lack of solar access is widely perceived to be a barrier to solar utilization, especially by such important actors as lending institutions. Some form of legal guarantee should be provided, but the remedy should be appropriately scaled to meet the problem.

- A broad range of land-use initiatives to ensure solar access are available. They range from enabling legislation to include solar access considerations in local land-use planning to mandatory programs, such as California's inclusion of passive solar design in subdivision maps. The choice of mandatory versus voluntary programs depends largely on local acceptance, but it is also related to the speed with which programs are instituted and the overall energy savings desired. In Oregon's mandatory land-use planning process, the quality of discrete local efforts may not be high, but they will have been sensitized to the issues and will have established a basis upon which to engage in further planning efforts. A series of other considerations in the choice between mandatory versus voluntary

programs to ensure solar access are presented in Table 5-2. Initiatives can also be seen as general, such as in local comprehensive planning, or specific, as in the case of privately negotiated solar easements. While local comprehensive planning is an ongoing process into which solar factors can be injected, specific measures may be cheaper, quicker, and more uniform in coverage. It may take a relatively long time for local planners in Oregon to include passive measures in subdivision design, but California's recent legislation will accelerate adoption of this strategy in that state. At the same time, a top-down planning approach does little to develop expertise at the local level and tends to discourgage innovative approaches. Table 5-3 contains a list of considerations in adoption of specific versus general initiatives to ensure solar access. In general, initiatives should be analyzed by each state with an eye toward their compatibility with state politics and political structure.

- Unclear drafting of legislation can leave doubts as to lines of administrative authority and the basis upon which administrative rulings must be made. California legislation regarding passive solar design in subdivisions calls for inclusion of passive "to the maximum extent feasible." Without administrative rulings, no clear standard exists. New Mexico's Solar Rights Act contains a definition of a solar collector that could include south-facing windows not intended as a part of a passive heating system. In the same act, it is clearly intended that authority for the administration of solar rights reside at the local level; however, the language is unclear. Legislation should be carefully drafted. Definitions are important, especially for such basics as what a solar collector is. Many legislatures have faced this problem and several models exist. Action enforcing provisions should be explicit so that a potential solar user is aware of who has what kind of legal authority.

- Land-use planning to ensure solar access is a multidisciplinary activity, involving elements of land use and energy planning. For that reason, several bureaucracies can be, and probably should be, involved. Coordination is, therefore, of critical importance. In Oregon, the Land Conservation and Development Commission is responsible for the overall local land use planning process. The Department of Energy has a great deal of expertise in the areas of energy conservation and land-use planning. Cooperation between these two agencies has come late in the planning process, at the expense of not having distributed valuable technical information to local planners in a timely fashion. Coordination of various state-level bureaucracies should take place early on, with either an energy agency or land-use planning agency taking the lead.

- Until recently, energy has not been an area of concern to most local land-use planners. Energy conservation and decentralized energy systems are issues uniquely suited to action at the local level. However, the lack of financial and technical resources is a barrier to effective action. In Minnesota, local-level planners were waiting until model ordinances were developed before initiating

TABLE 5-2

CONSIDERATIONS IN THE SELECTION OF MANDATORY VERSUS VOLUNTARY PROGRAMS TO ENSURE SOLAR ACCESS

Mandatory	Voluntary
• Overall energy reduction presumably greater	• Those localities interested in energy conservation and solar energy will initiate action
• Energy is an issue of statewide concern	• Low local level of expertise does not justify mandatory requirements
• Common format facilitates transfer of experience and information	• Gives more time for experimentation in order to develop a better body of information
• Addresses issues that tend to span jurisdictional boundaries	• Lower cost to local and state government
• Creates timetable and objectives	• Does not require state bureaucracy to monitor local activity
• Even application implies fairness	• Less controversial and therefore can be adopted sooner
• Mandatory program implies state funding, monitoring, evaluation	• Better adapted to local needs and responses
• Initiates action	
• Legal uniformity	

TABLE 5-3

CONSIDERATIONS IN THE SELECTION OF SPECIFIC VERSUS GENERAL INITIATIVES TO ENSURE SOLAR ACCESS

Specific	General
• May be cheaper, quicker, more uniform	• Provides for ongoing planning process
• May not respond to local conditions, i.e., shading bill in hot, humid areas	• Responsive to local conditions, goals
• May not require detailed studies or plans for effective implementation	• Addresses energy related issues in other sectors, i.e., limiting urban growth to encourage densification which leads to less transport-related energy consumption
• Assures that some type of implementation activity will actually take place	• Longer startup time may be required to develop specific implementation tools
• Provides for citizen enforcement through judicial review	• Educates local citizens, planning commissions, etc.
• Establishes a precedent which may initiate further implementation strategies	• Spurs creativity, innovative approaches
• Publicizes solar energy more quickly	

action in their own jurisdictions. The quality of energy conservation elements in local Oregon comprehensive plans was varied, depending on the interest and knowledge of consultants or staff. In order to assist local jurisdictions in the implementation of state-level initiatives, technical information such as design handbooks, model ordinances and easements, and baseline energy information should be provided as early as possible. This type of information is presently available and more definitive work is being presently prepared (forthcoming solar access publications by the American Planning Association and the Environmental Law Institute).

5.4.3 State-By-State Analysis

The following analyzes land-use planning incentives to ensure solar access in the four case study states. A summary of the particular state's incentive is followed by a list of several issues involved in program design and implementation.

5.4.3.1 Oregon

Oregon is currently engaged in a statewide, mandated local comprehensive planning process which was enacted in 1973 in the form of the Oregon Land Use Act (ORS 197). Major amendments were made in 1977 which clarified agency responsibilities and procedures to be used in reviewing local plans. A Land Conservation and Development Commission (LCDC) was created to adopt statewide land-use planning goals and guidelines to be used in the formulation of city and county plans. Completion of the planning process is slated for July 1980. A Department of Land Conservation and Development (DLCD) was also formed to review local comprehensive plans and provide coordination and planning assistance. Nineteen goals with guidelines were adopted effective January 1, 1975. These range in subject matter from recreation and housing to ocean resources and forest lands. Goal 13 specifically addresses energy conservation:

> Goal: to conserve energy. Land and uses developed on the land shall be managed and controlled so as to maximize the conservation of all forms of energy, based upon sound economic principles.[10]

A series of six guidelines follow, including consideration of renewable energy sources:

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[10] Statewide Planning Goals and Guidelines, Department of Land Conservation and Development, Salem, Oregon, undated.

> Whenever possible, land conservation and development actions provided for under such plans should utilize renewable energy sources.[11]

While originally intended to be mandatory in nature, the guidelines were made advisory after objections regarding overburdening from local jurisdictions. It is not clear how many comprehensive plans will, therefore, address the guidelines. DLCD cannot interpret the goals other than by the goal language itself. Consideration of land-use planning for renewable energy sources, therefore, is not a mandatory part of the comprehensive plan.

A related goal, number five, requires an inventory of natural resources, noting their location, quality, and quantity. This inventory is applicable at the county level. Only those renewable energy sources unique to certain areas, e.g., geothermal or wood, will apparently be inventoried.

Issues. Oregon is presently engaged in its first statewide planning effort. Considerable tension exists between what is regarded as an overriding state need for land-use planning and local desire for autonomy. LCDC has been and is subject to political attack (due to resistance to planning in general) which may limit its impact.

Certain goals are receiving greater emphasis than energy conservation, in part because they set clearer standards for local planning. However, the total package of goals may all serve to reinforce conservation concepts. Urban growth boundaries, agricultural land preservation, economic development, and housing are perceived as being the major goals. Some eight goals mention energy considerations, so it is possible that energy concerns will be addressed in the context of other goals.

There is a lack of technical information on energy conservation techniques for local planners. The Oregon Department of Energy is in the process of preparing a handbook and certain cities, notably Portland, have been engaged in sophisticated energy conservation efforts. At issue is the transfer of this information. Local planners and DLCD itself are concerned that technical information deriving from LCDC would be perceived as additional requirements from the state.

Since guidelines are now considered advisory, there is little basis for the rejection (or approval) of local plans based on vague goal language. In order to deal with a large number of plans submitted for acknowledgement, the DLCD staff has prepared a draft "checklist." This checklist reflects the extent to which there is a lack of criteria to judge local compliance.

Three criteria are established with three possible responses: yes, no, and unclear:

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[11] Ibid.

- Does the plan contain policies addressing energy conservation?
- Do the policies take advantage of energy conservation opportunities present in the jurisdiction?
- Are there implementation measures to carry out the policies?

Since expectations at the state level regarding the completeness of local planning efforts are low, there is a need for ongoing plan revision and review as energy conditions and the level of available technical information change. The concept of post-acknowledgement procedures is now receiving attention by LCDC. Many local jurisdictions who consider themselves "innovators" see the need for project grants and immediate marketing information rather than continued planning.

5.4.3.2 California

California has recently adopted two bills related to solar access, the Solar Shade Control Act and the California Solar Rights Act of 1978, effective January 1, 1979. This analysis will only be able to outline the provisions of each act and address implementation issues in a speculative manner.

The Solar Shade Control Act is an attempt to deal with the issue of solar energy system shading by vegetation. It contains the following provisions:

- Any person owning or in control of property is prohibited from placing any new vegetation or allowing vegetation to grow that would shade more than 10% of a solar collector surface from the hours of 10 a.m. to 2 p.m.
- Replacement of an existing tree or shrub is allowed.
- The 10% maximum shading is figured over the entire year, not just at the point of installation or at a specific date.
- Trees planted, grown, or harvested on timberland or on land devoted to the production of commercial agricultural crops are exempt.
- A person who utilizes vegetation as a part of a passive or natural heating and cooling system which impacts a neighboring active solar system can be declared exempt if they can show a greater net energy savings than the active system impacted.
- After a notice is filed by a district, city, or prosecuting attorney, a "shader" has 30 days in which to bring his property into compliance. Maintaining vegetation which shades a solar collector is a public nuisance and is subject to a fine of $500/day.
- Any city or county can adopt an ordinance exempting their jurisdiction from the provisions of the Act.

The California Solar Rights Act of 1978 contains several provisions dealing with solar access, including an easement procedure and provisions voiding restrictive covenants that restrict solar energy use and precluding legislative bodies from enacting ordinances restricting or prohibiting the use of solar energy systems; a requirement that tentative subdivision maps provide, to the maximum extent feasible, for future passive or natural heating or cooling opportunities; and an authorization to local legislative bodies to include by ordinance a requirement that solar easements be dedicated as a condition to approval of a subdivision map.

Easements: The law establishes minimum contents of a solar easement, including a description of the dimensions of the easement expressed in measurable terms, the restrictions placed upon vegetation, structures, and other objects which may obstruct sunlight, and the terms or conditions of revision or termination. The cost of the easements will be considered as part of the total solar energy system cost for the purpose of the tax credit.

Restrictive covenants: It is the policy of California to promote and encourage the use of solar energy systems and to remove obstacles thereto. Any restrictive covenant which effectively prohibits or restricts the installation or use of a solar energy system is void and unenforceable. "Reasonable" restrictions which do not significantly increase the cost of the system or significantly decrease its efficiency and which allow for comparable alternative systems are allowed.

Land-use planning: Legislative bodies are precluded from enacting ordinances restricting or prohibiting the use of solar energy systems. Tentative subdivision maps shall "provide to the extent feasible, for future passive or natural heating or cooling opportunities." The legislative body can require by ordinance the dedication of easements to all lots in the subdivision to ensure access to solar energy. The builder/developer has the choice whether to claim the tax credit themselves or pass it on to the subsequent homeowner.

Issues. The Solar Shade Control Act is an attempt to deal with the problem of solar energy system shading by vegetation only. A great deal of controversy exists regarding statewide regulation of vegetation when trees and shrubs can be effectively used for cooling purposes, thus saving energy, in certain regions within the state.

The basis for making such a tradeoff is established within the legislation, but without guidelines an individual is left with the difficult task of proving greater benefits from shading than without. Most legislative bodies in regions with significant energy benefits from shading will probably opt out of the Act. Proposition 13 has reduced local funds available for enforcement of such provisions, thus further making the opt-out provision more attractive.

In regard to the Shading Control Act, the removal of restrictive covenants, and the acquisition of solar easements, the initiative is left to the individual homeowner. The potential solar users' awareness of the legal remedies available to them and the manner in which such remedies operate will be critical to implementation.

Legislation regarding land use calls for the provision "to the maximum extent feasible" of future passive solar design in tentative subdivision maps. No specific mandate is contained within the legislation for the development of guidelines to aid local planners in such design. Examples are contained within the legislation and a definition of "feasible" given, but in the absence of workbooks, training programs, etc., the ability of local planners to meet the intent of this section is uncertain.

Rather than a general approach, (as is being used in Oregon and Minnesota) California is designing specific programs for implementation at the local level. Local planning and implementation is a slow process and the provision of these specific programs may accelerate this.

Dedication of solar easements within subdivisions may take some time to be established as common practice. In 1965, California enabled local legislatures to require the dedication of open space within subdivisions. Not until several jurisdictions had gained experience with the concept did the practice become widespread.

The Solar Rights Act contains a section that declares that in the event a single provision is declared unconstitutional the rest of the act shall stand. There is some question whether the state has the authority to declare existing restrictive covenants (which are essentially agreements between private parties) void and unenforceable.

5.4.3.3 Minnesota

The Minnesota Energy Agency's 1978 Omnibus Energy Bill (Laws 1978, Chapter 786 signed April 5, 1978) contains several amendments to include solar energy as a factor in land-use planning and establishes a solar easement procedure.

Planning in Minnesota is performed at the county, municipal, regional, and metropolitan levels. Variations in the provision of solar access in land-use planning exist at each level:

County planning

- Ordinances to protect and encourage solar access are allowed.
- County boards of adjustment may, when considering variances, deem inability to use solar energy as a "hardship."

Municipal planning

- Ordinances to protect solar access are authorized.
- Municipal boards of appeals and adjustments may consider that "undue hardship" includes inadequate solar access.

- Subdivision regulations may prohibit, restrict or control development to assure solar access
- For subdivision variances unusual hardship includes inadequate solar access.

Regional development commissions

- In comprehensive development plans, each region shall recognize needs such as solar access.

Metropolitan governments

- Each metropolitan area regional planning and development commission may include methods for protecting and assuring solar access.
- The comprehensive plan prepared by each local governmental unit within a metropolitan area shall include an element for protection and development of solar access.

The other solar access provision of the 1978 Minnesota Omnibus Energy Bill is a procedure for the establishment of private solar easements.

- The easement must be transferred in writing and must be recorded at the county recorder's office.
- The easement runs with the land.
- A legal document must include: real property descriptions for the benefitting and subject property; a definition of the solar angles that are to be included; any conditions of sale or transfer; and any compensation that is to be granted for maintaining the easement, and/or in case of default.
- Any depreciation caused by the solar easement can be deducted from the subject property owner's property tax assessment but will not be considered as an addition to the benefitting property owner.
- A solar easement may be enforced by injunction or proceedings in equity or other civil action.

Issues. The legislation affecting metropolitan governments inadvertently amended an outdated section of the law pertaining to the Twin Cities Metropolitan Commission, predecessor to the Twin Cities Metropolitan Council. Therefore, there is no legislation which either requires or specifically enables the Metropolitan Council to plan for solar access. However, since the 195 local governmental units within the Council (representing half the state's population) are required to plan for solar access, the Council is providing assistance. Local comprehensive plans will be submitted to the Council for

review and approval by July 1, 1980. Amendments at the state level correcting the situation are not immediately forthcoming due to a lack of funds and the promise of action at the local level.

The provisions to include solar access in county and municipal planning are considered initiating actions. Most areas are holding back until model ordinances are developed. The Minnesota Energy Agency is requesting funding to develop model ordinances and initiate "pilot" programs. County and municipal solar access provisions are in terms of zoning and subdivision regulations rather than general planning as is the case for regional development commissions and metropolitan governments. Therefore, there is a split between the specific versus general approaches within the state of Minnesota.

Neither of the two counties covering the Minneapolis/St. Paul area had any solar easements on record. This area represents approximately 50% of the state population. This may reflect a low level of solar use in this region, but there may also be a problem in the transfer of information about the availability of this legal mechanism to individual property owners.

5.4.3.4 New Mexico

One approach to assuring solar access is to base legislation on other areas of natural resources law. Water law has been advanced as analogous to solar rights because both resources are used (rather than captured or sold) and are renewable.[12]

In 1977, New Mexico passed the Solar Rights Act (Laws of 1977, Chapter 169) in which the legislatuare "declares that the right to use the natural resource of solar energy is a property right." A "solar right" means a right to an unobstructed line-of-sight path from a solar collector to the sun, which permits radiation from the sun to impinge directly on the solar collector.

Two concepts borrowed from water law are used: beneficial use and prior appropriation. Beneficial use "shall be the basis, the measure, and the limit of the solar right" in the regulation of disputes over the use of solar energy where practical. Prior appropriation means that priority in time shall have the better right except that legislatures may ordain that "a solar collector user has a solar right even though a structure or building located on neighborhood property blocks the sunshine from the proposed solar collector site." Solar rights are transferable. ". . . Permit systems for the use and application of solar energy shall reside with county and municipal zoning authorities."

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[12] Miller, et al., op cit. p. 17.

Issues. Loose legislative drafting has raised more questions than are answered in the Act. At this point it is unclear whether amendments to the Act will resolve internal inconsistencies and issues of implementation. If not, a new approach will be necessary. Judicial rulings are also seen as important to the bill's definition.

The definition of solar collectors was intended to avoid the problem of "solar toys." However, the owner of a building with a substantial amount of south-facing glass, while not intended as a part of a solar energy system, apparently could declare a solar right.

How is a solar right established? The legislature's intent was that administration would occur at the local level, but the Act's language is unclear on this point. Only a few local jurisdictions engage in zoning, although there is a statewide mandatory building code. The definition of beneficial use only mentions that it be the "measure and the limit." A possible interpretation is that a solar right has been broadly granted and only its limit is to be interpreted.

How are tradeoffs made? Prior appropriation is currently the only mechanism to determine the "better" right. Conflicts may arise where a single landowner can block development of what is considered a "better and higher" use of land. Zoning is seen as a solution to this conflict where some areas may be declared off-limits to solar rights provisions, such as the central business district. Such a condition is not provided for within the Act and whether a local jurisdiction can enact solar zoning provisions which are less strict than the state solar rights standard is questionable.

How extensive should the solar right be? In general, the more extensive the solar right, the greater the infringement on property rights. New Mexico provides for a 100% solar right: all radiation that hits the solar collector is protected. A constitutional test may be forthcoming in New Mexico. More limited approaches may be advisable, such as defining a time horizon and a small percentage of collector area permitted to be shaded.

In order to rapidly establish a solar right there may be premature use of solar energy systems.

5.5 CONCLUSIONS AND RECOMMENDATIONS FOR FURTHER RESEARCH

From the analyses of the four case study states, the following conclusions were drawn:

- Legislation should respond to an actual need or perceived barrier and not just be a demonstration of concern by the state. Some form of solar access protection should be provided, but the remedy should be appropriately scaled to meet the problem.

- Initiatives should be analyzed by each state with an eye toward their compatibility with state politics and political structure. Such choices as enabling versus mandatory or general versus specific programs will depend upon local attitudes and expertise and the level of energy savings desired from solar energy use.

- Legislation should be carefully drafted so as to clearly indicate lines of administrative authority and the basis upon which administrative rulings must be made.

- Coordination of state-level bureaucracies with jurisdiction over land use and energy should be performed early in the adoption of a particular initiative. This is especially important in the transfer of technical information from the state to the local level.

- In order to assist local jurisdictions in the implementation of state-level initiatives, technical information such as design handbooks, model ordinances and easements, and baseline energy information should be provided as early as possible.

Considering each of the land-use planning incentives outlined in Subsection 5.2, the following recommendations for further research are made:

Broad Legislative Grant of Solar Rights. Solar access protection must take a form that balances solar rights with property rights. As was seen in New Mexico, solar rights can be protected to such an extent so as to potentially halt development in some cases. In considering the adoption of a solar rights approach, it may be best to distinguish between various land-use patterns and the extent of solar access protection required.

There is probably sufficient, shade-free collector area within suburban and rural neighborhoods, although shading by vegetation and siting buildings to take advantage of passive design are of concern. Central business districts and high density residential areas may be unsuitable for conventional solar systems (flat-plate collectors) and solar access guarantees may unduly restrict development. In addition, other land-use goals such as energy conservation are served by establishing centers with high density commercial and residential development. More needs to be learned about the availability of shade-free collector area in different land-use patterns. Given this information, a better match can be made between the extent of solar access protection and the type and intensity of development.

Nuisance Law. Regulation of vegetation to prevent solar collector shading is a controversial approach. There are many benefits from vegetation (including wind screening, beauty, noise reduction, absorption of pollutants, food production, and shading itself) that need to be reconciled with the need for shade-free collector area. Climatic regions where shading by vegetation does not provide energy conserving benefits may be the only places in which this approach is justified. Classifying collector shading by vegetation as a

public nuisance means that criminal proceedings are used. Are there approaches to the problem of shading by vegetation that can recognize the benefits of shading, protect solar collectors, and avoid the use of criminal proceedings?

Restrictive Covenants. In areas where zoning is not practiced, restrictive covenants are extensively used to control the use of land. What issues face the retroactive removal of restrictive covenants and the addition of new covenants protecting solar access?

Solar Easements. Privately negotiated easements are already in use. This activity should be monitored in order to address three issues: (1) cost; (2) any difficulties with multiple easements; and (3) coverage. High cost, the need for multiple easements, and insufficient coverage would argue for a more comprehensive approach. But if private negotiation is found to be working, government intervention may not be called for.

Land-Use Planning and Regulation. State enabling legislation permitting local jurisdictions to include solar access considerations in local land-use planning is a relatively non-controverisal procedure. In states where this has occurred, how many jurisdictions are actually including solar factors in land use planning? If the number is small, is it a lack of interest or a lack of information? The provision of technical information or methods may aid local planners. Who should provide this information? Will information about land use planning for solar access prepared at the national level be applicable to local-level problems? What sources are trusted by local-level planners and decision makers?

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_____, "Preliminary Review Draft, Post Acknowledgement Review Procedures," undated.

_____, "Statewide Planning Goals and Guidelines," undated.

APPENDIX 5-A

ATTENDANCE

NMSEA SOLAR RIGHTS SYMPOSIUM

October 7, 1978

Bob Stromberg	NMSEA
Bruce Allen	NMSEA
Harry M. Davidson	Albuquerque Environmental Health P.O. Box 1293 Albuquerque, NM 87103
Bobbi Mundy	2235 Bosque Farms Blvd., Suite A Bosque Farms, NM 87068
Robert Benjamin	315 Rover Boulevard Los Alamos, NM 87544
Doug Balcomb	
Bob Wells	2202 Hoffman Dr. NE Albuquerque, NM 87110
Larry Sherwood	NMSEA
David Miller	NMSEA
Gene Roll	1718 N. McAllister Tempe, AZ 85281
Peter Pollock	SERI
Michael A. Warren	University of Denver Law 1741 Marion Street Denver, CO 80218
Mel Eisenstadt	7800 Phoenix NE
Bill and Karin Hillhouse	666 Humboldt Street Denver, CO 80218
Paul Sturiale	The New Mexican 202 E. Marcy Santa Fe, NM
John Lucero Rex King	Albuquerque Planning Department P.O. Box 1293 Albuquerque, NM 87103

Jan C. Vanerven	Bernalillo County Zoning Administration 513 6th Street NW
M.L. Morton	N.M. Energy and Minerals Department P.O. Box 2770 Santa Fe, NM
Larry Palmiter	NCAT Box 3838 Butte, MT 59701
Lina K. Robinson	Consulting Services 2038 N. 22nd Place Phoenix, AZ 85006
Bill Lazar	NMSEA
Vernon Kerr	113 Sherwood Los Alamos, NM 87544

APPENDIX 5-B

INDIVIDUALS INTERVIEWED

California

Telephone Interviews:

Gregg Wheatland, Legal Council, California Energy Commission.

Tom Willoughby, Consultant, Assembly, Committee on Resources, Land-Use and Energy.

Wayne Parker, Deputy Director, Solar Cal.

Aggie James, Executive Secretary, California Solar Energy Industry Assoc.

Bill Keiser, Legal Counselor, League of California Cities.

Personal Interviews:

Karin Nardi, Consultant, Assembly Committee on Resources, Land-Use and Energy: Sacramento, California, (August 4, 1978).

Minnesota

Telephone Interviews:

Mark Monson, Energy Technical Analyst, Minnesota Energy Agency, St. Paul, (September 26, 1978 and January 15, 1979).

Paul Smith, Environmental Planner, Metropolitan Council, St. Paul, (September 27, 1978).

Peter Tripec, Research Analyst, League of Minnesota Cities, St. Paul, (September 27, 1978).

Suzanne Stewart, Legislative Analyst, Minnesota Energy Agency, St. Paul, (September 29, 1978).

John Gostivich, Researcher, Minnesota House Energy Committee, St. Paul, (October 5, 1978).

James P. Uttley, Local Planning Assistance, Twin Cities Metropolitan Council, St. Paul, (January 15, 1979).

Personal Interviews:

Mark Monson, Energy Technical Analyst, Minnesota Energy Agency, St. Paul, (August 3, 1978).

New Mexico

Personal Interviews:

Pat Brown, Director of Planning, Los Alamos, (July 18, 1978).

Joan Ellis, Attorney, Energy and Materials Department, Santa Fe, (July 19, 1978).

Gary Carlson, Energy and Materials Department, Santa Fe, (July 19, 1978).

Vernon Kerr, State Representative, Los Alamos, (July 18, 1978).

Nick Gentry, Assistant Attorney General, Santa Fe, (July 19, 1978).

Symposium on the Solar Rights Act, sponsored by the New Mexico Solar Energy Association, Santa Fe, (October 7, 1978), (participant list attached).

Oregon

Telephone Interviews:

Maggie Collins, Senior Planner, Yamhill County, McMinnville, Oregon, (September 28, 1978).

Gordon Fultz, Association of Oregon Counties, Salem, Oregon, (September 27, 1978).

Bill Mackie, Conservation Specialist, Oregon Department of Energy, Salem, Oregon, (September 9, 1978).

Lloyd Chapman, Plan Review Team, Department of Land Conservation and Development, Salem, Oregon, (September 27, 1978).

Don Masseotti, Chief Planner, Policy Development and Research, Portland, Oregon, (October 4, 1978).

Nancy Fadely, State Representative, Eugene, Oregon, (September 27, 1978).

Nancy McKay, League of Oregon Cities, Salem, Oregon, (September 26, 1978).

Brian Almquist, City Manager, and Richard Box, Planning Director, Ashland, Oregon, (September 28, 1978).

Dick Matthews, Supervisor, Research and Policy Division, Department of Land Conservation and Development, (September 27, 1978).

Marion Hemphill, Energy Conservation Specialist, Portland, Oregon, (October 9, 1978).

Personal Interviews:

Dick Matthews, Supervisor, Research and Policy Division and Lloyd Chapman, Plan Review Team, Department of Land Conservation and Development, Salem, Oregon, (July 13, 1978).

Section 6.0 State Education and Information Programs

SECTION 6.0

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SECTION 6.0 SUMMARY

This section includes a summary of findings related to program design and implementation, overviews of state experiences with information and education programs, case study reports, recommendations, and a bibliography. Information was obtained from telephone interviews with key state personnel and from the states' published reports.

A diversity of content and method exists among and within educational and information programs. Federal, state, and local organizations have designed and implemented programs focused on provision of technical and nontechnical information, dissemination of general consumer information, and development of energy-related curricula, to name only a few. Diversity of programs reflects the complexity of education and information requirements for the promotion of solar energy use. The importance of coordinating the numerous activities and programs has increased as the number of programs has increased. Despite this diversity, our preliminary findings suggest that several common factors related to the implementation process exist. Further research will determine the validity of these findings.

The preliminary findings can be grouped into those related to: (1) selection of implementing agency and program, (2) coordination of state information activities, (3) role of the state as educator, and (4) other factors. Findings for each group are given below in capsule form.

- Selection of implementing agency and program:

  * Legislation for the promotion of solar energy has not usually stipulated the type of education and information program desired; consequently, program selection, design, and delegation of administrative authority have been determined by the definition applied to "education" and information by interpreters of the legislation. Where "education program" has been defined as "curriculum development," the Department of Education has usually been involved. Where it has been defined as "workshops and seminars," the energy office has usually been responsible for program development and implementation. In some cases, this has meant that state resources which might have been valuable in designing and implementing a program have not been used. In other cases, it has resulted in duplication of effort (a situation not regarded as undesirable by some solar outreach specialists).

  * Residential consumers are most often the targets for programs; consequently, business, industrial, and governmental needs remain unsatisfied.

  * Programs usually have been selected on the basis of their frequency of use in other states; however, frequency of program selection was not found to be an indicator of program effectiveness or potential success.

- Coordination of state information services:

  * Coordination of programs between federal, state, and local agencies (public and private) has been lacking in some states. Other states have developed viable working relationships among agencies. Successful coordination usually has resulted in cases where delegation of administrative authority has been defined clearly and/or agencies have had a history of coordinated effort. Coordination depends upon the willingness of groups to cooperate with each other. In some cases, political considerations have inhibited coordination between state and local groups.

  * In many cases where state-level activity has been minimal, grassroots organizations have filled the information gap.

- Role of the state as educator:

  * States need to approach their role of educator differently depending upon the audience being addressed. Builders have expressed skepticism and resentment at state involvement in trade activities. This problem has been minimized by involving trade associations in design and implementation of programs.

- Other implementation factors:

  * Lack of adequate staff to service the education and information needs of the business, industrial, government, and public solar sectors has been a problem. One state found it difficult to find qualified instructors to staff its community college technician training program.

  * Most education and outreach programs have been federally funded. Many are housed within energy conservation programs of which some have been established by executive order. These latter programs are vulnerable to dissolution with a change in state administration.

Preliminary evidence suggests that the following issues also need to be addressed in future research:

- The desirability and feasibility of separating information/outreach program design, development, and administration from education program design, development, and administration;

- Resolution of the questions of whether energy information and education programs should be centralized or decentralized, public or private, local or regional;

- The development of evaluation criteria for selection of programs for education and information exchange;

- Determination of the degree to which monies allocated to education and information activities can and should be directed to independent groups for program development;

- Determination of the degree to which states can and want to encourage participation of grassroots organizations in the development of state-affiliated and nonstate-affiliated education and information programs.

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6.1 INTRODUCTION

Unlike preceding sections, this section is a nonanalytical, descriptive inventory of selected state-level education and outreach programs. It is not intended to be a comprehensive overview of state activities in solar education and outreach, nor does it presume to analyze or evaluate the relative merits of alternative programs. Programs are described only for those states chosen for the four main issue areas. This preliminary survey is an attempt to determine whether common implementation factors exist across state programs. Findings will serve as the basis for further analytical research on the implementation process of state education and information programs.

Education and information activities relevant to solar energy have been initiated by many states. Recognizing that awareness of energy problems and understanding of them are quite different matters, legislators have supported policies which encourage education and information programs on energy use. In some cases, the policy goals have been to promote energy use awareness and to stimulate diffusion of renewable energy technologies.

This section provides a descriptive inventory of some of these state programs and addresses:

- findings related to program design and implementation;
- overview of experiences with different types of information programs;
- overview of experiences with different types of education programs;
- suggestions for future research.

Appendix 6-1 contains case studies of selected state education and information programs.

6.2 EXPERIENCES WITH EDUCATION AND INFORMATION PROGRAMS IN SELECTED STATES

6.2.1 Findings Related to Program Design and Implementation

For the purposes of this report, information and education programs have been divided into separate categories. Information activities are defined as those which transmit information to a recipient while educational programs include not only transmission of information but also transfer of skills to use that information. Types of education and information activities conducted by states are described in Table 6-1.

Review of the various state efforts has uncovered several common factors relevant to program design and implementation:

- factors influencing selection of implementing agency and program;

- factors related to coordination of activities;
- issues related to the role of the state as educator;
- other implementation variables.

6.2.1.1 Selection of Implementing Agency and Program

Most legislative mandates have not specified an implementing agency nor the type of program to be implemented; consequently, delegation of administrative authority for programs and their content has been dependent on the definition attributed to "education" and "information" by legislative interpreters. Where "education" has been interpreted to mean "curriculum development," the Department of Education has been involved in design and implementation (e.g., Minnesota); where it has been defined as provision of general information, the local energy agency has been responsible for program development (e.g., New Mexico). This variation in interpretation of the legislation has contributed to a situation in which valuable state resources are not being employed. For example, expertise of the Department of Education is often not being used in those states where the energy agency conducts the outreach program.

Another factor related to agency selection and program design is that not all information needs are being served. The solar use sector includes, among others, builders, architects, present and potential consumers, innovators, and assessors. All have different information needs. When a state implements only a consumer-oriented education program, then other sector information needs are left unaddressed. For those whose information needs are not met, the process of information gathering is arduous and long. A survey of solar users in the Phoenix area by the Arizona Solar Energy Research Commission found that "in some cases, the information-gathering period took 30 months. Moreover, most of their information was gleaned from public library sources or from friends who owned solar installations." The report further notes that ". . . builders stressed, again and again, their uncertainty (and in some cases distrust) of the performance and reliability information they received from potential solar suppliers."* Identification of the reasons for this unbalanced situation are not within the scope of this chapter; however, it is apparent that a variety of reliable programs need to be designed to satisfy the diversity of information needs.

Choice of type of program and program content has been varied. These are discussed in more detail below. Some states have chosen information programs such as media spots, demonstration programs, and toll-free energy "hot lines." Others have developed hands-on workshops, seminars, and energy technician training programs. In some cases, establishment of a solar office has been a primary educational measure (e.g., Massachusetts).

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*Arizona Solar Energy Research Commission, Arizona Solar Energy Development Plan, March, 1978, p. 74.

Table 6-1

TYPES OF EDUCATION AND INFORMATION ACTIVITIES CONDUCTED BY STATES

Information Activities

- Assessments of state solar resources
- Development of economic analyses program for solar applications
- Development of a state Solar Plan
- Support of internal agency information needs
- Spanish translations of solar printed materials
- Compilations of state-level incentives
- Publication of guidelines to specific state incentives
- TV and radio blitzes to advertise an incentive
- Installation of solar showers in state park facilities
- Development of state and regional energy-oriented curricula for use in grades K through 12
- Development of audio-visual materials
- Development of energy information centers and libraries
- Conference design and coordination
- Operation of telephone "hot lines"
- Tours of solar buildings within the state
- Presentation of solar exhibits, displays, demonstrations
- Development of mini-grants for individual teachers for energy projects
- Support of traveling energy road shows
- Development of a state network of education and information resources

Education Activities

- Publication of solar data manuals, solar-cookery books, and basic solar information brochures
- Design and implementation of workshops
- Provision of technical support to local groups
- Development of self-instruction workshop manuals
- Training other agency staff in solar fundamentals
- Development of energy technician training programs
- Creation of traveling mini-workshops on solar energy fundamentals and applications

Programs usually have been selected on the basis of their frequency of use in other states; however, frequency of program selection is not an indicator of program effectiveness or potential success. Although workshops often have been chosen, no criteria exist yet for comparing workshop effectiveness with the effectiveness of an alternative program. In short, program choice has not been based upon program evaluation.

Most programs have been federally funded (usually via ECPA) and have been tied to energy conservation programs. In those states where solar energy potential is greatest, these programs have focused on solar energy alternatives. Energy conservation measures have been stressed in those states with limited solar potential.

6.2.1.2 Coordination of Informational and Educational Activities

Many states have developed several information and education programs. New Mexico, for example, has three energy institutes, a Solar Energy Institute, an Energy Extension Service, and numerous independent solar activist groups. For some states, lack of coordination among the different information programs has resulted in duplication of effort. Some do not consider this duplication undesirable but instead perceive it as contributing to the diversity of the overall state program.

Experience has shown that coordination is needed at many different levels:

- between incentive programs (particularly RD&D) and information outreach programs;
- between the regional solar energy center and the state agencies;
- between state agencies and departments;
- between state agencies and independent groups.

Some states have successfully coordinated activities and agency efforts. Massachusetts has built outreach activities around the HUD solar hot water heater initiative. California's tax credit has been the subject of media spots and printed materials. The California Solar Energy Association and the Energy Commission have developed a "CalSEAL" program which certifies solar systems which qualify for the tax credit. Minnesota's Energy Agency (MEA) and Department of Education have developed a working relationship in which the MEA channels funds for education programs to the Department of Education. (See Appendix 6-1 for a full description.) In New Mexico, the Energy Extension Service distributes information developed by the Solar Energy Institute. Montana is developing a statewide network of groups involved in solar activities.

Coordination depends upon the willingness of groups to work together. This has been a problem in states where either the state agency does not wish to become affiliated with independent, particular interest groups or where local groups have renounced state involvement for political, philosophical, or other reasons. (California has experienced both problems.)

Grassroots information and education programs have been strong where state programs have been minimal. In Colorado and Montana, state programs have built upon established grassroots outreach programs.

6.2.1.3 The Role of the State as Educator

The role played by the state as educator is another significant factor in the implementation of state education and information programs. Experience in Colorado and California has shown that states need to approach this role differently depending upon who they are trying to educate. State government designers of conferences for builders encountered resistance from building tradespeople to state involvement in trade activities. Some builders felt the state had no role in educating them about their field. This problem was diminished by involving union and industry people in the design and implementation of the conferences and by having the state maintain a low profile. Similar problems have not been encountered by programs aimed at consumer groups.

6.2.1.4 Other Implementation Variables

In addition to the problems discussed above, unique implementation failures and successes have been experienced by the states. (See each case study report, Appendix 6-1, for a full description of experiences.) Some examples of problems are:

- Due to lack of adequate staff, Arizona has not been able to handle the large number of information requests and other state educational needs.
- Minnesota's technician training programs have found it difficult to locate qualified instructors.
- New Mexico's Department of Education has been unable to develop energy curricula because of insufficient funds and staff time.

Some examples of successes are:

- Oregon may design an energy technician program by rearranging existing courses into a new course of study, thereby eliminating the need for new appropriations to implement the program.
- Minnesota conducted a needs assessment before implementing a technician training program. As predicted, the program has been overwhelmingly successful. Students are being hired before completing the program.
- California's Energy Commission worked with the Building Industries Association (CBIA) to develop a series of solar energy seminars for builders. CBIA involvement insured that builders' informational needs were addressed and that antagonism toward state involvement was minimized.

6.2.2 Overview: Experiences with Information Programs

Information programs include such activities as development and dissemination of printed materials, media coverage, demonstrations, exhibits, talks, and establishment of consumer hot lines and energy information centers. Education programs include workshops, seminars, technician training programs, and curriculum development. The discussion here covers only the most frequently selected programs. Complete discussions are included in the case studies, Appendix 6-1.

The most frequently selected information program has been the development and dissemination of printed materials. Every state reviewed had prepared or had obtained from the federal government, brochures and pamphlets covering basic solar energy concepts. Other states had printed information designed to satisfy specialized informational needs (e.g., available local loan programs, consumer fraud tips, resource lists of solar manufacturers). Books covering such subjects as solar cookery methods and state climatological data relevant to solar system use also had been prepared. Selection of topics for coverage in brochures usually was based on the agencies' perceptions of local information needs. Federal funds most commonly have been used to support program development.

Distribution of printed materials has been spotty. Some agencies successfully have distributed their materials throughout the state via other state organizations, conferences, and mail-outs. Others have relied on consumer requests for the materials via the information "hot lines." In New Mexico, Spanish translations of some publications have been prepared.

Demonstrations, exhibits, and talks frequently have been used to inform the public about solar energy. Staffs of the federally funded state energy offices and local Energy Extension Services have prepared slide shows, films, and solar home tours. Many of the exhibits are available on loan from energy information centers and libraries which have been specially created as depositories for the information.

Consumer "hot lines" have been set up in several states. Supported usually by federal funds, the toll-free lines serve as a switchboard for solar information. Technical and nontechnical questions can be answered; researchers, manufacturers, and consumers can be put in touch with each other.

6.2.3 Overview: Experiences with Education Programs

Education programs have included workshops, seminars, technician training programs, and curriculum development.

Workshops have been the most frequently selected educational programs. The most popular has been on the construction of attached solar greenhouses. Workshops on the construction of solar food dryers and cookers also have been popular.

Funding for workshops usually has come from grants and participant fees. The popularity of the workshop format may result from the speed and effectiveness with which the information can be transferred and from the atmosphere of conviviality shared by the participants.

Two drawbacks to workshops are that they only reach a small audience and that they require a large amount of energy office staff time. At present, most workshops address the needs of the residential consumer. Expansion of the scope of workshops will help diminish the small audience problem. One state has overcome the problem of staff time availability for workshops by developing a self-instruction workshop manual.

Seminars on solar design, performance characteristics, and economics have been frequently offered via the local community college and adult education programs. Some state agencies also have offered technical seminars for internal and other state agency staff and researchers. These technical seminars have provided a vehicle for needed communication of RD&D results and other information among state agencies involved in information and outreach. Funding has been from federal or private sources with additional costs being covered by participant fees.

A few states have developed energy technician training programs in their vocational-technical schools. Funded with state and local monies, some of the programs focus solely on solar installations while others cover energy conservation (energy audit techniques, weatherization) topics as well. The response has been overwhelming. Most programs have long student waiting lists and graduates are being hired prior to completion of the course of study. In states where local funding is difficult to acquire for establishment of new programs, already existing courses may be regrouped into an energy-oriented curriculum (e.g., Oregon).

Recognizing the importance of educating children about energy use, many states have developed or are developing energy curricula for school children. At present, most programs involve science projects (construction of solar collectors, dryer, cookers). Minnesota has prepared a social studies energy program. Federal monies, augmented in some cases by state funds, have supported school program development. In Maine, mini-grants have been made available through the energy agency to individual teachers for development of classroom energy projects. Some teachers have created libraries, others have held hands-on workshops. On a regional level, educators in DOE's Region V (Minnesota, Ohio, Indiana, Illinois, and Missouri) are beginning discussions on development of a regional energy curriculum.

6.3 RECOMMENDATIONS FOR FUTURE RESEARCH

Increase Breadth of Agency Programs. From our preliminary review, most programs appear to be oriented to the residential solar sector. The Arizona study cited earlier suggests that the business and technical sectors need and want reliable information programs. These programs would cover such topics as natural (passive) and mechanical (active) system design and installation, financial aspects (e.g., borrowing and lending factors), legal issues (e.g., building codes, land-use regulations), and grant and tax incentive

availability. Further research should examine the validity of this observation.

Separation of Education and Information Programs. Agencies need to assess the desirability and feasibility of separating information/outreach program design, development, and administration from education program design, development, and administration.

Coordination Among Programs. Coordination is needed among all levels, public and private, in order to avoid undesirable duplication of effort, to take advantage of diverse state resources, and to increase knowledge and program effectiveness. Coordination will also prevent the dissemination of contradictory and/or erroneous information.

Development of Evaluation Criteria. Criteria need to be developed for selection of programs for education and information exchange. The present method of emulation by one state of another state's program has not proven to be adequate.

Allocation of Program Design and Implementation Responsibilities. State agencies need to: (1) resolve the question of whether energy information programs should be centralized or decentralized, public or private, local or regional; (2) determine the degree to which monies earmarked for solar education and information activities can and should be directed to independent groups for program development; and (3) determine the degree to which state agencies can and want to encourage grassroots participation in the development of state-affiliated and nonstate-affiliated programs.

APPENDIX 6-1

CASE STUDIES: EDUCATION AND OUTREACH

Arizona

The numerous solar informational and educational activities in Arizona are conducted by many different state, local, and independent organizations.

The Arizona Solar Energy Research Commission (ASERC) is mandated by state law (Chapt. 58, ARS Sections 41-571) to collect, analyze, and provide information and data on solar energy technology and to enourage cooperation and involvement of those knowledgeable about solar energy in the development and use of solar technologies. The six-person Commission staff assists in operation of the "Energy Hotline" of the state Energy Information Center and obtains and distributes federal energy publications. During 1977, members of the staff gave over 200 talks throughout the state and numerous exhibit/workshops were conducted. Publications of the Commission include: an Arizona Solar Energy Directory, October 1977, a Solar Consumer Guide No. 1 and No. 2, Putting the Sun to Work in Arizona, Digest of Major Solar Legislation--State of Arizona--November 1977, and Arizona Solar Incentives--August 1977. Reports containing climatological data and information on commission-funded solar R&D projects are available also. Other publications available from the Commission include Solar Science Projects and Solar Cooling Made Easy.

Sponsorship of conferences has been another major focus of the ASERC. These included: "The Arizona Solar Cooling and Commercialization Conference," "Solar Energy Industries Association Annual Meeting," "AIAA Solar '78," "Arizona Professional's Solar Conference," "Tucson Solar '78," "Energy Month" programs at the state capitol, and "Sun Week" programs. ASERC plans to have a media blitz in November 1978 to advertise the tax credit.

ASERC outreach activities have been so numerous that, not surprisingly, one of the problems encountered has been lack of adequate staff. "Energy Hotline" phone calls alone have been too numerous for the six-person staff to handle.

Educational efforts in the schools have been diverse and decentralized. Many of the community colleges offer solar cookery, solar training, or other solar classes. University engineering and architectural departments also conduct solar classes. Northern Arizona University held a two-week solar energy training course for community college instructors. The Department of Education has established an extensive energy information library which is available to teachers who want to develop their own energy curricula. Many teachers have taken advantage of the library; one has developed a solar cooking course.

Cities, counties, and independent groups have also been responsible for solar educational activities. Mohave County established a six-member Solar Energy Commission which held workshops on construction of low-income residence attached greenhouses. Workshops for teachers were held also. The Arizona Community Action Association (ACAA) has sponsored greenhouse and solar water construction workshops throughout the state. Numerous independent organizations (e.g., Arizona Solar Energy Association, Helios, Northern Arizona University Solar Energy Club, Verde Valley Solar Energy Association, Arizonans

for Jobs and Energy) have conducted seminars, workshops, and informational programs throughout the state.

Summary: Arizona's solar-related educational and informational activities have been numerous and diverse. The Arizona Solar Energy Research Commission (ASERC), funded by the state legislature, has designed and implemented information centers, adult education programs, conferences, and workshops. Several publications on solar energy-related activities in Arizona are available. Staffing has not been adequate to satisfy all education and outreach needs.

Many universities, city and county groups, and grassroots organizations have developed programs. Some problems related to duplication of effort by the ASERC and these other groups have been reported.

California

Education and information activities of the California Energy Commission's Solar Office have been oriented primarily to provision of information of a helpful nature to residential consumers. Other activities have included organization of seminars for business people and preparation of technical papers for journals and conferences.

Developing and disseminating information about the 55% solar energy tax credit has been a major task of the Solar Office. A glossy, nontechnical brochure and a comprehensive, technical booklet providing detailed guidelines and criteria for the credit have been published. Both are available on request from the Energy Commission and are distributed at energy functions around the state. The Franchise Tax Board has printed guidelines to accompany the tax credit application forms, but refers questions about the credit to the Solar Office. Next year, a special page in the state tax booklet will describe the tax credit. The "CalSEAL," a seal certifying that a solar system qualifies for the tax credit and is certified by the California Solar Energy Association, has been developed.

Until recently, most of the Solar Office education and information publications have been general in nature covering such subjects as pool heating, hot water heating, and natural (passive) solar systems. Work has begun on a more technical series of publications. A 261-page book, Solar for Your Present Home, discusses "everything from energy conservation to the pros and cons of the various solar applications feasible in the San Francisco Bay area."* The book, designed for the layperson, includes charts, tables, and data on performance characteristics, climate, and existing Bay area retrofits. Another book, the California Solar Data Manual, provides "the basic solar data needed to design residential or commercial heating systems, solar heated swimming

*Calif. Energy Commission, Solar for Your Present Home, March 1978, p. 1.

pools, and solar air conditioning systems." In-house papers also have been prepared on solar radiation data, natural (passive) solar systems, and planning for solar access.

In collaboration with the California Building Industries Association (CBIA), the Solar Office has conducted four-hour seminars designed specifically to meet the informational needs of builders. The seminars, which are offered in different parts of the state and cost $20, cover such topics as building codes, marketing, installation, warranties, and tax credits. Response to the seminars has been overwhelming. CBIA involvement in the design of the seminars has insured that builder's needs have been addressed and has minimized builder's skepticism about the content of the seminars.

Numerous innovative education and information programs have been conducted by a multiplicity of independent solar- and energy-oriented groups in the state. The scope of the present report precludes a complete description of these programs here. Collaboration with these groups by the Solar Office has been decreasing, a situation which has been attributed to political considerations.

Summary: Information and outreach activities of the Solar Action Office have been oriented primarily to the residential consumer. Brochures, pamphlets, and books have been developed and distributed. Many relate to the tax credit. A new program of seminars for builders has been designed and implemented with the assistance of the California Building Industries Association. Industry involvement insures that seminar content addresses the needs of the participants.

Development of technical information has begun and will be a larger part of SAO efforts in the future.

Many independent groups are conducting educational and outreach programs. Coordination between SAO and these groups has been decreasing (most probably as a result of political considerations).

Colorado

Colorado does not have an independent, state-level solar office. A Solar Coordinator for the state is housed within the federally funded Office of Energy Conservation (OEC). Created by executive order, OEC and its eight community center affiliates are responsible for state-associated energy conservation and solar education and information activities. Since no formal state effort has been conducted, many independent local groups have initiated education and information programs. These are discussed below.

OEC's education and information activities have included distribution of Department of Energy solar information brochures, preparation of a Solar Energy Handbook for Colorado and organization of a one-day solar information workshop in October 1978, for builders, lenders and architects. The Solar Handbook, to be published in late 1978, provides basic information on the physics of solar energy, the varieties of solar systems, the options applicable to new construction and retrofits, and installation instructions.

Cost and distribution factors have not been decided yet. The emphasis of the workshop will be on providing information on solar system applications, availability, and financing to the professional potential solar market. Some builders have expressed resistance to the workshop contending that the state has no place "educating" them about how and what to build. This suggests that the state will need to carefully assess its role as educator and that different audiences will require different educational methods.

The absence of a state-funded solar office has been attributed to the fact that the state Legislature has not had a solar package placed before them and that the legal requirement for a 7% budget increase ceiling has prohibited creation of new programs. The effect of this situation has been to encourage grassroots educational and informational activities. In several cases (e.g., San Luis and Grand Junction), grassroots activities were already in place and operating when the OEC community center concept was adopted. These established programs were adopted by the community centers and have been a model for community center education and information programs.

Summary: Colorado's state-level, solar-oriented education and information activities have been limited by inadequate staffing and an emphasis upon energy conservation. However, a conference for the professional solar market and a handbook on solar fundamentals have been developed. As a consequence of minimal state activity, many independent, grassroots groups have taken the lead and prepared and implemented numerous solar education and outreach programs.

Florida

State-supported education and information activities have been conducted primarily by the Florida Solar Energy Center (FSEC). FSEC is mandated to provide solar energy-related technical education services, to develop and disseminate information on solar energy, to provide technical assistance to state agencies for the development of standards, and to conduct demonstration projects.*

A comprehensive educational program in solar energy has been developed by FSEC. The program addresses the information needs of the general public, educational institutions, and organizations interested in the commercialization of solar energy systems.*

Programs designed for the general public have included publications, lectures, seminars, workshops, and news media spots. A traveling lecture series, "The Sun at Work", includes three slide-illustrated mini-workshops on the fundamentals of solar energy, practical applications of solar energy, and the

*Florida Solar Energy Center Activities, December 1977.

*G. G. Ventre, "The Florida Plan for Solar Education." Paper presented to the International Solar Energy Society. Undated.

potential for solar energy as a national energy resource. In January 1977, a 10-day public information program and exhibit was held in conjunction with ERDA's Transportable Solar Laboratory.

Programs designed for educational institutions have focused on establishment of Solar Energy Institutes for Community College Teachers. The Institutes will be responsible for assessing educational needs, developing curricula, reviewing of textbooks, and assisting in the professional development of teachers. Program development at the various community colleges is expected to range from implementation of one solar-related course to establishment of associate of science programs in solar energy applications.

Other FSEC activities have included establishment of a toll-free telephone "hot line," maintenance of an extensive library of solar energy information, publication of a quarterly newsletter, "The Solar Collector," and dissemination of other technical and nontechnical brochures and pamphlets. Tours of the FSEC facility are available to visitors.

Summary: Florida has established a comprehensive solar energy information program. The program is designed to meet the needs of all sectors involved in the development of solar energy. As part of the program, a unique traveling mini-workshop lecture series has been developed to provide the general public with information on solar energy. Technically-oriented conferences and workshops have been held. Solar Energy Institutes for Community College Teachers have been established.

Maine

Educational and informational activities for solar energy in Maine have been part of energy awareness programs conducted by the federally funded Maine Office of Energy Resources.

Most programs have focused on energy conservation with solar-related activities conducted where appropriate. Activities have included poster contests, newspaper spots, and distribution of brochures.

Other educational and informational activities have been carried on by non-state-affiliated or funded groups. The local chapter of the American Institute of Architects is sponsoring a visit by the HUD solar information van in October for Energy Conservation month. Senator Muskie's Portland Office will host other federal energy exhibits.

The Office of Energy Resources has established a program of mini-grants for teachers to conduct energy activities in the classroom. The grants are disbursed by the Office of Energy Resources. Notice of grant availability was sent to principals of all public and private schools in the state. Review of grant applications was performed by a task force of educators and OER staff. Response to the program was excellent. More applications were received than could be funded. Projects ranged from establishment of energy libraries to

"hands-on" classroom workshops and science projects. Grants averaged $400 per teacher. The program has been so successful that funding has been continued for FY79 at approximately $20,000.

Massachusetts

The Massachusetts Solar Action Office, created in the Summer of 1977 within the Office of Consumer Affairs, administers federal funds for solar demonstration in the state and serves as a clearinghouse for solar information.* The major focus of state energy policy and consequently, education program, has been on energy conservation for meeting present and short-term energy needs while developing solar and other alternative energy resources as long-range energy solutions.

The placement of the Solar Action Office under the auspices of the Consumer Office is reflected in its information and education programs. Printed materials have been aimed at the needs of residential consumers: a directory of certified solar manufacturers has been compiled to assist consumers in avoiding fraudulent dealers. An inventory of Massachusetts solar industries installations and educational institutions offering solar-related courses has been published. Solar water heater installation guidelines have been prepared for participants in the HUD-sponsored Solar Hot Water Initiative Program. Self-help information brochures describing common pitfalls in buying solar systems are available through the Self-help Information Center. The brochures explicitly detail how to differentiate between manufacturers' claims, how to choose a contractor, and how to evaluate a warranty.

Several installation workshops sponsored by the Solar Action Office and the Northeast Solar Energy Center have been held for homeowners and professional installers. The program has been aimed at recipients of HUD solar water grants who want to install their solar system themselves. Response has been strong. The Northeast Solar Energy Center conducts many education programs; however, only those related to state efforts are discussed here.

Summary: While most information and education activities in Massachusetts have been energy-conservation-oriented, the Solar Action Office has been actively developing programs and information specifically in support of solar energy.

Solar information and education activities have been oriented to the residential consumer. This orientation probably has been the result of the Solar Action Office having been formed under the Office of Consumer Affairs. Several activities (workshops, guidelines) have been developed for the HUD Solar Hot Water initiative recipients. Self-help information brochures have been published. Distribution is through the Self-help Information Office and other solar-related functions.

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*Massachusetts Office of Consumer Affairs, Energy in Massachusetts: An Update of Energy Activities and Policies, May 1978.

Minnesota

Minnesota's education and information outreach programs are numerous and diverse. The Minnesota Energy Agency (MEA) is mandated by state law to collaborate with the State Department of Education on the development of an interdisciplinary environmental conservation education program for elementary and secondary schools (1977 c 381 s 20). Approximately $20,000 has been appropriated to the Department of Education to perform a curriculum needs assessment, the first phase of the curriculum development program.

The MEA staff and the Department of Education maintain a close working relationship. Monies received by the MEA are often channeled to the Department of Education for development of instructional programs. In this way, educational program development is carried on by those who are most qualified to do so, and MEA staff are freed to devote their efforts to information dissemination and outreach.

The 12-person education and information staff of the MEA includes an education coordinator, a technical writer, a technical editor, a press person, and persons associated with the energy library/information center. Bibliographies on general solar energy information and solar retrofits, lists of solar equipment suppliers and solar resource groups, a report on Legislative Options for Encouraging Solar Energy Use in Minnesota, and a basic information booklet, Solar Energy and Your Home, have been developed and made available for distribution by the staff. A film library has been compiled and is distributed through the Minnesota Instructional Materials Center. Several pamphlets containing valuable solar consumer information are available through the information center. One booklet, Who Has the Cash?, itemizes where and how Minnesota homeowners can obtain loans and grants for energy-conserving home improvements.

Curriculum development by the Department of Education has included design of a junior high school, energy-related social studies and science activities program (one activity is construction of a solar collector), preparation of a solar-oriented industrial arts program, and an updating of existing elementary curricula to include energy conservation and solar-energy-related activities. A senior high school energy curriculum is being designed presently and should be ready by 1979 or 1980.

A Solar Energy Technician Training Program is offered at Red Wing Vocational-Technical School. Response to the program has been overwhelming. Students have been offered employment prior to completion of the program. The only major problem encountered has been locating qualified instructors for the program. Red Wing also has begun development on a comprehensive energy information center, modeled after the MEA information center, to service local needs.

Many local energy awareness groups have sponsored solar demonstrations, workshops, and adult education classes. One designer/consultant noted that he has been operating a de facto solar hot water installation course: when he and his crew install a domestic solar hot water heater system, local plumbers and other tradespeople attend in order to learn the installation procedure.

On a regional level, Minnesota Department of Education staff are working with other states on the development of a regional energy information network. Operating on federal funds, the network staff would design an energy curriculum to be used regionally in grades K through 12.

Summary: Education and outreach programs in Minnesota are extensive. As a result of state legislative mandate, a major emphasis has been placed on development of K through 12 and voc-tech energy curricula. The Minnesota Energy Agency and the Department of Education maintain a close working relationship. This has facilitated design and implementation of education programs. MEA also has prepared and printed several brochures containing information relevant to local needs.

Many local groups also have conducted education and outreach programs. Minnesota's Department of Education is active in developing an energy-oriented curriculum for regional use.

Montana

Montanans have adopted the Montana Solar Plan for the systematic development of solar energy. The plan, based on the idea that solar energy "must be understood to be used," emphasizes networking as a means of coordinating educational and informational activities of research and development institutions, state organizations, and independent groups in the state and the region. The plan includes development of workshops for professionals, a solar technician training program, retrofit manuals, formal education curricula, a government employee solar training program, and a media production unit. Montana plans to use the Western Sun staff as a key resource in implementation of the solar plan; consequently, delays in formation of the Western Sun Office have slowed implementation of the plan. However, education and information activities have been begun by an independent group, Alternative Energy Resources Organization (AERO), and the state energy organizations. A first draft of a comprehensive Solar Handbook detailing the fundamentals of solar energy, basic climatological data, available manufacturers, and other pertinent information was completed in mid-1978. Energy-informative workbooks and coloring books are available on request to teachers of grades K through 12. Initial contacts with solar groups are being made by AERO in preparation for development of the information network. A slide show has been developed for presentation to community groups and schools.

The scope of the present report does not permit discussion of the activities of independent groups. However, since most of the education and outreach in Montana has been conducted by these groups, some reference to them needs to be made. (Future research will cover this topic.)

AERO maintains a "greenhouse team" which conducts greenhouse construction workshops statewide. A traveling energy show, the New Western Energy Show, travels throughout the state and the region performing energy-related dramas and conducting energy-oriented creative dramatics classes for elementary and high school students.

Although implementation of education and information activities in Montana is in its infancy, the Solar Plan provides for a systematic, coordinated implementation process.

Summary: Montana has adopted a Solar Plan. The Plan includes a variety of education and information programs to be developed and implemented in a systematic and coordinated manner. Preliminary steps toward implementation are being taken now, but have been slowed by the delay in the establishment of the Western S.U.N. office.

Montana has a strong and viable network of grassroots organizations involved in solar education and outreach.

New Mexico

Education and information activities in New Mexico are conducted by several different public and private groups. These include the New Mexico Solar Energy Institute, the New Mexico Energy Institutes, the Energy Extension Service, and the New Mexico Solar Energy Association.

The New Mexico Solar Energy Institute, located in Las Cruces at the New Mexico State University campus, is mandated by State Law (Chapt. 347, Laws of 1977, Paragraph B) to ". . . collect and disseminate information to the citizens and industry in the state concerning solar energy research, development, and demonstration and solar energy application and technologies . . ."

The five-person staff of the Information and Education Division is responsible for satisfying this mandate. Efforts have focused on information development, exchange, and dissemination. Programs have reflected the diversity of informational needs of the business, industrial, government, and public sectors within the state.*

Information development activities have included:

- assessment of state solar resources and definition of incentives to increase solar energy production;
- development of economic analyses program for solar applications;
- design of solar short courses for a) University of Chihuahua Solar Energy Research Facility, b) participants from Central and South America;

*A complete list of these activities is included in the New Mexico Solar Energy Institute, Briefing to the Secretary of Energy and Minerals, July 28, 1978.

- Spanish translations of solar educational materials;
- development of visual educational materials (e.g. solar film series and slide shows);
- development of self-instructing solar workshop materials;
- support of internal NMSEI informational needs (e.g. literature searches, graphics development, production of reports).

Information exchange activities have included:

- provision of technical support to community solar workshops and training programs;
- statewide community workshops for Sun Day, a Solar Energy Consumer Protection workshop, "Thinking Solar" workshops jointly sponsored by local banks in Lake Arthur, Deming and Gallup (with the Energy Extension Service);
- "Solar Energy Today" conferences in Las Cruces, Roswell, Clovis, Silver City and Farmington, "Sun Energy '78" International Solar Energy Conference, Second National Passive Solar Conference, 13th IEEE Photovoltaic Specialist Conference;
- tours of Las Cruces solar buildings;
- response to solar information inquiries from the public, industry, business, and government;
- establishment of public information center and information retrieval services;
- training of cooperative extension staff on solar energy.

Information dissemination activities have included:

- publication of solar pamphlets, director, technical papers, Entrada al Sol, and internal house organ;
- presentation of solar exhibits (some with the Energy Extension Service) in Las Cruces (3), El Paso, Roswell, Clovis, Silver City, Farmington (2), Lake Arthur, Deming and Gallup;
- dissemination of solar information via media releases;
- coordination with Energy Extension Service on solar information dissemination activities;
- provision of speakers and materials for state and national solar conferences.

By coordinating with the Energy Extension Service (EES) for information distribution, NMSEI has avoided duplication of information dissemination efforts and has been able to concentrate on the development of educational materials. NMSEI provides support for the EES in the form of solar publications, solar exhibits, technical assistance, training of staff, and technical review of EES materials. NMSEI also maintains a close association with the New Mexico Energy Institute. Internal NMSEI technical projects and New Mexico Energy Institute projects provide data for inclusion in educational programs developed by the Information Division. As an example, the Information Division publishes the results of data gathered from monitoring solar demonstration homes in the state.

New Mexico Energy Institutes are located at the New Mexico State University, the New Mexico Institute of Mining and Technology, and the University of New Mexico. Each Institute directs research in specific energy areas and is responsible for information dissemination and development of educational programs.* The NMEI at New Mexico State University (NMSU) directs research in solar, wind, geothermal, and waste energy utilization. As described above, solar-related information and education programs are conducted in collaboration with the NMSEI located on the same campus.

Information and education programs of the New Mexico Energy Institute at the University of New Mexico, Albuquerque, are oriented primarily to energy conservation. The Institute directs the activities of the New Mexico Energy Registry which maintains a computerized data base on statewide energy research and publishes the Energy Source newsletter of the New Mexico Energy and Minerals Department. The newsletter informs citizens of energy-related activities in the state. The NMSI has been instrumental in the implementation of EES programs. The Institute has developed energy-conservation-oriented information and education programs for the EES which have included workshops, training programs and media, printed, and display materials. Spanish translations of materials are available.

NMEI also provides technical reviews of EES materials, recommends solutions to legal, technical, and economic problems identified by the EES, operates the EES Information Center in Albuquerque, and supports the EES Energy Information Telephone Hotline.

In addition to the collaborative efforts of the NMEI and the EES, the EES conducts an Energy Conscious Community Program, "to encourage community participation in energy conservation and solar projects."* Under the program, communities work toward Energy Conscious Community status by participating in EES program(s). The communities first decide which EES program(s) are most appropriate for satisfying local needs, then contact the EES who assists in implementation by supplying printed materials and technical advice and sometimes, grants. "Special merit" awards are granted to communities which "reach

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*The research areas of the Institute of Mining and Technology do not include solar so a discussion of information programs is omitted here.

*NMEES, The Energy Conscious Community, 1977.

a significant percentage of the local population" with 5 of the possible 11 EES projects. "Outstanding achievement" awards, a plaque, and a flag are awarded to communities which complete eight or more of the EES projects. In all cases, the communities receive full recognition for successful program implementation. Communities choose projects from the three EES program areas: "residential," "small business," "and agricultural." Solar "residential" projects include workshops on the conceptual basis and actual construction of solar technologies, especially the attached solar greenhouse. "Small business" solar projects include workshops on alternate energy sources for businesses and assessments of the efficiency of local solar heated and cooled businesses. Assessments of possible alternate energy sources for agricultural use are part of the "agricultural" program.

The New Mexico Solar Energy Association (NMSEA), a private non-profit organization, is an important actor in solar education and information activities in New Mexico. Funded in part by the legislature and by grants, the NMSEA conducts teacher training workshops for vocational-technical school teachers; holds workshops, classes and conferences on general solar education; maintains a library of solar information; publishes newspaper articles on the benefits of solar energy use; and organizes solar fairs and seminars.

The NMSEA maintains five programs: 1) a Workshop Program which helps communities organize weekend workshops on construction of solar water heaters, greenhouses, dryers, and retrofits, 2) a Technical Assistance Program which supplies technical and design advice to all requesters, 3) an Education Program which works through the established educational system to educate the public, and 4) a Field Liason Program which includes six staff persons located in New Mexican cities where NMSEA affiliates exist. All the programs are designed to be decentralist, i.e., amenable to local needs and conditions. Educational efforts also are tailored to meet local requirements.

The two-day NMSEA teacher training workshops are designed to inform voc-tech teachers of solar technology options in their respective fields. The teachers then pass this information on to their students. Participation in the workshops is encouraged by the fact that attendees are reimbursed for their time (on a per diem basis), substitute teacher salaries at the home school are paid, and recertification credit (one credit) is available. (In many cases, teachers must ordinarily attend three weeks of school in order to acquire one recertification credit; consequently, receipt of one credit for a two-day workshop is a strong incentive.)

Summary: Educational activities have been conducted on a decentralist basis with the NMSEA and NMSEI providing most of the materials and expertize. Given the number of actors involved in solar education and information in New Mexico, it is surprising that very little duplication has been reported. This may be because of the "response attitude" of the educational agencies. Generally, programs have been designed in response to requests. The NMSEA has demonstrated its educational ability and is often relied on for educational materials. The NMSEI also has been successful in its first year and promises to be a significant contributor to solar education efforts. At present, the relationship the two organzations will maintain with each other is unclear. Interestingly, the Department of Education has not been involved in solar

education because of a lack of funding. Education funds from the legislature have been directed to the NMSEI and the NMSEA.

Evaluation of which types of activities have been most successful has yet to be done. Measurements of success (evaluation criteria) have not been developed. Response to workshops and to teacher training workshops has been overwhelming; however, the degree to which participants in these programs are able to use their new knowledge has not been determined.

Oregon

The Oregon Department of Energy, the Oregon Department of Education, the University of Oregon Solar Energy Center, the Pacific Northwest Solar Energy Association, and numerous other independent groups are involved in solar education and outreach. When established, Western S.U.N. will also play a role in educational activities.

The Oregon D.O.E. is involved primarily in energy conservation programs. Solar-related workshops (e.g. hot water heater construction and home weatherization techniques) have been conducted by the D.O.E. and local community colleges. Solar publications have included: The Oregon Sunbook, a handbook of solar energy fundamentals; the Oregon Solar Planning Study, a description of state solar resource use; the Oregon Solar Directory, a directory of solar manufacturers and dealers; and the Solar Hot Water Heater, a design manual for construction of a low cost solar water heater. The D.O.E. and the Department of Education are currently developing an Energy Technician Program (solar and energy conservation) for community college use. Program officials hope that funding will come from the federal government or from the local participating college. The lack of funding expected because of the current tax revolt issue has prompted program designers to consider creation of the technician program by rearranging already existent community college courses applicable to solar design and construction (e.g., sheet metal classes) into a new course of study.

Oregon D.O.E. and Oregon State Parks, funded in part from a grant from the Pacific Northwest Regional Commission, have constructed two solar heated shower facilities at Tumalo and Washburne State Parks. The projects have been so successful that two more installations at other parks are planned.

At the local level, Lane County's Office of Appropriate Technology has designed and built for demonstration a solar water heater, window box air heater, cooler, and greenhouse. Slide shows and displays on solar energy are also available.

Numerous independent organizations conduct solar-related educational and informational programs. The Pacific Northwest Solar Energy Association, formed in March of 1978, serves as a clearinghouse for general and technical information for and among the groups. Although the scope of this report precludes lengthy discussion of the programs conducted by these groups, it should be noted that many of the programs have been extremely innovative and effective. As an example, the Ashland-Medford area groups held a town meeting on Sun Day to discuss energy issues. As in some other states where energy

conservation has been the focus of state-run activities, Oregon's independent groups have filled the solar information gap.

Summary: Oregon's Department of Energy solar-related activities largely have been part of energy-conservation-related programs. Several brochures and handbooks on solar energy have been prepared and distributed. An energy technician training program is being developed for community college use. ODOE and the State Parks Department have built solar shower installations for two of the state parks.

Local governments and independent groups conduct many general information programs. The University of Oregon in Eugene maintains a Solar Energy Center which provides general information on research and other solar-related activities.

Washington

The Washington State Energy Office has been responsible for state-level solar-related education and information activities. These activities usually have been part of energy conservation programs and projects.

The Energy Office and the Superintendent of Public Instruction have prepared an energy conservation (includes solar information) curriculum aid program for teachers of grades K through 12. Children of the Sun, a handbook of solar educational activities for teachers of grades K through 12, was published for Sun Day. Implementation of a vocational-technical training program has been postponed pending announcement of a program design by an independent Seattle vocational institute.

As in other Pacific Northwest states, independent groups have played a major role in solar education. The Seattle-based Ecotope Group has conducted numerous workshops, maintains a library, and provides speakers for solar functions. Workshops oriented to local needs (e.g., solar design for Seattle homes, urban agriculture) have been most successful. An extensive informational network has been created as a result of the close relationship maintained by solar activists in Washington and Oregon.

SECTION 6.0

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Section 7.0 | Evaluation of State Solar Energy Programs

SECTION 7.0

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SECTION 7.0 SUMMARY

This section provides an overview of program evaluation and a short analysis of the utility of evaluation for state solar energy incentive programs. A definition of formal program evaluation is followed by a general assessment of its current role in state solar energy programs. The major portion of this section summarizes evaluation efforts in the case study states for each of the four major incentive programs covered in this report (financial, RD&D, testing and certification, and land-use planning). Based on this analysis, a number of recommendations are developed:

- evaluability assessments need to be done of specific state programs;
- multistate comparative designs are needed;
- some true experimental designs for evaluation are needed;
- federal and/or private funding should be used for some state program evaluation;
- Energy Extension Service evaluation requirements should be assessed for their application to state solar energy programs;
- a workshop on state solar program evaluation should be held.

7.1 INTRODUCTION

A general goal of this study is to determine what types of state incentive programs can be effective in advancing the development and practical application of solar energy. Reliable evaluation of program effectiveness is not a casual task; rather, evaluation requires dedicated effort, careful measurement, and thoughtful analysis. Detailed evaluation of the state programs studied in this research task has yet to be performed. This section reviews the present condition of evaluation of the state solar energy programs we have studied, analyzes the needs for effective program evaluation, and makes recommendations for establishing useful evaluation of these solar programs.

7.2 DEFINITION OF PROGRAM EVALUATION

A "program" may be any purposeful activity (or set of activities) undertaken by a government. "Program evaluation" is a formal process of studying programs which have these necessary characteristics:

- an explicit description (or model) of what the program actually is doing (or has done);
- some systematic (reliable and valid) measurement of the effects of the program;
- a comparison of the measured effects of the program to some set of criteria;
- application of the resulting information to policy or management decisions.

A few points are needed to clarify this definition of program evaluation.

First, the basic perspective of program evaluation is historical. Program evaluation focuses on what actually is happening or what actually has happened. Studies of future options, policies, costs, impacts, or outcomes are not included in program evaluation.[1]

Second, evaluation does not assign values to a given program but rather tests the effects of a program against an explicit set of given values or criteria.[2] The purpose of program evaluation is not to label a program as "good" or

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[1]Hatry, H., et al., Practical Program Evaluation for State and Local Government Officials, The Urban Institute, Washington, D.C., 1973, p. 8.

[2]U.S. General Accounting Office, Evaluation Guideline and Methodology: Program Plan for the Lead Division Area, GAO, Washington, D.C., 1978, p. 1-5.

"bad," but is to demonstrate as reliably as possible how the actual effects of the program compare with specific objectives, expectations, standards, or conditions.

Third, the criteria (costs, benefits, impacts, outputs) against which a program is evaluated are not confined to formal statements of program goals and objectives, but may include the values, goals, interests, and needs of any stakeholder. Also, the effects to be measured can and should go beyond the intentional outcomes of the program to include unintended side effects, both positive and negative.[3] Evaluation of programs also requires measurement and analysis of costs, which itself can be a complex and difficult task. In addition to directly budgeted investments of money, people, and other resources, costs include indirect economic, social, or environmental demands. Whether the latter should be considered positive costs or negative benefits is arbitrary as long as benefits and costs are only added.

Finally, "[w]hile a program evaluation may include consideration of workload measures, operating procedures, or staffing; its chief focus is on measuring the program's impacts or effects. Evaluation aimed solely at a program's internal procedures, staffing, and management might better be labeled management evaluations or organizational audits."[4] In other words, the types of evaluation commonly required by management-by-objectives, zero base budgeting, or similar procedures generally are not considered program evaluation.

The above describes program evaluation as a formal research process. In reality, however, programs commonly are "evaluated" in informal ways which satisfy few, if any, of the above criteria. Investigative journalists, public interest groups, lobbyists, commercial associations, private foundations, universities, legislative committees or auditors, public hearings, and law suits are some of the mechanisms by which government programs often are "evaluated." What these means of critical program assessment lack in scientific validity, they frequently make up for in real impact on government decision making.

If "evaluation" is considered most simply as feedback from program effects to government decision making, the informal evaluation mechanisms just mentioned are clearly the most common, most inexpensive, and (probably) most influential forms of evaluation. Their major deficiency, from a scientific viewpoint, is their high degree of subjectivity, and usual reliance on inaccurate, incorrect, unreliable, and even dishonest information. These means of informal evaluation are not equivalent to formal program evaluation. Both are valuable to the political process, and neither is a substitute for the other.

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[3] Rutman, L., Evaluation Research Methods: A Basic Guide, Sage, Beverly Hills, California, 1977, p. 17.

[4] Hatry, H., et al., 1973, p. 8.

7.3 GENERAL CONDITION OF STATE SOLAR PROGRAM EVALUATION

An exhaustive investigation of the evaluation practices in state solar programs was beyond the scope of the present task. However, from the extensive interviews and other studies of selected state solar programs that have been completed so far, several strong impressions have emerged of the current condition of state solar program evaluation.

The major means of evaluating the effectiveness of existing state solar programs are the informal mechanisms mentioned above. State legislatures exercise some oversight of established programs, but the practice is still rudimentary and uneven in most cases. For the most part, legislatures respond to external pressures of informal evaluation. When asked how the state legislature would determine whether specific solar programs are effective, one state legislative analyst commented:

> . . . I think we'll find out [the] way the legislature finds out anything, and that is somebody coming in and complaining about the program not working right. [The legislators] don't usually go out and seek problems, but are willing to listen when someone comes in and says they have a problem.

We asked then whether the legislature had some more formal process for evaluating program effectiveness. The same person continued:

> We're getting more to that. I will not say yet that we really do have that kind of setup. The House's Natural Resource Committee and the Senate's Energy and Housing Committee have kept a pretty close watch on the work of the energy agency. There are several ways. One is by saying the energy agency will report back on specific tasks that are assigned to them by a certain date. [The legislature has] also done it simply by calling in [the agency head] and various other people from the agency and saying, "What are you doing?" and so on . . . .

The executive branch view of evaluation was presented by a member of the staff of the agency responsible for implementation of the solar energy programs in the same state. When asked whether these programs need to be evaluated, the staff member remarked:

> I think there always is [a need for evaluation], . . . because if we don't do it the legislature will come along and say, "You messed up the program," and blame the agency. [Evaluation is] really both the agency's and the legislature's role, but the agency really has to do it first.

And, the staff member continued later:

> . . . Evaluations, of course, get overlooked just because it's easier to go ahead with the program. Plus, it's hard to evaluate something that's within your own agency. But the agencies have to do that or else the legislature comes in and does it for you.

The agencies' (both this agency and those in other states) means for evaluating their programs, though, is essentially the same as the legislatures'. The agencies do develop some elementary measures of program activity (e.g., staff hired, grant applications received), particularly to bolster annual budget requests. But the agencies evaluate program effectiveness mostly as the legislatures do: by reacting to negative feedback from informal evaluators out in the program's environment.

Another observation from our study is that state officials often lack a clear understanding of the meaning of program evaluation as defined above. Formal program evaluation commonly is not distinguished from more informal evaluation and political processes, or from fiscal or management audits. This probably reflects the fact that program evaluation is still far from being a standard practice in most state (or federal) government agencies. (Arguments probably can be made that program evaluation should not be a standard practice; the point here is simply that many officials have little experience with formal evaluation.)

Formal responsibility for solar program evaluation had not been delegated, nor was there any explicit legislative mandate for formal evaluation of solar programs in any states studied. In one state, the major energy agency's office for program evaluation apparently disappeared, as a member of the agency staff explained:

> . . . [W]hen this [agency] was first formed there was one office called Program Evaluation, and all it did was critique the programs of everyone else. It disappeared. The person who was the head of it isn't fired or anything; in fact he has been promoted . . . . So I don't know why it did disappear. They did have some independent functioning. I guess probably if you would talk to the [head of the agency] he'd say that, yes, that office still exists really; it just isn't identified in our organization chart, and it's in my office.

When questioned further, the staff member indicated that what he viewed as evaluation was actually management audit, and that no real measurement of solar program effectiveness was being performed. In some state agencies, an office or individual may have titular or rhetorical responsibility for program evaluation, but true functional responsibility is vague or undefined. The lack of formal evaluation of state solar programs probably is not unusual. A 1972 survey of state program evaluation activities disclosed that only 21 of 42 responding states had any full-time staff explicitly assigned to doing program evaluation. Twenty-nine of the respondents viewed their program evaluation activities as inadequate; only two of the states provided any formal training in program evaluation.[5]

The absence of any major effort to evaluate the effectiveness of state solar energy programs should not be viewed as an insult to those programs, nor as a symptom of any lack of enthusiasm for them. Quite to the contrary, the

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[5]Hatry, H., et al., 1973, p. 17.

paucity of serious demand for program evaluation is an indicator of the broad base of popular support for solar energy and the eagerness, even urgency, with which state solar programs are being initiated and developed. The emphasis in recent implementation of state solar programs is on near-term action, on expanding agency capabilities in a new area, and on meeting rapidly growing constituency demands for government support of solar energy. Under these circumstances, program evaluation inevitably receives relatively lower priority in budgeting the allocation of money, resources, and staff time than do other program needs more closely tied to direct action. Because there is no significant hostile opposition to solar programs, there is no strong constituency for critical program evaluation. Whatever qualms agency staff may have about the ultimate effectiveness of the programs they must implement (and many had serious doubts about the effectiveness of specific programs), they perceive accurately that they will be held accountable more for the level of program activity than for the effectiveness of the results, at least in the near term.

Our interviews indicate that state officials almost uniformly believe that formal evaluation of state solar programs is needed, and that the present level of evaluation activity is inadequate. However, there is considerable reluctance to dedicate a significant portion of insufficient program funds and staff (agencies universally view program funds and staff as insufficient) to program evaluation, which seems unproductive in the near term. If program evaluation is funded by any means other than the program budget itself, state officials generally find it an attractive and even necessary activity.

If and when formal evaluation of state solar programs is undertaken, state officials generally seem to feel that evaluation studies should be responsive to state government needs, but should be carried out by evaluators outside the state line agencies. The views of the following state legislator about who should do evaluation of state solar programs appear to reflect the feelings of most state officials:

> I do feel that if the state does [the evaluation] there is more consciousness or awareness of it, [and] more commitment to it. It seems to build a little more trust rather than have someone from the outside come in and do the evaluation. [That is, someone from outside the state.] I think if it were done at the state level, it should be done by a third party. I don't want the state to evaluate its own programs. I would rather see a private agency or consultant evaluate the program. Maybe that could break down differently when we are talking about the [multistate region]. Maybe, on some ventures, it would be appropriate to have the [federal government do the evaluation], but somehow there really ought to be a state hook in there so the state takes ownership of its results, [so that] the state is committed to following it up. Speaking as a legislator, that might just be done between the federal and state agencies as an administrative arrangement that I don't hear about until the agency comes in for a budget. I would rather have some involvement earlier so that I, too, am aware of [the evaluation] and become committed to it. I think the legislative branch . . . has to be a little more explicitly involved along the way, not just at the end of it when the money requests come in.

As these remarks indicate, evaluation studies need to be designed to respond to the information requirements of the state government itself. State officials are concerned that evaluators be objective and disinterested; they see outside consultants as a way to achieve this independence, although independent evaluation offices within the state government conceivably could satisfy this need. Evaluations need to be planned with the participation of all relevant state decision makers, including the legislature. And federal participation in program evaluation is generally acceptable as long as the state has sufficient control of the focus and direction of the evaluation.

All the above caveats are not meant to imply that nothing is being done to evaluate the implementation of state solar programs. Every agency studied is maintaining some records, and developing some information, to document the implementation of the solar programs. Generally, this is being done in relation to the annual budget cycle, to enable the agency to describe its activities, to defend itself against potential criticism, and to justify its budget requests.

However, the solar program evaluation (perhaps more accurately described as implementation documentation) that does exist commonly is characterized by two major flaws. First, the measures of program activity that are being kept often are measures of program inputs or management processes, rather than measures of program outputs or impacts on the community that is intended to be served. Second, even when outputs or external effects of the program are measured, the measures often fail to correspond to the actual or even the rhetorical objectives of the program.[6] These points are illustrated more extensively below. In general, existing solar program evaluation does not generate the kind of information decision makers require about program effectiveness.

7.4 STATUS OF EVALUATION BY PROGRAM AREA

The following reviews the present status of evaluation in each of the state program areas studied in this task: financial, RD&D, testing/certification, land use, and information/education. The existing measures of program performance are compared with the major areas of concern for program effectiveness. The results of this assessment are summarized in Table 7-1.

Financial. The most popular measure of the effect of financial incentives are the number of taxpayers claiming a credit, or similar accounting of the use of sales or property tax exemptions. The emphasis is on the number of cases where the incentive is used. Tax records also provide some information about the type of people claiming credits or exemptions. Some of the major areas of concern about the effectiveness of financial incentive programs expressed by those interviewed are:

[6] Hatry, H., et al., 1973, p. 23-24.

TABLE 7-1

EVALUATION BY PROGRAM AREA

Program Area	Existing Measures	Actual or Implied Criteria
o Financial	o number of tax credit claims o number of exemption claims o types of people claiming incentive	o equity o legitimacy o fiscal impact o diffusion effects
o RD & D	o number of grants & contracts o distribution of recipients o tangible products o technical performance	o true learning o value of products o transfer of results o diffusion effects
o Testing/Certification	o existence o number of participating manufacturers o number of tests and certificates	o disincentive for innovation o responsiveness to local needs o consumer protection o disincentive for decentralization o protection of business o diffusion effects
o Land Use	o evidence of new planning o new developments	o ESE effects o legality/equity o complication of planning o communication of new approaches o diffusion effects
o Information/Education	o funds and staff o number of materials produced o number of requests received o number of courses, meetings, workshops, etc.	o satisfying needs o human resource requirements o diffusion effects

- Equity: Do tax credits benefit the rich more than the poor? Do financial incentives generally apply unfairly to some classes; e.g., urban or rural, property owners, minorities, geographic regions, etc.?

- Legitimacy: Are the incentives being applied to legitimate solar equipment? Is there intentional fraud? Is some legitimate solar technology being excluded from the incentive (e.g., passive systems)?

- Fiscal Impact: What is the real cost of the financial incentives? How does the cost of credits, exemptions, and subsidies get paid?

- Diffusion Effects: Are the financial incentives actually stimulating the market for solar equipment, and increasing the use of solar energy? Do the incentives have any negative side effects which might undermine solar development?

Generally, agencies are measuring government inputs to the marketplace in the form of incentives, but not the outcome or effect of the inputs in terms of actual growth in solar energy use.

RD&D. The main measures being used of RD&D program performance are: number and cost of research rants and contracts, distribution of recipients of grants/contracts (e.g., universities, large v. small businesses, grass roots organizations, geographic area), and tangible products (e.g., reports delivered, equipment or buildings constructed). In some cases there may be fairly sophisticated measurement of the technical performance characteristics of innovative systems. Yet those interviewed indicated some of the major areas of concern about state RD&D program effectiveness are:

- True Learning: Are RD&D projects actually contributing new knowledge about solar energy use? Are the results scientifically valid?

- Value of Products: Are the technical problems being addressed truly important? Are the results of RD&D activities relevant to state needs, resources, and opportunities?

- Transfer of Results: Are the benefits of RD&D activities being made available to potential users? Are RD&D results transferable to practical implementation?

- Diffusion Effects: Are public interest in and enthusiasm for solar energy being stimulated by these activities? Is practical application of solar energy being accelerated by the RD&D projects?

In the RD&D program area there is a significant gap between existing measures of program performance and actual program objectives.

State solar RD&D projects are supported with the explicit goal of accelerating the practical use of solar energy in the state, yet no program measures are established to demonstrate success in achieving this goal. For example, in one state a major effort is underway to build innovative houses, using

unorthodox construction materials and various types of solar systems. The proponents of this state program indicated the program's ultimate objective is to change the standard practices in housing construction in the direction of greater energy conservation and major reliance on renewable resources. Yet our interviews disclosed that most of those involved in the program doubted the housing designs being demonstrated could or would be acceptable to the majority of the state's housing construction industry. Such evaluation measurement as existed in this program focused on the technical performance of the innovative houses, and not on the impact of the new designs on industry attitudes and practices.

The interviews suggested that a tacit objective of the RD&D program just mentioned was to excite consumer interest through "hands on" experience of the alternative housing designs the program would demonstrate. Again, there were no measures built into the implementation of the program to demonstrate whether this desired outcome is actually achieved; no plan even has been made simply to record names and addresses of visitors to the demonstration houses, a practice which would permit some follow-up survey research to determine the impact of the innovative houses on consumer attitudes.

Testing/Certification. The primary measures used to evaluate testing/certification programs appear to be (1) the existence of implementation and then (2) some measure of compliance such as the number of participating manufacturers or the number of models tested and certified. Again, these are mainly input measures which do not indicate program success in responding to such expressed concerns as:

- Disincentive for Innovation: Do standards create a barrier to innovative solar technologies?

- Responsiveness to Local Needs: Are statewide standards too inflexible to reflect local needs, resources, environmental conditions, and interests? Are statewide building codes an infringement on local prerogatives?

- Consumer Protection: Are state standards effective in protecting consumers from illegitimate operators? Do consumers need such protection?

- Disincentive for Decentralization: Do standards and codes discourage low-cost, do-it-yourself systems? Are they a barrier to decentralized applications?

- Protection of Business: Are standards effective in protecting legitimate solar businesses from unscrupulous competitors? Do businesses need such protection? Is there a differential impact on small v. large businesses?

- Diffusion Effects: On balance, do standards and codes help or hinder the growth of solar energy use? Do standards, testing, and certification increase consumer confidence? Does certification reduce institutional resistance to new equipment?

Land Use. Land use is an area where informed evaluation is important. Local planners, city councils, builders, real estate brokers, and citizen groups are potentially vocal critics of state land use decisions. Measurement of the performance of land-use programs is limited; to the extent that any indicators are used, they seem to be confined to some evidence of the implementation of new planning activities, and perhaps accounting for new developments using solar energy. Important areas of concern in the land-use area are:

- ESE Effects: What are the environmental, social, and economic impacts of solar-oriented land-use planning?
- Legality/Equity: Can access to sunlight legally be protected? Does solar-oriented land-use planning discriminate in favor of property owners or the affluent? Do solar rights damage property rights?
- Complication of Planning: Solar access implies three-dimensional land-use planning: is this feasible? Do the complications of solar-oriented land-use planning add to housing and building costs?
- Communication of New Approaches: Are solar land-use principles, building designs, etc., being communicated effectively to architects, planners, bankers, assessors, contractors, and others who have key roles in implementation?
- Diffusion Effects: Do solar land-use programs accelerate the use of solar energy?

Conventional land-use practices commonly are viewed as a major barrier to solar energy use. Formal evaluation of innovative land-use procedures is needed to determine just how effective new practices are in facilitating solar development.

Information/Education. This program area was not studied as extensively as the others in this research task. Common performance measures of these programs appear to be primarily input measures, such as funds and staff, number of materials produced, number of requests received, number of courses offered, number of meetings, workshops, seminars, etc., held. Concerns about the effectiveness of these programs include:

- Satisfying Needs: Are information/education programs satisfying the important needs for information and learning about solar energy? What are the important target groups for information and education? How are the needs of each group being served?
- Human Resource Requirements: What are the specific human resource needs of the growing solar industry? How are education and training programs meeting these needs?
- Diffusion Effects: Is the information being communicated relevant to changing behavior in the direction of greater use of solar energy? Is behavior actually changed? How do specific information/education activities help accelerate the growth in solar energy use? What learning occurs and from what sources?

Information and education programs may be the most popular form of state government solar energy activity; they are also an area in which there is extensive experience and precedent for formal evaluation. Yet significant evaluation of these programs so far seems to be lacking.

The Program Package. Formal evaluation of specific state solar energy programs is scanty. Equally important is evaluation of the total package or system of state solar programs (in fact, of the system of both state and federal programs). Actually evaluation of the total package may be easier than evaluation of individual components. Programs need to work well not only in isolation but in combination with each other. In reality, programs may conflict with one another or at least may fail to support each other's objectives. Tax incentives may be ineffective without good equipment standards to determine eligibility. Equipment standards may be inconsistent with building codes or land-use regulations. RD&D programs may be trying to promote technological innovation, while testing and certification programs may be obstructing the penetration of innovative technology into the marketplace. Communication programs may be needed to inform the public about the availability of financial subsidies, and educational programs may be required to insure that building inspectors or tax assessors understand solar design and equipment. From our study, it appears that no systematic evaluation is being made of the effectiveness of the total package of solar programs operating within a given state.

7.5 NEED FOR PROGRAM EVALUATION

The needs for solar program evaluation are essentially the same as the needs for evaluating any area of state government activity. Some of the benefits of formal evaluation of state solar energy programs are:

- Improved Program Design: Feedback from the actual effects and impacts of programs can lead to more effective designs of new programs in the same state or elsewhere.

- Improved Program Management: Program administrators can manage their programs effectively only by determining the actual outcomes and effects of their activities. Accurate feedback from program impacts enables administrators to adjust program management and implementation strategies to increase program effectiveness.

- Budget Documentation: Accurate information about program outcomes provides a more objective basis for annual budget decisions. Under conditions of fiscal constraint, programs that convincingly can document their effectiveness are likely to fare better than those that cannot.

- Empirical Knowledge: Good program evaluation research can contribute to our overall knowledge about political and social behavior; such knowledge ultimately provides indirect benefits to government planning and management.

- Side Effects: All government activities generate unintended, and often unanticipated side effects, both positive and negative. Formal evaluation can help identify these side effects. Specific measures then can be implemented (and evaluated) to mitigate negative impacts and to enhance or capitalize on positive side effects.

- Transfer of Experience: States want and need to share with other states the benefits of their experience in developing and implementing specific types of solar programs. Without careful measurement and documentation of program performance, most of the value of such experience cannot be transferred.

- Better Definition of State-Federal Roles: If both state and federal programs are formally evaluated, the resulting information eventually will indicate which solar activities are most effectively performed at the state versus the federal level, and vice versa.

- Public Accountability: The last but certainly not the least argument in favor of formal program evaluation is that the public has the right and the need to know how effectively its tax dollars are being spent.

This section is not intended to argue that program evaluation is uniformly a good thing, and that the more the better. Actually, no formal program evaluation should be undertaken until some detailed assessment has been made of the evaluability of the program, in terms of the questions decision makers need to have answered about program effectiveness. Such an evaluability assessment will disclose one of three possibilities:

- all testable questions may be unanswerable in reality;

- testable questions may be answerable from reality but the cost of getting the answers far exceeds their value;

- testable questions may be answerable from reality and the value of the answers is significantly greater than the cost of obtaining them.[7]

Only in the third case is a formal program evaluation justified. The costs of program evaluation are not free; anywhere from 2% to 15% of total program funds may be required to do a thorough evaluation. The cost of doing formal program evaluation needs to be weighed against the expected benefits.

[7] Nay, J., and Kay, P., Government Operations and Evaluability Assessment; J. Nay, Washington D.C., 1978, p. 261.

TABLE 7-2

BENEFITS OF PROGRAM EVALUATION

- Improved Program Design
- Improved Program Management
- Budget Documentation
- Empirical Knowledge
- Side Effects
- Transfer of Experience
- Better Definition of State-Federal Roles
- Public Accountability

7.6 RECOMMENDATIONS AND CONCLUSIONS

In conclusion, several recommendations are offered to strengthen the formal evaluation of state solar energy programs. The recommendations are the following:

- Evaluability assessments need to be done of specific state programs. States need to be identified which have a substantial interest in initiating formal evaluations of solar energy programs. Evaluability assessment studies of particular programs should be carried out in several of the interested states. Such studies will identify specific questions and acceptable approaches for more thorough evaluation research.

- Multistate comparative evaluations are needed. The diversity of state programs provides some opportunity for comparison of alternative government approaches to solar commercialization and diffusion. Where certain large-scale programs offer a sufficiently broad base of statistical data, multistate evaluation studies should be developed, in addition to specific intrastate program evaluations.

- Some true experimental designs are needed. There are at least five basic designs of evaluation, which progressively increase in both cost and validity of results. The most costly and most informative design is the "true experiment": randomly selected populations are subjected to carefully controlled treatments. The purpose is to determine as closely as possible the actual relations between specific causes and effects. Given the long-range national importance of solar energy development, some such experimental projects are warranted to determine what types of government intervention are most effective in accelerating solar energy commercialization and diffusion.

- Federal and/or private funding should be used for some state program evaluations. Inevitably there will be some state solar programs of great interest in terms of general program strategy which lack state funding for adequate program evaluation. Although most state program evaluations should be financed with state funds (including shared federal funds), the absence of state funding should not be an insurmountable obstacle to evaluation of state solar programs. In some cases, grants from federal and/or private agencies should be sought to support well-designed evaluation studies of state solar energy programs.

- Energy Extension Service (EES) evaluation requirements should be assessed for their application to state solar energy programs. The EES may become a major focus of state energy activities. The evaluation requirements of this federal-funded, state-managed program will be quite substantial. These evaluation requirements need to be assessed in the near future to determine the extent to which they will help meet the needs for state solar program evaluation.

- A workshop on state solar program evaluation should be held. State officials generally seem to feel that more thorough and informative evaluation of state solar programs is needed. Certainly formal evaluation can be carried out only with the support and cooperation of concerned state officials. A workshop or conference involving state officials responsible for the implementation of solar programs, experts on program evaluation methods, social scientists, solar technology experts, and officials of agencies which might fund evaluation studies, would be a useful step toward initiating more formal evaluation of state solar programs. Such a workshop would help clarify needs for evaluation of state solar programs, and would help develop a practical strategy for improving scope and quality of solar program evaluation.

SECTION 7.0

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Rutman, L., Evaluation Research Methods: A Basic Guide, Sage, Beverly Hills, California, 1977.

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APPENDIX 7-1

INDIVIDUALS INTERVIEWED

Arizona

Susan Court, Legislative Analyst, Arizona Senate, (September 8, 1978).

Gerry Cunningham, Arizona Office of Economic Planning and Development, (September 8, 1978).

Dick Foreman, Legislative Analyst, Arizona House of Representatives, (September 8, 1978).

Don Osborn, Arizona Solar Energy Research Commission, (September 9, 1978).

Lina Robinson, Private Consultant, (September 9, 1978).

Greg Stutzman, Arizona Solar Energy Research Commission, (September 9, 1978).

California

Michael DeAngelis, California Energy Resources Conservation and Development Commission, (July 21, 1978).

Minnesota

Roger Aiken, University of Minnesota, (August 5, 1978).

Jerry Allen, CRITERIA, Inc., (August 5, 1978).

Ned Hoffman, Ouroboros Project of the Science Museum of Minnesota, (August 5, 1978).

Dorothy Hozza, Minnesota Energy Agency, (August 5, 1978).

Sarah Meyers, Legislative Analyst, Minnesota Legislature, (August 4, 1978).

Mark Monson, Minnesota Energy Agency, (August 4, 1978).

Bruce Nelson, Minnesota Energy Agency, (August 4, 1978).

Ken Nelson, State Representative, Minnesota House of Representatives, (August 4, 1978).

Sam Rankin, Legislative Analyst, Minnesota Legislature, (August 3, 1978).

Ron Rich, Minnesota Energy Agency, (August 3, 1978).

Suzan Stewart, Minnesota Energy Agency, (August 3, 1978).

Daryl Thayer, Daryl Thayer Associates, Inc., (August 3, 1978).

Mary Tingerthal, Minnesota Housing Finance Agency, (August 3, 1978).

Karen Wilson, Minnesota Energy Alternatives Lobby, (August 3, 1978).

Montana

Randy Moy, Montana Energy Research Coordinator, (August 14, 1978).

Oregon

Karen Brown, Oregon Department of Revenue, (July 20, 1978).

C. J. Hill, Oregon Department of Revenue, (July 20, 1978).

Chuck Kensey, Staff member, Oregon State Legislature, (July 20, 1978).

Alan Kiphut, Oregon Department of Energy, (July 20, 1978).

Other

Sumner Clarren, The Urban Institute, Washington, D.C., (August 8, 1978).

Irwin Dubinsky, Office of State and Local Programs, Office of the Assistant Secretary for Policy and Evaluation, U.S. Department of Energy, (August 9, 1978).

Al Schwartz, Energy Extension Service, U.S. Department of Energy, (August 9, 1978).

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Section 8.0 Observations, Findings and Areas for Further Research

SECTION 8.0

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SECTION 8.0

OBSERVATIONS, FINDINGS, AND AREAS FOR FURTHER RESEARCH

8.1 IMPLEMENTATION AND RULE-SETTING

8.1.1 Importance of Implementation

In each of the four major incentive types studied in this report, the implementation process was an important determinant of the final form and of the effectiveness of each state program. In particular, rule-setting and administrative agencies shaped the incentive programs for solar energy in three specific ways:

- Choice of Technologies and Components for Eligibility. Because legislative definition of solar energy systems or alternative energy systems was often vague, the rule-setting agency usually determined which solar technologies or which individual components of solar systems would be eligible for financial incentives, for protection by solar easements, and for state-funded research and development grants. This eligibility selection was particularly important for passive components, homebuilt solar systems, and experimental technologies such as vertical axis wind turbines, underground houses, and solar ponds.

- Performance Standards for Individual Systems Within a Given Technology. Once the choice of eligible technologies had been settled, the rule-setting or administrative agency still had to determine the criteria that an eligible technology must meet to receive the incentive. The setting of eligibility standards was important, particularly in the case of financial incentives, and affected most directly low-performance but low-cost systems.

- Coordination of Multiple State Programs. Many of the states which pioneered in the development of incentives for the adoption of solar energy have enacted several pieces of legislation in any one incentive area, and up to a dozen enabling acts in all the incentive areas covered in this report. The responsibility for the rule-setting and implementation of each incentive type may have been delegated to a separate governmental agency. These separate legislative mandates were usually enacted during different legislative sessions, and little effort was made to consolidate or even coordinate these incremental incentive programs. If the implementing agency or agencies effectively coordinate all the financial, RD&D, and land-use planning incentives using common standards and eligibility criteria, the cumulative impact may be substantial. If incentives within the same state require different system configurations or stimulate different technologies, then the overall impact of each of the incentives may be vitiated in the consumer marketplace.

8.1.1.1 Need for a Clear Statement of Legislative Intent Coupled With a Clear Delegation of Administrative Authority

One finding common to all incentives examined in this report is that it is crucial that the legislature clearly indicate

- what objectives it is trying to accomplish by establishing the incentive;
- which of these objectives is the most important;
- why these objectives are important; and
- who within the state governmental system is charged with responsibility for each phase of the implementation process.

Legislatures too often have provided a long list of public policy justifications for the passage of solar energy incentives without indicating which should take precedent over others in the development of administrative rules and procedures. In the nine states examined, enabling legislation or legislative history gave the following major objectives for the incentive (among others): reduction of fossil fuel consumption, promotion of the adoption of solar energy technologies, protection of the environment, encouragement of the formation of an in-state solar energy industry, provision of energy for local firms facing reductions in supplies of natural gas and fuels, consumer protection, local job creation, and provision of energy for agricultural production. Without a clear designation of priorities, implementing agencies' officials were often stymied over whether or not to include certain technologies and design approaches in the list of units eligible for incentives or for research and development projects. Swimming pool covers, for example, may or may not be strictly solar devices (depending on their transparency, among other things) but they do assist in the conservation of fossil fuels. Certain components of passively heated buildings also serve a structural function, such as holding up the roof. Should they be eligible for a tax credit? The resolution of such difficult administrative questions can be greatly assisted by clear legislative guidance.

In virtually all states examined in this pilot study, there was a delegation of overall program authority to one or more agencies within the enabling agency. However, there was usually no guidance on the limits of that programmatic authority. This could be a serious omission when two or more agencies are instructed to share in the rule-setting and administrative tasks for the incentive. There is also some uncertainty over the ability of the implementing agencies to modify procedures and rules as more experience is gained on how best to administer a solar incentive program. This question of administrative discretion will be discussed further in the following section.

8.1.1.2 Desirability of Implementing Agency Discretion

In a new and rapidly evolving field such as solar energy, it is important that the agencies administering state incentives be allowed the flexibility to alter their criteria, program structure, and funding mechanisms. This is

particularly important in the initial stages of program implementation, because of the need for learning and experimentation to find administrative mechanisms appropriate for local conditions. Some portions of each program will prove to be inadequate, inappropriate, or difficult to administer, and will require subsequent modifications. In addition, solar energy technologies are undergoing rapid change, and implementing agencies should be able to modify their programs to recognize technological advances as those advances occur. Such administrative discretion can greatly enhance the impact of state incentives on promoting commercialization of solar technologies, protecting of potential consumers, and removing barriers to solar adoption. However, administrative discretion must be bounded by a clear statement of legislative purpose and by active legislative oversight. When an implementing agency proposes a modification of its procedures for administering an incentive or of its eligibility criteria, there should be an external set of standards to which this modification can be compared to determine if it more nearly reflects the intent of the lawmakers.

8.1.1.3 Potential Conflict Between State Standards and the Development of National Commercial Markets

The promulgation of performance standards and eligibility criteria by each state offering incentives for solar energy may prove to be a serious obstacle to the development of an industry with nation-wide marketing, distribution, and service facilities. The existence of different design criteria in each state makes it difficult for successful local manufacturers to expand their operations into adjoining states and for existing national firms to enter the solar energy field. The development of national consensus standards which allow for adaptation to local conditions will provide adequate consumer protection without imposing additional costs of multiple criteria on solar manufacturers, designers, and installers.

8.1.1.4 Problem of Providing Consumer Protection Without Stifling Innovation and Without Eliminating Home-Built Solar Systems

Highly detailed state eligibility criteria for incentives have been developed in a number of states to insure that the systems subsidized by the state treasury are well-designed, durable, and adequately sized. However, detailed eligiblity criteria may exclude new, innovative designs which are developed after the criteria were established. They may also prevent individual taxpayers from constructing solar systems appropriate to their own personal needs. One alternative is to insist on performance criteria, such as Oregon's decision to provide financial incentives to any alternative energy system that provides 10% or more of the total energy consumption of the dwelling. This approach allows for innovation and experimentation. It has one draw-back, shared by detailed eligibility criteria, that it discriminates against low-performance but low-cost systems. Such systems may be more cost-effective than large technically sophisticated systems and may be more accessible to low-income families.

8.1.1.5 Ease of Administration of Solar Incentives

Legislative leaders and solar energy advocates consulted in the course of this study expressed concern over the ablity and willingness of existing state institutions to administer solar energy incentives. In some of the case-study states, this concern helped determine the choice of administrative agencies, as well as the administrative mechanism indicated to carry out the legislative intent. In a field such as state incentives for solar energy where there are few precedents at the local and state level, the tendency has been to use mechanisms which are familiar to administrative officials and legislative staff members, even though they might not be the best possible choices for implementing the legislative intent. The best examples are found in financial incentives for solar energy installations. Many state legislators and state energy office staff members noted the pressing need to make renewable energy sources available to the working poor and to the elderly, since these two groups are often the hardest pressed to meet rising energy bills. Yet most of the states which have enacted solar financial incentives have chosen income tax credits and deductions, which do not assist those without substantial incomes, rather than grants or income tax rebates. In part, this was done because of concern that state departments of revenue would oppose mechanisms such as rebates, which are not only unfamiliar but which also might encourage wide-spread (and therefore costly) citizen participation.

Based on the limited sample of states surveyed for this report, these concerns seem to be unnecessary. As long as clear guidelines have been provided either in the initial legislation or in the rule-setting process, implementing agencies have not reported encountering major problems either with solar energy incentives *per se* or with innovative mechanisms for dispersing those incentives.

Moreover, there are potential problems with applying mechanisms developed for other purposes to incentive programs designed to encourage the usage of solar technologies or the removal of barriers to solar installation. These mechanisms may be inappropriate to the problems facing solar energy users and producers, creating problems which were not anticipated. This was true in the case of applying principles of traditional water law to the protection of solar access.

8.1.2 Role of the States in Providing Incentives for Solar Energy

In the past five years, individual states have developed incentive programs for solar energy in a wide variety of areas. These were developed for reasons described above, including consumer protection and the removal of legal and institutional barriers to the use of solar energy. Some of the state legislation was the result of a lack of decisive action at either federal or the local levels to deal with perceived impediments to wide-spread use of alternative energy systems.

As federal government and local governments have begun to become active in energy planning, energy conservation, and solar energy incentives, it may be timely to more closely consider what incentive areas are most appropriate for state-level implementation. Based on the case study states examined in this

report, state RD&D programs and financial incentives can rapidly provide significant market price reductions for solar equipment and can assist in the removal of barriers to installation of solar energy systems, while encouraging the adaptation of solar technologies to local conditions. In the area of testing and certification, new state initiatives may have substantial drawbacks such as the adverse impact of the proliferation of standards on the national marketing of equipment, on development of innovative systems, and on rapid development of national consensus standards within the solar energy industry. Development of standards and testing facilities is also expensive and technically complex, requiring a substantial investment by the states which duplicates similar efforts currently underway within the private sector and within the federal government research community.

In land-use planning, a major issue requiring attention is the impact of state-mandated planning and provision for solar access on innovative local programs for energy conservation and renewable resources. The question that remains unanswered is whether a state best promotes solar energy by enabling and assisting local jurisdictions in developing energy initiatives, or whether a more active state role is justified and instrumental in the removal of current land-use barriers to solar use.

8.2 AREAS FOR FURTHER RESEARCH ON STATE INCENTIVES FOR SOLAR ENERGY

8.2.1 Development of Interstate Agreement on Data Requirements for the Evaluation of Solar Energy Incentives

In 1979, several states will be initiating internal reviews on the effectiveness of existing or recently enacted incentives for solar energy. These evaluation efforts will require collection of extensive data on programs costs, number and type of solar installations, number and nature of applicants, dissemination of research results, and implementation problems. 1979 will also be the first year that a substantial amount of information will be available on the nature of the response by individual taxpayers and industrial energy users to the passage and implementation of solar energy incentives. This information will be derived primarily through tax returns and direct applications to state energy offices. While still in the planning stages, these individual state information-gathering efforts should be coordinated to make certain the lessons learned in one state are shared rapidly with other state governments.

To begin the coordination process, a comprehensive catalogue of possible social and economic measures of impacts of incentives for solar energy should be compiled, along with suggestions on the form that each measure could take. This collection of possible measures would then be presented to a meeting of legislators, tax officials, and energy office staff members drawn from interested states. These state representatives would then select information that they as policymakers find most useful for revision and evaluation of incentive design and of program implementation. If state officials reach a concensus on the utility of a substantial number of data

points, these selected measures then could be compiled into a common data collection design. Adoption of such a uniform data format would insure that certain portions of the information collected by each state would be compatible with data produced by evaluation programs in other states.

SERI and the regional solar energy centers (RSECs) could coordinate these efforts and assist in the development of common evaluation techniques for financial incentives. Similar common formats could then be developed by the states to present and disseminate the technical information and implementation experience developed by the state-funded RD&D programs and by state programs to insure solar access.

8.2.2 Collection of Comprehensive Intermediate Outcome Data

Until a coordinated effort is made by a number of states to gather systematically data on the impacts of state incentives for solar energy, it will be difficult to develop significant measures of ultimate program success. By "ultimate success," we mean the accomplishment of the objectives of the enabling legislation, such as reduction in fossil fuel consumption, provision of environmentally benign energy at competitive market prices, reduction of monthly energy expenses for the poor and the elderly, creation of local employment, etc. While data required to assess the effectiveness of state incentives to meet such objectives is being developed by each state or by the states working collectively, there is currently available a great deal of information which would be useful to policymakers on the administration and implementation of existing incentive programs. As has been demonstrated in this text, rule-setting for an incentive and subsequent administration is important. Incentive implementation helps determine which systems qualify, which portions of the population can take advantage of the incentive, and which barriers to the use of solar energy are removed. By systematically examining components of the implementation process--resources allocated, staff assigned, the level of activity education and outreach efforts--we can begin to determine just how important implementation is. These process variables we will call "intermediate" outcomes, and study of these measures will form the bulk of the next major phase of the SERI long-range research effort on state incentives.

To be as useful as possible, a study of intermediate outcomes should be comprehensive. It should examine as many major state programs as possible in one or more incentive areas, so that the set of programs studied will be large enough to allow for some controlling of external variables, such as size of the state, regional costs of fossil fuels, and program design variation.

8.2.3 Initiation of a Major Program of Monitoring and Assessing State Education and Information Programs for Solar Energy

In the course of conducting research for this pilot study, the SERI research staff encountered hundreds of private, local, state, and federal programs for dissemination of information about solar energy, solar energy incentives, and energy conservation. Some of these programs are outlined in Section 5.0. Like implementation procedures, education and information programs are crucial

to the success of state solar energy incentives. Unless citizens are aware of existence of the incentives and potential contributions of solar energy systems, they will not take advantage of even the best-planned incentive. Little comprehensive research has been undertaken to date on what outreach and education approaches are being attempted, much less on what variations within the approaches contribute to program success. There is an immediate need for a program which would gather information on education and outreach programs for solar energy, disseminate information on innovative programs to interested state officials, and assess impacts of program variables on the success of these private, local, state, and federal education initiatives. Such a program should be compatible with the internal evaluation programs of the Energy Extension Services, and should provide useful and timely information to state and federal decisionmakers seeking to increase the effectiveness of their existing incentive programs.

8.2.4 Role of Legislative Intent In Shaping Implementation of Incentives for Solar Energy

A wide variety of reasons have been given by state legislators for the passage of incentives for solar energy, ranging from environmental protection to the stimulation of small business. Some of these rationales used are only marginally connected with energy conservation or with the commercialization of solar energy. These include desires to promote labor-intensive technologies, to provide energy for businesses threatened with reductions in natural gas supplies, and to promote decentralized power sources less susceptible to interruptions in utility service. Administrators in the states studied in this pilot study often encountered difficulty in forming rules and regulations to implement incentives for solar energy, due to vague legislative definition of eligible systems and to the multiplicity of legislative goals. More research is needed on this problem and on developing simple remedies in the form of clarifying language.

8.2.5 Cumulative Impact of Incentives for Solar Energy

Several states studied in this pilot project have multiple incentive programs for solar energy, including two or more financial inducements, solar access statutes, state-funded RD&D programs, testing and certification, and education and information dissemination projects. Federal financial incentives, research programs, and education programs also have been enacted. Local governments have developed innovative programs for energy conservation, land-use planning, and financing alternative energy systems. Most research conducted to date on incentives for solar energy has considered each incentive program separately. Now, extensive work is needed to determine which combinations or configurations of incentives reinforce one another, thus increasing the effectiveness of each component. Also, there is some evidence that certain state-level efforts (such as education and information programs) act as catalysts, making all other local, state, and federal incentives more effective. Research is needed on such catalytic processes, as well as on optimal combinations of incentive programs.

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