REPORT OF THE SPECIAL SOLAR ENERGY ADVISORY COMMITTEE

Research Report No. 190

LEGISLATIVE RESEARCH COMMISSION
Frankfort, Kentucky

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REPORT OF THE SPECIAL SOLAR ENERGY ADVISORY COMMITTEE

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Legislative Research Commission
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FOREWORD

The 1980 House Concurrent Resolution 42 directs the Legislative Research Commission to appoint a Special Solar Energy Advisory Committee to study the potential of solar/renewable energy resources in the Commonwealth and submit a report including legislative proposals. This special committee's membership includes four legislators and eleven members representative of the housing industry, solar business, labor unions, universities, utilities, environmental groups and consumers. Their report establishes that "solar" has a viable place in the utilization of various energy systems to meet our state's energy needs.

Various members of this committee demonstrated their concern through their sharing of expertise for the technical areas of this report. The final report was prepared by D. W. Swain, Linda Kubala and Richard Sims. Don Stosberg staffed the Subcommittee on Tax Incentives. The report was edited by Charles Bush and typed by Beth Wilson.

Vic Hellard, Jr.
Director

The Capitol
Frankfort, Kentucky
December, 1981

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

DEFINITIONS

1. Active Solar Energy Systems - In contrast to passive solar energy approaches, an active solar energy system utilizes mechanical power (pumps or fans, for example) to operate the system and to transfer the collected solar energy from the collector to storage and distribute it throughout the living unit. Active systems can provide space heating and cooling and domestic hot water.

2. Earth Berm - A mound of dirt against a building wall to stabilize interior temperature or to deflect the wind.

3. Life-cycle Cost Analysis - The accounting of capital, interest, and operating costs over the useful life of the solar system compared to those costs without the solar system.

4. Passive Solar Energy Systems and Concepts - Passive solar heating applications generally involve energy collection through south-facing glazed areas; energy storage in the building mass or in special storage elements; energy distribution by natural means, such as convection, conduction, or radiation, with only minimal use of low-power fans or pumps; and a method controlling both high and low temperatures and energy flows. Passive cooling applications usually include methods of shading collector areas from exposure to the summer sun and provisions to induce ventilation to reduce internal temperatures and humidity.

5. Photovoltaic Cell - A device without any moving parts that converts light directly into electricity by the excitement of electrons.

6. Retrofit - To modify an existing building by adding a solar heating system or insulation.

7. Trombe Wall - Masonry, typically 8 to 16 inches thick, blackened and exposed to the sun behind glazing; a passive solar heating system in which a masonry wall collects, stores, and distributes heat.

SUMMARY

During the 1980 Session of the Kentucky General Assembly, House Concurrent Resolution 42 was passed, directing the Legislative Research Commission to appoint a Special Solar Energy Advisory Committee. For this special committee, two members from the Senate and two from the House were appointed; the remaining eleven members are representative of solar architects, installers, businessmen and such related areas as the housing industry, financial institutions, universities, utilities, labor unions, environmental groups and consumers.

The primary directives of HCR 42 are to: (1) determine the potential for solar/renewable energy resources in the Commonwealth; (2) oversee for the General Assembly the development of solar in the state; (3) design a state plan; and (4) produce a study report with legislative recommendations.

After considering the potential of solar and other renewables for meeting the energy requirements of Kentuckians, the committee determined that such technologies can contribute substantially to meeting specific energy needs. A simple passive solar design can supply a home with 40-60 percent of its space heating and cooling requirements, at no extra cost. At a slightly higher cost than a comparable conventional home, a passive solar home can provide itself 70-80 percent of such energy needs. An active solar hot water system is cost-competitive with an electric hot water system, particularly with the 40 percent federal tax credit. The other renewables available in Kentucky - wood, alcohol fuels and waterways for hydroelectricity - have already demonstrated their feasibility, and their utilization is just beginning. Data on wind as an energy resource is incomplete; wind is thus cited as part of a Kentucky Department of Energy plan to obtain region-specific data on energy sources.

The committee, charged with an oversight role regarding the development of solar within the state, evaluated the program of the new Division of Alternate Energy, which had been established in June, 1980, within the Kentucky Department of Energy. This division's primary task has been to evaluate alternate energy systems and design a comprehensive alternate energy program. Most of the program effort of this division has been educational - workshops, seminars and the Energy Hot Line have been the accomplishments to date.

The information component of a state solar program is one of four basic elements of a design approved by the committee. The other components are: (1) research, development and demonstration projects, (2) program planning and (3) institutional barrier mitigation.

The committee decided that many aspects of solar/renewable energy systems were feasible and, in fact, presently needed in Kentucky. It found that the economic impact of solar/renewable energy use allows consumers to spend some portion of their energy dollars elsewhere, often in their own community. Also, the solar industry is labor-intensive on the local level. These are attractive economic factors, yet the economics of the high initial cost outlay prevents many people from "going solar."

For this reason, and in the interest of promoting the use of renewable energy, most states have provided some type of tax incentive. The committee reviewed other state programs and formulated a solar tax credit bill for prefiling with the 1982 General Assembly. This proposed legislation allows a

30 percent tax credit for qualifying energy property up to a $3,000 maximum for the time period of January 1, 1981 to December 31, 1986. This self-extinguishing tax credit, a permissive solar easement act and a proposal for an alternate energy development fund comprise the statutory changes requested. In addition to these proposals, three resolutions are recommended for passage; one directs the Public Service Commission to study federally-mandated energy programs and methods to assure non-discriminatory rates for renewable energy users; another directs the Department of Finance to require consideration of conservation and alternate energy applications in purchasing and bidding regulations for state facilities; and the remaining resolution requests that the tenure of the Special Solar Energy Advisory Committee be extended through the next interim.

This legislative package and the committee report were the topics of a public hearing held in Frankfort on August 14, 1981. Over one hundred and twenty-five people attended the public hearing and the support for the tax credit proposal was unanimous. Among solar installers, solar builders, architects, environmentalists, homeowners, community action groups, plumbers, electricians, and other interested citizens, there appeared a coalition of support for the report and its comprehensive approach to solar implementation in the state. The final committee recommendations are:

1. A state tax incentive should be available to deal with the high initial cost outlay problem to many Kentucky homeowners.

2. The solar homeowner should be afforded the opportunity to secure adequate solar access through state legislation which allows the recording of a solar easement (an easement recorded with the property deed assuring adequate access to sunlight).

3. The Public Service Commission (PSC) should review non-discriminating rate policies for renewable energy users, the Residential Conservation Service Plan and Public Utilities Regulatory Policies Act (PURPA) regulations as they relate to renewable energy users, study the feasibility of their implementation and report their findings to the Energy Committee. Non-discriminating rate policies prohibit charging users of renewable energy more than comparable customers whose only energy source is the utility.

4. The Department of Housing, Buildings and Construction should continue to allow input from Kentucky solar installers, engineers and other professionals regarding the approval of various building codes.

5. The Office of Community and Regional Development (formerly the Department of Local Government) should establish methods to provide solar information for local planning commissions. The Kentucky Department of Energy could provide valuable assistance in this effort.

6. The State Solar program, operated by the Kentucky Department of Energy, should include the following:

   * An in-depth assessment of institutional barriers and a program to mitigate such barriers.

   * A monitoring program for the evaluation of retrofit projects, such as solar greenhouses and solar hot water systems.

* A solar evaluation and information program which includes region-specific data for Kentucky, site-specific diagnostic services, seminars for professionals and citizens and product-testing results on commercially available equipment.

* A computer simulation model for subdivision developers and planning and zoning commissions.

* A solar hot water and space heat demonstration project on an existing state facility to promote public awareness and as a saving of tax dollars.

* A design competition for solar structures.

Further details on the recommendations are found in Appendix 5.

Energy costs will continue to increase and in this unstable economy, any approach offering some control over an increasing dollar drain must be considered. Solar and other renewable energy sources are available, embargo-proof and eminently practical. Admittedly, we will continue to require a variety of energy sources, but for many structures solar/renewable energy will be the obvious choice.

CHAPTER I

INTRODUCTION

Background

Until recently the use of solar energy was considered futuristic by most people. Recent oil embargo fears fostered a new attitude toward all kinds of energy, however. By 1980, the debates over whether our nation was in an energy crisis had given way to discussions, often frantic ones, of how to reduce our dependence on foreign oil supplies. Indeed, in expected fashion, our aim was to become independent and fully utilize our own resources. One energy discussed was embargo-proof and an unlimited resource; solar energy began to look attractive. President Carter's Domestic Energy Program proclaimed a goal of supplying 20% of the nation's energy from the sun and related renewable resources by the turn of the century. An energy project at the Harvard Business School reported that with reasonable incentives solar could provide up to 25% of the national energy requirements by the year 2000.

A Special Subcommittee on Energy of the Kentucky General Assembly had reviewed state solar activities, heard testimony and visited a solar home in 1977. In 1980, Kentucky remained one of the very few states which did not have solar legislation; the lack of information on solar's potential in Kentucky was discussed by legislators. During the 1980 session of the Kentucky General Assembly, solar and renewable energy were addressed by the passage of House Concurrent Resolution 42, establishing a Special Solar Energy Advisory Committee, which would study the need for solar legislation.

Focus of Study

As directed by the General Assembly, the Special Solar Energy Advisory Committee was to accomplish the following:

(1) Determine the potential for the use of solar/renewable energy resources in the Commonwealth;

(2) Assume an oversight role on behalf of the General Assembly on all matters pertaining to the development of solar/renewable energy sources during the 1980-82 interim;

(3) Design a plan for the development of solar and renewable energy; and

(4) Submit a report including recommendations and legislative proposals to the General Assembly.

The committee chose to include all the renewable energy technologies included in the federal definition of solar except ocean thermal. Solar was defined, then, to include the following:

1. Solar thermal application: active and passive systems for the purpose of heating and cooling buildings, including hot water heating, agricultural and industrial process heating;

2. Photovoltaic: cells converting solar radiation to electricity;

3. Biomass: Combustible plant matter;

4. Wind; and

5. Hydropower.

Methodology

As directed by the resolution, two members from the Senate and two members from the House were appointed to serve on the Solar Committee. The Legislative Research Commission (LRC) appointed recognized experts in related areas, such as solar architects, solar installers, home buildings, and representatives from housing development associations, financial institutions, labor unions, universities, utilities, environmental groups, state energy agencies and consumers to complete the committee membership.

In order to provide legislative proposals to the 1982 General Assembly, the committee determined to obtain information on the need for solar energy in Kentucky and the feasibility of solar, both technically and economically, for the region. Resources within the state's public and private sectors would be identified, as well as available federal assistance. With this information, strategies could be developed and presented to the legislature. Adopting this study plan in July of 1980, the fifteen-member committee proceeded as follows:

1. Federal and other states' legislation was obtained and analyzed.

2. Federal guidelines, activities and funding were surveyed.

3. Other states' activities were inventoried.

4. Presentations were made before the committee and information was obtained from Kentucky state agencies, including the departments of Energy; Natural Resources and Environmental Protection; Community and Regional Development; Housing, Buildings and Construction; Insurance; Revenue; and Education; the Attorney General; and the Public Service Commission.

5. On-site visits were made to residences with active and passive solar systems, an earth sheltered subdivision, a hospital utilizing a solar water heating system, and businesses utilizing solar space and water heating systems.

6. Information was obtained from the National Conference of State Legislatures, the Southern Solar Energy Center, the Solar Energy Industries Association, the National Center for Renewable Resources, Appalachia-Science in the Public Interest, the University of Kentucky Survey Research Center and the Tennessee Valley Authority. (Many of these sent representatives to appear before the committee.)

7. Factors impeding solar implementation were identified.

8. Potential state incentives were analyzed.

The topic of Solar/Renewable Energy was found to be quite broad; with the abundance of activities and reports from other states, the need for subcommittees became apparent. They were established as follows: (1) Subcommittee on Tax Incentives, (2) Subcommittee on Institutional Barriers and Incentives, and (3) Subcommittee on Research, Development, Education and Information.

The three subcommittees met monthly from December through May and their final reports comprise Chapter V of this document.

During the interim the administration change at the federal level affected the state level programs, in that less federal support in energy programs was now anticipated. The National Conference of State Legislatures emphasized the point that states would now be the key to solar implementation.

Throughout the interim the committee requested and received information from the Kentucky Department of Energy regarding the development of the solar program in Kentucky, in order to fulfill the oversight role assigned to the committee. The solar activities of the Kentucky Department of Energy reported in Chapter IV demonstrate that the Department plans to evaluate solar's potential for the state and is in the process of designing a comprehensive program.

Having completed a draft of the final report, including legislative proposals, the committee held a public hearing to allow citizen response to committee findings and proposals. More than 125 participants, including solar architects, businessmen, installers, representatives of Community Action agencies, Audubon Society Chapters, local energy councils, construction companies, the Kentucky Solar Coalition, and other interested citizens, attended this hearing. Presentations were all in support of a state solar implementation program, the main issues being the need for a tax credit to assist in the initial cost outlay, energy-efficient housing for low-income groups and the need to inform the general public that many solar methods do work efficiently and economically in Kentucky.

After review of the issues reported in the public hearing, the committee drafted its final recommendations and legislative proposals, which comprise Chapter VI.

CHAPTER II

NEED FOR SOLAR ENERGY

Kentucky is rich in fossil fuels. It is the nation's number one coal producer, with deposits sufficient to last for centuries at current production levels. The state also produces oil and natural gas, and has vast deposits of tar sands and oil shale which have not yet been developed.

Nevertheless, Kentucky, like the nation, can benefit from the expanded use of renewable energy technologies. It would be unwise to develop only fossil fuel deposits simply because these resources were emphasized in the past. The state also can benefit by developing the energy potential of its solar resources, its woodlands, agricultural products and flowing streams.

The industrial revolution began with the exploitation of coal, and the tremendous prosperity of America has been linked to the availability, throughout our history, of cheap and abundant energy resources. Wood was the main fuel used before the Civil War. By 1900, coal fired 80 percent of the nation's industry, heated homes and ran the railroads. Oil soon began to displace coal for transportation and, after World War II, oil and natural gas became the mainstays of the economy. They were easier to transport, easier to use, and cleaner to burn than coal.

The "energy crisis," which became a popular concept after the oil embargo of 1973-74, does not refer to any absolute lack of exploitable energy, but to shortages and much higher real prices for the most desirable fossil fuels. In 1979, over 70 percent of the fuel consumed in the United States came from oil or natural gas. Twenty-three percent of this total consumption was oil imported from other parts of the world.[1] Imported crude oil now costs more than 10 times what it cost in 1970. The average wellhead price of natural gas rose from 17.1¢/MCF to 114.4¢/MCF from 1970 to 1979 (MCF = thousand cubic feet), and will continue to rise until natural gas prices are fully deregulated in 1985. Gasoline, which cost 36¢/gallon in 1970, cost an average of $1.39 in February, 1981.[2] Our committee has been told to expect electricity and natural gas prices to triple in the next few years. Although such rapid increases may not occur, virtually all sources predict that energy prices will continue to rise.

Shortages and higher prices of oil and natural gas force the nation to look to alternate energy sources and also to conservation, in order to maintain a reasonable prosperity. Higher prices also lessen the overwhelming competitive advantage once enjoyed by oil and gas and make the development of other energies more attractive. Coal liquids, wind power, solar heat, oil shale and alcohol are a few of the energy sources which could not compete with $2.50 per barrel oil, but which are being reconsidered now that oil costs $35 per barrel. Technical advances which make these alternatives safer, cleaner or cheaper also have improved their competitive position.

Coal is an important part of a national energy solution and of Kentucky's economy, but almost no one seriously argues that coal could, or should, meet all future energy needs. This country has doubled its energy consumption every decade for most of the century. More coal is mined today than ever before, yet coal now supplies less than 20 percent of the energy we consume.[3] Today, very little coal is used directly by households. It is burned

to produce electricity and used by certain large industries. Although electricity is clean and efficient at the point of consumption, 2/3 of the energy in coal is lost when it is converted to electricity, and power plants, despite strict emission standards, are major sources of air pollution. About 36 percent of the coal-fired electrical generating capacity in the country is located along the Ohio River and its tributaries. Besides electricity, these plants produce an estimated 32 percent of the total sulphur dioxide emissions in the nation's air.[4]

Kentucky has been at the forefront in demonstrating coal gasification and liquifaction technologies, which convert coal into clean and convenient substitutes for petroleum and natural gas. If successful, these developments should increase demand for coal and lessen our dependence on petroleum. However, optimistic projections estimate that synthetic fuel plants could produce, at most, 25 percent of the nation's need for petroleum by 1990. At the present time these technologies are very costly, and the amount of government subsidies to be continued is uncertain.

Like the nation, Kentucky needs to look at many alternate energy sources, and to encourage the development of those which promise to be technically, economically, and environmentally viable. While self-sufficient in coal and electricity, Kentucky produces only about 30 percent of the natural gas consumed in the state, and produces less than 2/10 of a percent of the nation's petroleum.[5]

Solar and renewable energy technologies have great potential in Kentucky. They will not by themselves solve the energy crisis, but can contribute substantially to its solution. Commercialization of some technologies, like high-temperature solar furnaces, will take many years. Some may prove too expensive or too unreliable ever to be used widely, or may not be practical in Kentucky's climate. Other techniques are so simple that their widespread adoption seems more like common sense than the spread of innovation. Thousands of Kentuckians now use wood burning stoves as backup heat, and use south-facing windows for supplemental daytime heat. Numerous applications of solar and renewable technologies lie between these extremes, such as active solar space and hot water heating, passive solar heating, underground and earth-sheltered construction, and small wind generators. Most are being developed for small-scale domestic or commercial applications, but there are exceptions. Several huge alcohol plants are slated for construction in the state, and the City of Vanceburg is constructing electric generators on an existing Ohio River dam.

Kentucky needs to look very carefully at the potential of its renewable energy resources and encourage their development.

CHAPTER III

FEASIBILITY OF SOLAR ENERGY

The term "solar energy" embraces a wide variety of techniques for producing usable energy, either directly, from solar radiation, or indirectly, from wind, water, or biomass. No generalization can be made on the viability of this diverse lot. Some technologies are very far from either technical or economic practicality. Some are essentially fully developed and under specific circumstances are competitive with other forms of energy. A few enjoy widespread practicality today. The committee found that some passive solar siting and design elements could be incorporated in almost all new homes today at virtually no extra cost, and provide significant energy savings.

HCR 42 directs the committee to "determine the potential for use of solar and other renewable energy resources in the Commonwealth." The committee's very broad jurisdiction and the limited time for completion of its work did not allow an in-depth analysis of all technologies. The committee concentrated most of its effort on clarifying some of the controversy over the economic viability of solar space and water heating, including both active and passive designs, in Kentucky's climate and compared to projected fuel costs in the region. Committee findings on these topics comprise most of this chapter.

The committee also gathered information on the potential of other "renewable" technologies and in some cases identified problems which may hinder their optimal development in Kentucky. Although these were not studied in depth, developments in the use of wood, alcohol, water power and wind are discussed briefly in the following sections.

Use of Renewable Energy Technologies in Kentucky

Wood

Wood has once again become a common home heating fuel in Kentucky, and the sale of firewood is a profitable sideline for an increasing number of small farmers and entrepreneurs. Virtually no state data are available, but nationally the sale of wood burning stoves increased from 200,000 in 1970 to 1,000,000 in 1978 and 1,500,000 in 1979.[6] Seven percent of the homes in the country are now entirely or partly heated with wood stoves or furnaces. This proportion could well be higher in Kentucky, with its relatively larger rural population and abundance of wood.

In addition, at least nine Kentucky industries burn wood to produce process heat, space heat, or electricity for their own use. The largest project to date is operated at the Westvaco paper mill at Wickliffe, Kentucky, where a wood-burning boiler burns 1,000 tons of bark, sawdust and other waste wood materials daily and supplies approximately 1/2 of the plant's process steam requirements.[7]

Wood burning can pollute the air just like the burning of coal or other fossil fuels, although wood contains almost no sulphur or radioactivity. Nearly $5 million of the $24 million investment for the boiler at Wickliffe

was for environmental and air quality protection equipment. The slow-burning fires in modern "airtight" wood stoves for home heating produce more nitrates and other noxious compounds than their less efficient older counterparts. Environmental problems do not appear serious now, but they could be if wood became widely used by homeowners in the state's metropolitan areas.[8]

Wood heating is one way to utilize forest resources which otherwise would go to waste. Kentucky's forest lands have increased steadily since the first forest survey in 1948, as land which once was cleared reverts to trees. It is estimated that each year these woodlands grow 20-30 million tons more wood than they lose from timbering.[9] Wood stoves could burn this surplus without depleting the resource base.

Alcohol Fuels

Alcohol has been used as a special-purpose fuel for a long time. Gasoline engines can be modified fairly easily to run on this renewable fuel. Current interest in alcohol as a fuel, however, stems primarily from use in "gasohol," a mixture of 90 percent gasoline and 10 percent anhydrous ethyl alcohol (ethanol). This product has been well-accepted by the public even though it costs slightly more than gasoline. The federal government and many states (including Kentucky) offer tax incentives for gasohol. This new use greatly increases the demand for the production of ethanol.

In Kentucky, three large-scale projects currently are underway to produce ethanol for fuel. National Distillers is converting idle distilleries in Frankfort and Louisville to produce an estimated 14,000,000 gallons of pure ethanol a year. Similarly, Bardstown Fuel Alcohol Company is converting the Willett Distillery to produce 5.5 million gallons a year. The Kentucky Agricultural Energy Corporation, with Chevron Oil, is building a new facility in Franklin, Kentucky, to produce 20 million gallons a year. A number of other projects are in planning stages.

Alcohol can be produced from all types of plants, but corn is the preferred feedstock. A gradual shift towards the use of agricultural residues, low-grade grains, or wood would be desirable. Alcohol fuels can lessen the nation's dependence on petroleum products only if fuels other than petroleum are used to fire the production facilities, since the energy required to produce alcohol equals or exceeds that contained in the product. House Bill 838, passed by the 1980 General Assembly, gives tax incentives to ethanol production facilities, but only if they use coal as the main fuel source in the distilling process.

In addition to large-scale ethanol production, there is a growing interest in small-scale production for home use, particularly on farms, where ethanol can be used to power tractors and other farm machinery. The federal Department of Alcohol, Firearms and Tobacco has liberalized its permitting procedures for legal alcohol stills, to allow small-scale, experimental facilities to produce fuel alcohol. By Spring, 1981, 180 permits were issued for small-scale stills in Kentucky.

Hydroelectricity

For centuries, the energy in flowing water has been harnessed to provide mechanical power for homes and industry. Today the most common use of water power, by far, is in the production of electricity. Hydroelectric facilities today produce about five percent of the electricity used in Kentucky.

Once built, a hydroelectric facility costs very little to operate and maintain, burns no fuel, and does not pollute the air or water. Many such plants have run reliably for 50 years. Over the life of the plant, hydroelectric facilities can produce electricity more cheaply than any other source. However, in the postwar period, technological improvememts and economies of scale drastically lowered the costs of coal-fired units, making additional hydropower developments less attractive.

Today there is a resurgence of interest in developing Kentucky's hydroelectric potential, partly in light of tremendous increases in construction costs for new coal-fired facilities. On some sites today, hydroelectric generating units can be added to existing dams for about the same investment per kilowatt of capacity as the cost of a new coal-fired plant with all of the required pollution control equipment. Since coal plants cost considerably more to operate, hydroelectric power is very competitive under these circumstances, even in the short run. Improved turbine design and the development of standard generating units, especially for small facilities, also make hydro generation economically attractive at sites which previously were not developed.

The Kentucky Department of Energy has identified 50 dams on Kentucky rivers and lakes with a potential for "small-scale" hydroelectric development. "Small-scale" is defined as a capacity of between 100 kilowatts and 30 megawatts, or enough power for anything from a small factory to a middle-sized city. In addition, several dams along the Ohio River offer potentials for between 50-150 megawatts each. All of these sites together could produce as much as 800 megawatts of electricity, somewhat more than the largest coal-fired unit in the state.

Applications have been made for site assignment by the Federal Energy Regulatory Commission, prior to feasibility studies on 29 of the 50 dams identified by the Department of Energy. The City of Vanceburg will soon complete a 70-megawatt generating facility on Greenup Dam on the Ohio River, and has permits for construction on three additional Ohio River dams.

The monopolistic position of existing electric utilities may cause some problems in the development of Kentucky's hydroelectric potential by anyone other than the utilities themselves. State law presently prohibits some municipal utilities from selling surplus power to other municipalities and prohibits rural electric cooperatives from selling to or buying from cities (KRS 96.520 and 279.125). Vanceburg is being forced to sell its surplus power to Hamilton, Ohio, rather than to Kentucky users. Developers of small dams will be exempted from Public Service Commission regulations, but they must either consume the power themselves or sell the power to a utility company. They cannot distribute the power to retail customers. The Public Service Commission is presently conducting proceedings to establish standard guidelines for the determination of a "fair price" for surplus power purchases by utility companies. Until these guidelines are developed, any such purchase would be at a negotiated price or at a price ordered by the Commission. Such insti-

tutional problems must be addressed if maximum development of hydroelectric potential is to be achieved in Kentucky.

Wind

Technically, windmills and wind generators are old, proven, reliable sources of renewable energy. Even before the turn of the century, windmills were widely used in the midwest and great plains areas to pump water and provide irrigation. By the 1920s, wind power had become a major source of electrical power on farms and homesteads across the nation. A number of manufacturers both here and abroad sell wind generators capable of producing household electricity. Experiments continue perfecting much larger wind machines, each capable of supplying a village with electricity. A March, 1980 article in EPRI Journal, an electric industry trade publication, predicts that wind energy probably will be the first solar-electric technology used for utility power generation.[10]

Nevertheless, the committee found very few projects utilizing wind energy in Kentucky. Most of the small wind generating systems on the market require at least 7-mile per hour wind speeds to begin operating and only achieve optimal efficiency in wind speeds over 20 miles per hour. Wind data in Kentucky is very sketchy, but average wind speeds of 10 miles per hour or greater do exist in certain locations. Low average wind speeds can support viable wind systems if, in general, windy periods correspond to periods of high electricity demand. This appears to be the case in many parts of Kentucky. The Department of Energy plans to study the wind energy potential within the state. It also plans to purchase wind monitoring equipment for loan to individuals interested in installing wind systems. These individuals will in turn be expected to furnish the data to the Department of Energy; eventually those areas of the state with reasonably good wind energy potential will thus be identified.

In locations not hopelessly remote from existing electric lines, small wind generators are most feasible when used in conjunction with the existing electric power grid. Storage batteries and related equipment account for a large portion of the cost of self-contained systems. Devices which interface with the electric power grid, taking power from the grid when needed and sending surplus power into the electric lines, are now on the market. Utility companies are understandably reluctant to purchase small amounts of power from self-generators, but the Public Utility Regulatory Policies Act (PURPA) of 1978 requires them to do so, and to pay a reasonable price to the producer. The U. S. Department of Energy currently is studying solutions to some of the engineering and safety problems of interconnecting small wind systems to utility grids,[11] and the Kentucky Public Service Commission is developing regulations to set a purchase price if the parties cannot agree.

The Potential for Direct Solar Applications in Kentucky

The renewable energies discussed in the previous section derive only indirectly from solar radiation. Direct solar applications are those which intercept the sun's radiation and convert it into usable energy, which can be in the form of heat, mechanical power, or electricity.

The committee concentrated its efforts on techniques which collect solar heat at low to medium temperatures for space heating and cooling, and for domestic hot water heating. Photovoltaics are a promising source of electricity production, but still are cost-prohibitive except for special applications in remote areas. Experimental solar furnaces have been built which concentrate solar energy to produce very high temperatures for process steam or electricity, but the committee found no evidence that such applications are imminent or likely in this region.

Discussions of solar applications routinely differentiate between "active" and "passive" technologies. "Active" solar systems transfer heat by working fluids or air circulated mechanically, and typically use specially built collectors. "Passive" systems make use of natural forces such as convection, conduction and radiation to transfer energy, and often use structural components of the building, rather than special collectors and storage units. In practice these distinctions sometimes blur, and many operating systems contain both active and passive elements.

Technical Feasibility

The committee found no basis at all for the claim, which is sometimes still heard, that solar technologies will not work in Kentucky. When the committee began its work, the Kentucky Department of Energy supplied a list of 175 solar installations it had identified, located in about 40 Kentucky counties. Less than a year later, that list has grown to include over 300 known projects. About 50 percent of these projects include domestic hot water heating, and a majority involve residential buildings. These projects include architect-built homes designed in part to prove the feasibility of solar techniques; several passive homes built by TVA as prototype designs available to interested builders; a number of earth-sheltered homes; an envelope-design passive savings and loan branch office; retrofit projects using attached greenhouses to help weatherize homes of low-income elderly Kentuckians; and a wide variety of other applications and techniques. These projects are summarized in Table 1. The committee visited several solar buildings and installations in Louisville and Frankfort, and heard from the owners or builders of many others. In some cases, due to faulty design or installation, systems have not worked as well as anticipated. Some systems, especially some which were built as heavily subsidized demonstration projects, would not be practical at current costs. Such problems would be difficult to avoid at a time of experimentation with technologies relatively new to most of the users. The committee found, however, that most of the existing projects work, and work well.

Table 1

Kentucky Solar Projects by Application

Type of Project		Number of Projects
A. Active Solar	Total	233
1. Domestic Hot Water		111
2. Space Heating		43
3. Domestic Hot Water & Space Heating Combined		79
B. Passive Solar	Total	122
1. Space Heating		112
2. Domestic Hot Water		10
C. Earth Sheltered Housing		36
(Earth sheltered housing is included since these residences are generally very energy-efficient and, more specifically, almost all of these sites are utilizing passive solar gain as a significant source for space heating.)		
D. Wood Burning		9
(All of these are commercial/industrial sites.)		
E. Resource Recovery		5
(These are municipalities at varying stages of implementation, but each seems to have an excellent chance for success.)		
F. Wind		6
G. Hydropower		27
(These sites have permits either approved or pending to conduct a feasibility study to determine the site's potential as a small-scale hydropower producer.)		
TOTAL SOLAR PROJECTS IDENTIFIED		438

Source: Kentucky Department of Energy, Division of Alternate Energy, July, 1981.

Kentucky does not receive as much solar radiation as some parts of the country, especially the arid Southwest. Dr. Blaine Parker, of the University of Kentucky, offered the committee climatic data to show that while Kentucky's latitude and the number of cloudy days reduce the amount of solar energy available, this is by no means an undesirable area for solar development, since heating and cooling requirements for homes also are moderate.

None of the solar applications in Kentucky meet all of the space conditioning or water heating requirements of a building. Excessively large storage components would be required to store enough surplus heat to carry a building through a rare week of cloudy weather. Electric space heating or wood burning stoves appear to be the most common backup systems used for solar space heating.

Economic Feasibility

The economic practicality of solar investments is considerably harder to determine than technical feasibility. An investment in solar represents a decision to pay more initially in capital costs in order to minimize operating costs. The cost-effectiveness of such an investment depends on what happens to fuel prices and fuel availability in the future, since these are the costs and risks which are avoided by installing a solar system. Economists generally agree that energy costs will continue to increase. They do not agree, however, on the amount of such increases. Serious supply disruptions are possible, due to conflicts in the Middle East or elsewhere, which would make it impossible to obtain needed fuel at any price. It also is possible that a period of relatively stable prices will follow the dramatic increase of the past decade.

Despite these considerable uncertainties, it is not difficult to project reasonable fuel savings over the life of a system, and use these to evaluate the amount of initial investment which can be justified in order to obtain these savings. For this kind of evaluation, it is not necessary to differentiate by type of system, but merely to estimate expected savings. The figures in Table 2 were developed using life-cycle costing techniques as guidelines against which to evaluate specific projects. These figures assume that the system will operate for 20 years, that money for the initial investment is borrowed, and that interest rates remain 2 percent above whatever inflation may occur.

According to Table 2, an investment which is expected to save $100 in energy costs the first year is "worth" $1,668 if energy costs rise only as fast as the general inflation rate, and $4,850 if energy costs increase 10 percent in real terms each year. A system expected to save $500 in the first year could cost five times these amounts, and still be expected to recoup its entire cost, plus interest, in 20 years.

Table 2

Current Value of 20-Year Energy Savings, for Selected Energy Cost Projections.*

Expected First-Year Energy Savings	Projected Annual Energy Price Increase	Discounted Energy Savings Over 20 Years
$100	Same as overall inflation rate	$1,668
$100	5% above overall inflation rate	$2,750
$100	10% above overall inflation rate	$4,850

*Calculated as follows:

$$\text{Present Value} = S \times \frac{1 + e}{d - e} \left[1 - \left(\frac{1 + e}{1 + d} \right)^{n} \right]$$

Where: S = first year savings = $100

e = annual energy price increase

d = discount factor, intuitively the interest rate on a loan, assumed to be 2% above the inflation rate

n = number of years = 20

Several studies have attempted to determine the competitive position of active solar space and hot water systems relative to conventional systems.[12] Cost figures for active systems are easier to generalize because the solar components (collectors, storage, etc.) typically are discrete from the structure. Active solar hot water systems generally are cost-competitive with electric hot water heaters, especially if the owner claims the 40 percent federal tax credit on his initial investment.[13] Active space heating systems, properly designed and sized, also can pay for themselves over the life of the system. As a generalization, however, the most cost-effective active systems are those which operate year round, such as those which produce hot water.

Uses can be combined for greater cost effectiveness. The Port of Entry Building on I-64 near Catlettsburg, Kentucky, uses its collector capacity year round by providing hot water during the busier summer months, and producing part of both space and water heating needs in the winter.

The committee found that passive solar applications are, in general, more

cost-effective than active solar systems. The simplest siting and design concepts could be incorporated into virtually all new buildings at little if any extra cost; savings of 40-60 percent can be obtained with only moderate outlays.

Most passive solar techniques work by taking advantage of the sun's seasonal movements. In the dead of winter the sun rises in the southeast, sets in the southwest, and at noon hangs only about 30 degrees above the southern horizon. In the summer the sun rises almost due east, sets almost due west, and rises to 75 degrees above the horizon, or almost "straight up." So windows on the east or west sides of a building receive several hours of sun every day all year. North-facing windows get no direct sunlight. But during the winter the sun shines into south-facing windows all day, while, with proper design almost no sun enters them in the summer. Since extra heat from the sun is desired in winter but not in summer, it makes sense to put most of a building's windows on the south side and minimize the windows facing north, east or west. It also makes sense to make the long sides of the building face south and north; to put buffers, such as attached garages or utility rooms, on the north side; and to arrange plantings around the building so that the north side is protected in winter, and the south side is shaded, if at all, only in summer.

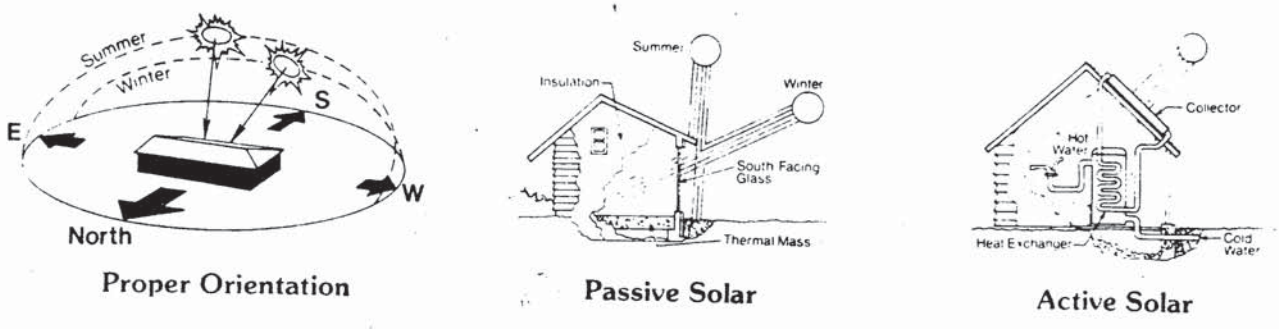
These orientation and design principles are, of course, oversimplified for purposes of discussion. However, a well-insulated home built with these concepts in mind can be expected to require no supplemental heat on sunny winter days between about 10:00 a.m. and 4:00 p.m., and to require only occasional supplemental heat during most of the fall and spring. The addition of storage - heavy masonry walls or floors to collect part of the excess heat during the day and release it slowly at night - can reduce temperature fluctuations and further improve performance. Any number of improvements, refinements and variations are possible. In a new building, simple solar design elements should not increase costs at all. A house with south-facing windows should cost no more to build than one with its picture windows facing east, and a fireplace located so that the masonry stores heat from the winter sun should cost no more than a fireplace somewhere else in the home.

Not all passive designs are cost-effective, any more than all active designs can be justified by these criteria. Where available, cost data for individual systems can be evaluated by using benchmark figures such as those found in Table 2.

Much time is spent debating costs and benefits of solar vs. conventional energy systems, as if cost effectiveness were the only consideration in the use of solar energy. If individuals so avidly debated cost effectiveness of other major purchases, it is doubtful that consumers could justify them, e.g., the purchase of economy cars at twice the price of full-sized models, or expenditures for the latest appliances, riding lawn mowers or new fashions. Therefore, perhaps the monetary, long-term costs and benefits of solar energy systems should be viewed as only part of solar energy use justification. Environmental and renewable aspects of solar energy, as well as the benefits of national self reliance, while not presently quantifiable, are important and deserve consideration along with debatable cost-effectiveness equations.

Figure 1

Solar Orientation



Proper Orientation | Passive Solar | Active Solar

Source: Pocket Solar Energy Information DATA BANK, SERI Document Distribution Service, Golden, Colorado.

Economic Impact

From a state and local economic perspective, there are two basic effects associated with increased utilization of residential solar energy. One is the economic effect of a reduction in total expenditures for energy. The other is the economic stimulation resulting from the growth of the solar industry. The first effect views solar as conservation; the second views it as new (and different) industrial growth. The general economic consequences of these effects should be similar, whether considering the state as a whole or a smaller economic sub-unit.

Income Effect

The first effect stemming from solar development is the "income effect." This occurs when the amount a person has to pay for a given service is reduced, leaving him more to spend on other things. The service that a consumer of energy buys is not the watts of electricity or the cubic feet of natural gas that he receives a bill for. Few people want these commodities for their own sake. Rather, the demand for electricity, gas or other energy sources is derived from the demand for a service that the consumer actually does want for its own desirability: a warm room, a lighted space, hot water, a cold food storage area. Presumably the individual is indifferent to the source of the comfortable temperature (electricity, natural gas, solar, etc.), but is quite sensitive to the costs of getting it that way. To the extent that solar energy can provide these services at less cost than conventional energy sources, its effect is to increase the disposable income of the consumer.

To estimate the regional economic impact of the energy savings from solar development requires four basic pieces of information: the typical conventional residential energy expenditure; the percentage of energy savings from

solar; the number of solar installations; and the regional economic multiplier. By considering a fifth variable, the effective tax rate, an estimate can be made of the fiscal benefits attributable to this energy savings.

The vast majority of new homes are currently heated by electric energy. Since 1976, the number of natural gas customers in Kentucky has actually been in decline and until late 1980, there was a ban on new natural gas hookups in the state. Primarily for this reason, but also because many recent forecasts indicate that natural gas prices will soon approach the levels of those for electricity, the present analysis uses the monthly electric bill of a typical Kentucky household using 1,000 kilowatt hours (KWH) of electricity per month as the basis for its residential energy cost calculations.[14] One thousand KWH per month should provide a conservative estimate of a typical Kentucky household's actual consumption.

The percent savings from using solar will vary tremendously, probably from zero savings to 100 percent savings. For lack of better information it is assumed in this analysis that the average installation will save 50 percent of the conventional energy consumption. The same shortage of data applies to the probable number of total solar installations. However, the Solar Energy Industries Association of Georgia, Inc., reported that in 1979 its members installed some 400 solar units in Georgia, a state with population, income, and socio-economic characteristics similar to Kentucky's.[15] Thus the number 400 is used as an estimate of Kentucky's total first year solar installations.

Finally, the multiplier for the expenditure effect is a selective one derived from several empirical models of Kentucky data. These models seem to cluster around a value of 1.8.

The economic impact on the state of 400 new solar installations, each saving 50% of a typical electric bill, would be:

$480 annual electric bill x 50% savings = $240 individual savings/year

$240 x total number of installations (400) = $96,000 total savings in the state

$96,000 x 1.8 multiplier = $172,800 total annual economic stimulation

Since the initial saving from solar installations is in the form of added income <u>after tax</u> (since no tax is paid on the "income effect" from savings) the state income tax gain would apply only to that <u>additional</u> economic stimulation induced by the multiplier effect, the $76,800 difference between the direct and the total stimulation. Kentucky's marginal income tax rate is 6 percent on income over $8,000. Applying that rate to the $76,800 should give the upper limit of the state income receipts from this overall process. Thus,

$76,800 x 6% = $4,608 new income tax revenue to the state.

This economic and fiscal stimulation addresses only those impacts flowing from the "income effect" of increased solar utilization. The impacts flowing from the "substitution effect" could well have a greater impact on the region (however defined) than those income effects, but of the broad array of uncertainties involved they are much less subject to quantification.

Substitution Effect

The local economic substitution effect results when income that is currently being spent for services from outside the local community is redirected toward expenditures within the locality. This substitution effect as it relates to solar energy is based on two characteristics of that industry. The first is that the solar industry will be labor intensive. This characteristic has been identified in several studies on the relationship between energy and employment, including a report of the U.S. Congress's Joint Economic Subcommittee on Energy.[16] The second characteristic is that the solar industry will be comprised of a large number of relatively small, regionally owned firms. This characteristic stems from the low cost of entering the industry (some firms may simply be the classic owner-operator with a few basic tools and no inventory), and the fact that the nature of the work and the raw materials required are such that it would not be restricted geographically (as opposed to industries that must locate near rivers, near a fuel source, or near major population centers). It would follow from these characteristics that diverting expenditure from conventional sources of energy (capital-intensive, non-locally owned) toward solar industries would leave more money in the local economy, money which would, in turn, further stimulate that economy.

Labor Intensity

The impact of the labor intensity factor of the solar industry on Kentucky and its local communities is further indicated by the observation of solar manufacturers that, on the average, it takes ten hours of installation time for each hour of manufacturing time. Compared to the traditional energy sources which require more manufacturing and less installation time, solar represents a shift away from manufacturing employment, and toward installation employment. For a given industry, manufacturing employment tends to be concentrated in a very few geographic locations and generally clustered near major population centers. Installation, on the other hand, would generally be done by local builders and workers. This shift toward an installation-weighted industry would bring about a broader distribution of jobs throughout the economy. It would mean greater employment opportunities for residents of local communities and more income remaining in those communities. Even if the total number of energy-related jobs in the overall economy remained the same (although several studies indicate that solar development should increase total employment), the less industrialized areas should benefit from a shift toward solar. Moreover, since solar installation employment occurs on the site of consumption of the solar products, areas which shift toward more utilization of these products will derive the employment benefits associated with them.

Other Areas

The Solar Energy Industries Association of Georgia (SEIAG) referred to earlier estimates that 400 installations in that state should produce $352,000 of cost savings to their owners and result in a decrease of $163,000 in purchases of fuel by electric power utilities from outside the state. The money from the electric utility fuel savings would presumably now be spent within

the state. Further, SEIAG estimates that a minimum of 40% of the cost of each solar collector will be spent within the state, creating local jobs and employment, and developing local skills.

The City of Carbondale, Illinois, recently established its own solar and conservation subsidized loan program. This program provides low or no interest loans to residents to install solar and energy conserving devices, and is funded by community block grants. The residents of Carbondale (population 23,000) spent over $33 million on utility-supplied energy in 1980, 90 percent of which went to sources outside the community. The goal of the program is to conserve 40 percent of the conventional energy that would have otherwise been consumed by the residents of the community. Should this ambitious goal be accomplished, it would mean an additional $14 million in direct economic stimulation just in the Carbondale area.

Many other state and local governments around the nation have attempted to assess the economic impact which solar energy development would have on them. Though the actual numbers differ in each case and the methodology and assumptions used to derive the numbers vary frequently, the basic theme appears consistently: because of the local labor-intensity of solar energy products contrasted with conventional energy commodities and because of the fact that solar utilization reduces local consumption of conventional energy, increased solar adaptation causes more money to remain in the local community.

CHAPTER IV

RESOURCE ASSESSMENT

The Federal Solar Program

President Carter established in his Solar Message of June 20, 1979, the concept that the Federal Government has a responsibility for providing incentives, information and the impetus for the solar goal of meeting 20% of the nation's energy needs from solar resources by the year 2000. The key elements of the message included endorsement of the following legislation: Tax credits for passive solar designs and applications and new investments which process heat for use in industry and agriculture; establishment of a solar bank to provide interest subsidies; and an extension of the exemption of federal gasoline excise tax for purchases of gasoline/alcohol mixtures.

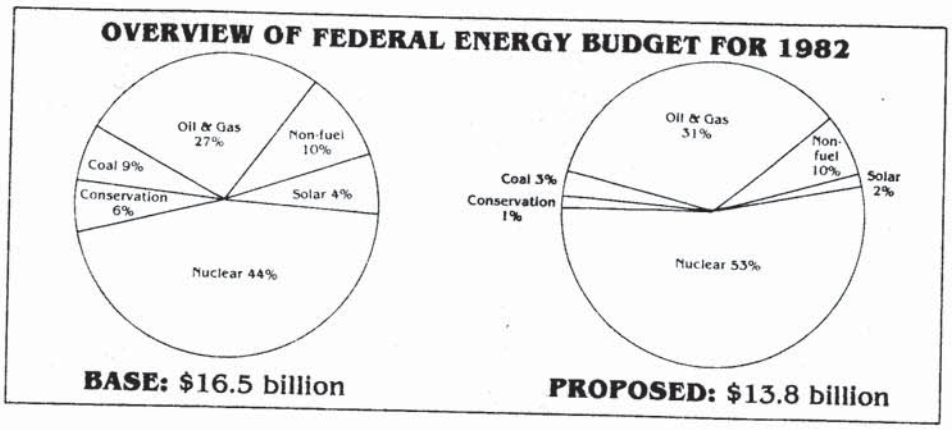
President Reagan's new administration has not emphasized energy issues. Indeed, there is doubt that a Department of Energy will remain in place, and the funding of solar programs remains in jeopardy. The main reasons for this policy change are the new administration's approach to balancing the budget and the emphasis on "getting the government off the backs of the people."

The question of the fairness of government subsidy for non-renewable energy while leaving solar to survive in the private sector without such subsidies is being raised, however. Yet some solar industries welcome the chance for solar to make it on its own. They claim that rising energy prices and deregulation will bring new customers and they welcome the competition.

Federal income tax credits were instituted as part of the National Energy Act of 1978. The Crude Oil Windfall Profit Tax Act of 1979 increased the amount of these credits. Since January 1, 1980, the federal government has made available a 40% non-refundable tax credit for investments designed to utilize renewable energy in both new and existing homes. The technologies included are for heating and cooling homes, supplying hot water, producing electricity or harnessing wind or geothermal energy. The investment must be made by December 31, 1985 and the credit may be carried over until 1987. Businesses could receive a 10% refundable tax credit for investments in renewable resource property installed between October 1, 1978 and December 31, 1979. For investments made between January 1, 1980 and December 31, 1985, a 15% non-refundable tax credit is offered. A 10% investment credit for biomass property acquired between October 1, 1978 and December 31, 1985 and a 4¢ per gallon excise tax exemption for certain alcohol fuels are available.

Many proposed budget cuts, if approved by Congress, will hurt solar programs. (See Table 3.) Not only the solar portion, but the entire energy budget may be reduced (see Figure 2).

FIGURE 2



Source: Energy Conservation Bulletin, Vol. I, No. 1, June/July 1981.

State Solar Program

The primary goal of many states is to trim expenditures and exercise fiscal restraint; yet of the states that list energy as one of their major concerns, many have a two-fold focus: incentives for conservation and loans for alternative energy. With federal dollars scarce, state legislatures will have to assess carefully the economics of support for solar programs.

Need for a State Plan

The Southern Solar Energy Center reports a growing interest on the part of state policymakers in developing a role for solar and renewable energy in state programs. Rising costs of conventional fuels, the potential for industrial development, and new employment associated with solar industry are the reported incentives for state policymakers.

The potential of solar for Kentucky can best be determined at the state level. Many options which have been taken by other states take the form of tax incentives, financing by utility companies of conservation measures and solar systems for customers, state assistance in capitalization of solar firms, solar industrial loan guarantees and commercial and industrial solar installations financing through tax-free revenue bonds. The removal of institutional barriers, research, development, and demonstration programs, and programs for public awareness are found in all state solar programs.

Table 3

Federal Solar Programs

PROGRAM	PURPOSE	STATUS - SPRING, 1981
RCS (Residential Conservation Service).	(Part of NECPA, National Energy Conservation Act) - A plan for a Utility Solar & Conservation Program.	Expected budget cuts which will affect federal monitoring capability.
PURPA (201) (Public Utilities Regulatory Policies Act).	Establishes mandatory utility Interconnection with small generators and "full avoided cost" buy-back of power.	FERC (Federal Energy Commission) has authority to enforce the law through the courts, but regulations are being challenged by some utilities.
CSA (Community Service Administration).	Provides Emergency Crisis Intervention program for needy poor and funding for six solar training centers (the program funded in the South is the Southeast Technical Group, Atlanta, GA).	May be abolished by Reagan budget cuts.
Jobs in Energy Program.	Established by National Commission for Full Employment; program includes a national Jobs in Energy clearing house and funds nine community-based Job in Energy Projects (none in Kentucky).	In effect; no reduction.
SERI.	National Solar Energy Research Institute.	May receive partial budget reduction.

(cont.)

Table 3 (cont.)

PROGRAM	PURPOSE	STATUS - SPRING, 1981
Solar & Conservation Bank.	Primarily a subsidy loan program; in some cases direct grants for low and moderate income people.	Facing extinction.
Small Business Administration Energy Loan Program.	Loans to be used to improve energy systems for small businesses.	Facing extinction.
National Solar Heating & Cooling Information Center.	Provides publications and specific answers to both technical and non-technical requests; toll free line.	May receive partial budget reduction.
Solar Energy Information Data Bank.	Developed by SERI; provides publications upon request, operates a national computer network of solar information.	May receive partial budget reduction.
Regional Solar Energy Centers (Southern Solar Energy Center in Atlanta serves Kentucky).	Provides technical assistance to states for various projects.	May receive partial budget reduction.
U.S. Department of Energy National Data Network.	Provides a data program on solar performance on a monthly basis at locations throughout U.S.	May receive partial budget rereduction.
Appropriate Technology Small Grants Program.	Operates out of Office of Small Scale Technology, U.S.DOE, through the Atlanta Regional Office. Individual grant application limits from $50,000 - $100,000.	Abolished.

The solar program is just beginning to be developed in Kentucky. Some national studies rank Kentucky last, or in the bottom five states, in solar implementation. But Kentucky is in the position of learning from others and with that knowledge can tailor a state program for the Commonwealth.

But in order to have an effective solar program, a comprehensive state plan must be developed. The four basic elements of a state solar energy program are: (1) program planning; (2) institutional barriers mitigation; (3) research, development and demonstration projects; and (4) information outreach efforts. The Solar Energy Research Institute (SERI) emphasizes its conclusion that a vital planning component is a comprehensive assessment of factors affecting solar energy application and commercialization within the specific state.

The committee, as directed by HCR 42, assessed planning elements and approved a design for Kentucky state plan for a solar program. (See Appendix 6.)

Kentucky Department of Energy

In June of 1980, the Governor of Kentucky, by Executive Order, created a Bureau of Energy Production and Utilization within the Department of Energy. This bureau is responsible for facilitating the development of all energy resources. There are two divisions within the bureau: the Division of Coal Development, and the Alternate Energy Division, whose primary concern is for other forms of energy that may be developed to complement fossil fuels. The responsibility for solar energy therefore falls to this division.

The primary task, as reported by the Kentucky Department of Energy has been to evaluate alternate energy development and design a comprehensive alternate energy program. This program has been primarily active in the area of education and information. The major objective for 1981-82 is the establishment of programs to assess the technical and economic feasibility of alternate energy in the state.

The federally funded Appropriate Technology Small Grants Program was implemented through this division. This program provided funding to applicants for research and development of new, energy-related, small-scale technologies. The Kentucky Department of Energy established a Technical Review Committee to assess technical feasibility and a state review panel which ranked the technically approved proposals. These recommended proposals were then forwarded to the regional U.S. Department of Energy office for approval. Of the 149 proposals submitted in 1980, only 9 were funded. The reasons given to the committee for Kentuckians receiving such a small portion of the funding available to the southeast region are a small population factor and the quality and number of applications received. This program has been abolished by the current federal administration.

Other Resources

During its deliverations, the committee learned of resources outside of state and federal government which are interested in developing renewable energy sources. Because of the "energy crisis," a variety of public and pri-

vate institutions have taken appropriate initiatives to encourage the use of renewable energy. This section of the report describes those projects and activities which the committee has discovered and which are an available resource to the citizens of Kentucky. There has not been any attempt by the committee to compile a comprehensive list.

Demonstration Projects

The Lakeland Wesley Project, located in Marshall County near Kentucky Lake, is an example of a project in which the combination of resources has led to a practical and beneficial application of solar technology. This project has received support from the United Methodist Church, TVA, HUD, and the Sherwin Williams Company. It consists of 96 units of subsidized housing for the elderly, designed to make extensive use of passive solar technology.

A passive solar house in Louisville, designed to be acceptable in the current market, is the product of a cooperative effort between the Southern Solar Energy Center, Omikron Construction Company, and Chrisman, Miller and Wallace, Architects. This 2,000 square foot home, with high insulation and passive solar features, uses about 60 percent less energy than a typical new home. The committee visited this home during the interim. (See Appendix 7 for sketch, floor plan and further details.)

Utilities

As a regional energy supplier in western Kentucky, TVA has exhibited considerable interest in energy conservation and solar application among its users. In addition to the assistance provided to the Lakeland Wesley project, TVA provides technical assistance on passive solar technology to its customers. It has published many instructional booklets, such as a step-by-step guide to building a solar hot water heater and another called "Safe and Warm Wood Heat."

Another major project sponsored by TVA is "Solar Homes for the Valley." Under this project TVA plans to build fifty demonstration houses - three in Kentucky.

TVA is also assessing wind resources at seven monitoring sites and doing other research to determine wind's potential in the TVA region. The renewable energy activities of other utilities were reviewed by the Subcommittee on Institutional Barriers and Incentives and are reported in Chapter V.

Universities

Eastern Kentucky University and the Oak Ridge National Laboratory funded a community solar energy project at Richmond, Kentucky, which was jointly sponsored by Eastern Kentucky University and the community of Richmond. The project, which was designed to increase citizen involvement in energy planning and encourage promotion of community renewable resources, has reportedly served as a model for other such projects in Kentucky.

The state educational institutions provide capabilities in research, testing, analysis, data collection and resource personnel for planning at state and local levels. Detailed information on solar activities of the state universities is provided in Appendix 4.

Solar Industry

Solar businessmen report that requests for solar equipment and installations are increasing. But the solar industry - as a network or infrastructure - is not fully developed in Kentucky. The Solar Energy Industries Association has not yet formed a Kentucky chapter, but the industry will come - as solar groups grow, as solar seminars and conferences spark more interest, as solar legislation is passed. Expertise from the existing solar industry, however, is represented on the Special Solar Energy Advisory Committee and the Alternate Energy Advisory Council of the Kentucky Department of Energy.

Grassroots Organizations

The Kentucky Solar Coalition reported their concerns to the committee. This solar advocacy group is also represented on the Alternate Energy Advisory Council. Representatives from Appalachia-Science in the Public Interest reported to the committee that solar has worked in many places in Kentucky. Their findings resulted from solar demonstration efforts. One example is the Rockcastle Resource Center, an energy efficient building which houses a technical staff who provide assistance in designing energy systems for low-moderate income families.

Sheet Metal Workers' Union

The Sheet Metal Workers' International recently opened a new facility on English Station Road in Louisville that will be used to train instructors, contractors and apprentices in solar technology. The facility and program are backed by a $1.5 million grant from the U.S. Department of Energy and by volunteer labor from the sheet metal industry.

Local Government

The Lexington-Fayette County government has assigned staff to review ordinances which may be obstacles to the development of solar systems in the county. This staff has requested assistance and advice from the Special Solar Energy Advisory Committee.

A Citizen's Energy Council is being established in Louisville and their concern regarding solar access was reported to the Subcommittee on Institutional Barriers and Incentives.

Throughout the nation scores of community energy efforts have been successful. Examples are available through publications from the President's Clearinghouse for Community Energy Efficiency (see Bibliography).

Funding Sources

Many of private and corporate institutions in Kentucky and the United States have become interested in alternate energy development. These include such prominent foundations as the Ford Foundation and the Stewart Mott Foundation. A list of these foundations can be found in a report entitled "Energy Alternatives for Small Farms and Rural Communities in Appalachia," prepared for the Appalachian Research Commission by Roger Blobaum and Associates (January, 1980).

CHAPTER V

STRATEGIES: SUBCOMMITTEE REPORTS

Due to the fact that federal agencies and other individual states have been involved with solar implementation, many reports and other sources of information on issues before the committee were available. As a result, the committee was divided into three subcommittees, whose responsibilities were focused on the areas of tax incentives; research, development, education and information; and institutional barriers and incentives. The final efforts of the three subcommittees are reported as they were presented to the full committee.

Tax Incentives

The Subcommittee on Tax Incentives of the Special Solar Energy Advisory Committee was established to study potential tax incentive measures in depth, and to make recommendations in this area to the full committee.

Tax incentives have been widely used to encourage individuals to invest in renewable energy equipment and so to foster the commercialization of renewable technologies. Between 1975 and the present, virtually all state legislatures have considered legislation to reduce various taxes on solar equipment. As of October 1980, 42 states provide some sort of tax incentives for solar and/or other types of renewable energy systems. On the national level, the Energy Tax Act of 1978 provides income tax credits for businesses and individuals.

Reductions in income or sales taxes effectively reduce the initial cost of renewable energy equipment, while property tax reductions reduce ongoing expenses of operating such equipment. With a few exceptions, renewable energy systems are much more expensive to buy and install, but cheaper to operate, than conventional systems. The high initial cost discourages many from investing in such equipment, even though this investment may be recouped in a few years through reduced fuel or electricity costs. If the cost of the energy system is added to the value of the property taxed, however, additional annual property tax assessments can decrease the desirability of investing in solar, wind, or other renewable energy equipment.

The earliest tax incentives for solar or renewable energy were adopted by innovative states, such as California, Florida, and Oregon. Federal tax incentives, described in Chapter IV, were first passed in 1978 and increased in 1979. These incentives already are available to Kentuckians and need to be taken into account when designing a state program.

The Subcommittee on Tax Incentives considered a variety of tax incentive measures which have been adopted by other states, and also analyzed existing federal incentives. The main types of incentives reviewed by the subcommittee were sales tax exemption, property tax reduction, income tax credit and income tax deduction. After weighing the advantages and disadvantages of each type of incentive, the subcommittee chose to concentrate on developing a viable income tax credit proposal.

Review of Tax Incentive Measures Adopted By Other States

Sales Tax Incentives. Sales tax incentives have been adopted by eight states.[17] Two approaches have been used. The first is to exempt taxes due for the equipment or system at the time of sale. The main advantage of this approach is that the incentive is available to the consumer immediately and is easy to administer. The other approach is to administer the incentive as a rebate. This approach offers special incentive to "do-it-yourself" builders, who can gather their materials from local sources and then submit receipts of their purchases for refund. Both exemptions and refunds are used in Kentucky for various products, but exemptions are far more common.

Sales tax exemptions or refunds for solar or renewable energy purchases would have little impact on the state treasury, especially if wood-burning stoves were not included. On the other hand, removal of the sales tax would provide a maximum reduction of 5 percent to the initial cost of a system. Subcommittee members felt that removal of this tax would be mainly symbolic. The 5 percent reduction would provide little if any incentive to potential buyers.

A small tax incentive can still be useful, if reporting requirements also provide information on the level of activity in a particular field. Not collecting sales tax does not provide such data, so an exemption would provide little, if any, new information. A rebate might be useful for data collection, but would be more costly to administer. The subcommittee chose not to recommend any sales tax incentive for Kentucky.

Property Tax Incentives. Twenty-nine states have adopted some type of property tax incentives for solar or renewable energy systems. The subcommittee decided not to recommend property tax incentives at this time, due mainly to the severe financial restrictions already facing local governments, which depend on property taxes as their sole revenue source.

Property taxes are based on an assessment of the market value of the property. Since renewable energy systems often require higher initial capital costs than conventional systems, local tax assessors may increase the value of a property to which a solar system has been added, thus increasing property taxes. Such increased taxes may offset the savings from reduced use of fossil fuels, and may act as a substantial barrier to the installation of solar systems.

States which have adopted property tax incentives generally follow one of three approaches: 1) solar systems are exempt from any property tax increase (15 states); 2) the individual property owner is given an exemption equal to the assessed value of the solar system (7 states); or 3) the solar house is assessed as if it had a conventional heating system (4 states). Some of these states do not require an exemption, but authorize local officials to provide exemptions if they wish.[18]

The Kentucky Constitution requires that all property be assessed at its actual value, and does not allow exemptions. Therefore, in Kentucky a property tax incentive would have to take the form of a reduce tax rate, such as 1/10¢ per $100 of value, applied to the renewable energy components of a building. The committee realized the difficulty of assessing solar buildings, due to their unconventional character. Some members of the subcommittee argued that until local Property Valuation Administrators are better informed

and able to make accurate assessments of unconventional structures, the need to separate the value of renewable energy components might merely add confusion.

The main argument against adoption of property tax incentives at this time, however, was the strained financial situation of many local governments which depend on the property tax. In 1979, the General Assembly placed a limit of 4% on the annual growth of local government revenue from property tax receipts (Special Session, HB 44). The subcommittee decided that a further reduction of these revenues would be unwise at this time.

Income Tax Deductions, Credits and Rebates. Twenty-three states offer income tax incentives for solar or renewable energy investments. Five of these offer deductions, and New Mexico provides a rebate. The rest of the states offer credits ranging from 5-55% of the cost of the installation, with the maximum credit ranging from $200 to $3,000.[19]

An income tax deduction is subtracted from an individual's gross income before income tax liability is computed. Generally a deduction is the simplest of the three incentives to administer, and can be expected to have the least impact on the state treasury. However, a deduction provides no incentive to individuals with little or no taxable income, such as a majority of retired people. Moreover, in Kentucky, the maximum income tax rate for individuals or corporations is 6% of adjusted gross income. Even for those in the highest income bracket, a deduction would save only a little more than the sales tax incentive (mentioned above) would, since the savings would only be the 6% tax on the deduction (which would be limited to the price of the solar installation).

An income tax rebate provides for more direct payment to an individual up to a specified limit, even if that amount exceeds the person's tax liability. As such, the rebate would be available to the poor and elderly as well as those with middle to upper income levels. However, a rebate may result not only in loss of revenues which otherwise would be collected by the state, but in payment from the treasury to individuals who have installed solar equipment. For example, if a solar investment qualifies for a $200 rebate but the taxpayer owes only $150 in taxes, then the state must pay the taxpayer $50 in addition to waiving his tax liability. Depending on the amount of the rebate, this choice could have a substantial impact on the state treasury, and it is a relatively untried form of incentive.

An income tax credit normally is a subtraction from the income tax due to the state. A credit can provide a substantial reduction in the cost of a renewable energy system to a consumer, depending on the percentage allowed, maximum credit, and carryover provisions. In Kentucky, a deduction could not reduce the initial cost of the system by more than 6%, but a credit could provide 10, 20, even 50% reduction. The credit would favor individuals in higher income brackets, if the maximum credit is substantially higher than the average amount of taxes owed by individuals.

Provisions of Income Tax Credit Proposed by the Subcommittee

The income tax credit proposal eventually drafted in bill form and adopted by the full committee was the result of careful consideration by the subcommittee. The proposed legislation is found in Appendix 3 of this report.

The following sections discuss major related issues considered by the subcommittee.

Definition of Renewable Energy Components Eligible for a Credit. The problem of definition is twofold. First, it is necessary to decide what types of systems and which components should be eligible for a tax credit. Then the eligible items must be defined clearly enough to avoid confusion, yet with enough flexibility to allow incorporation of new or changing technologies.

Much of the early legislation to encourage solar development in other states was drafted and passed in a hasty manner, and has suffered from vague wording and unclear delegation of authority. The incentives typically apply to broadly-defined alternative technologies, leaving much room for confusion regarding the intent of the legislature. "Solar energy" may or may not include passive solar systems integrated into a building's structure. A credit for property using wind energy might be interpreted to apply to sailboats as well as wind generators, and "biomass" may or may not be intended to include wood-burning stoves.

Some states have avoided the problem of defining eligible systems by incorporating the relevant sections of the IRS code dealing with renewable energy source expenditures or other existing federal standards.[20] The subcommittee rejected this option because the federal credits generally do not apply to passive systems, which the group felt should be eligible for any Kentucky credit. Another method, adopted by Oregon in 1979 (SB 337), is to place performance criteria in the statutes (a system capable of producing at least 10 percent of the energy requirements of a building), along with a general definition of eligible systems. Oregon's Department of Energy is required to evaluate each system for eligibility, based on the performance criteria. The performance of a system is very hard to evaluate before it has been in service for some time, even for qualified architects and engineers. The subcommittee felt this approach would be difficult to administer fairly and would give too much discretion to the administering agency. Instead, the subcommittee decided to specify clearly, as part of the legislation, which systems and costs should be eligible, and require an administrative agency to clarify specific questions by regulation.

Renewable energy technologies may include active solar, passive solar, wind, geothermal, hydrothermal, biomass, and water power. A variety of technologies is encompassed by each of these terms. The subcommittee decided to include active solar, passive solar, wind and hydrothermal energy. Wood heating was considered, but excluded, because this technology already is widely used and promises to grow in popularity without any additional incentive.

It was felt that geothermal, biomass and water technologies other than hydrothermal are less proven or less available to most customers, and that their inclusion at this time might well result in credits being given where they were not intended. While certain technologies in those areas might be included at a later date, subcommittee members agreed that they should be excluded from the initial proposal.

The subcommittee decided that labor or installation costs should be included as part of the investment eligible for credit, but that design costs, interest charges, and the cost of related energy conservation measures, such as insulation, should be excluded.

The subcommittee concentrated particularly on finding a workable definition of passive solar, which would make bona fide passive systems eligible for the credit. Passive features typically are designed as integral components of a building. Many working passive solar buildings contain no elements which can be identified as functioning solely as components of the passive system. South-facing windows, skylights or attached greenhouses may serve as collectors. Extra thick supporting walls or floors, even swimming pools, may be used to store heat, and the overall design may encourage natural air flows to distribute warm or cool air throughout the structure. These components are very real parts of a passive system, but they also support the building, let in light, provide a view, grow plants or provide recreation. It would be unfair to exclude these components from a tax credit, but equally unfair to calculate a credit based on the total cost of multi-purpose items.

In the process of developing criteria for the tax credit proposal, the subcommittee looked at the definitions of passive solar systems used by a number of states. Utah's 1980 Energy System Tax Credit (SB 38) provided some of the definitions incorporated into the subcommittee proposal. Guidelines developed by the Colorado Office of Energy Conservation to implement Colorado's tax credit for passive systems contain useful principles for the treatment of multi-purpose components of passive systems.[21] Basically, the guidelines state that multi-purpose structural elements, if they are a part of a passive solar system (containing collection, storage and distribution elements), shall be eligible for costs in excess of conventional construction. Other multi-purpose elements, such as south-facing windows or greenhouses, are eligible for half their cost. The subcommittee recommended inclusion of these concepts as part of the proposed legislation.

The definitions in the subcommittee proposal were intended to give clear guidelines to the agencies responsible for administering the credit. The subcommittee proposal would require that these agencies develop detailed regulations clarifying the treatment of specific items.

Eligibility for Both Corporations and Individuals. Early tax credits for solar and renewable energies generally were not available to businesses or for non-residential buildings. At the present time, however, most states with renewable energy tax credits either extend the same credit to both individuals and corporations, or provide a separate incentive, such as additional investment credit, to businesses making investments in renewable energy technologies. Several states, including Indiana, Kansas and Montana, allow higher maximum credits for non-residential than for residential buildings.[22] Indiana (Public Law 20, 1980) gives a 25% income tax credit for solar or wind energy systems. For single-family dwellings the maximum credit is $3,000; for other buildings, the maximum credit is $10,000. While individuals with limited budgets and rising fuel bills may be most in need of assistance, experience shows that successful innovations in building design usually have been introduced first in public and commercial buildings and then in custom houses before they reach the mass residential housing market.[23] The central purpose of most tax incentives for renewable energies is to encourage broader use and greater acceptance of these technologies. In theory, greater demand will spur mass production and new techniques, which in turn will lower costs and make the technology more attractive.

The subcommittee decided to apply the credit both to individuals and corporations who must pay Kentucky income taxes, and decided not to limit applications to any particular type of building. The maximum credit was to be the same for corporations as for individuals (including privately owned businesses

and partnerships). The committee discussed the possibility of providing multiple credits to corporations, since some of these control many buildings around the state, and could be influential in expanding public awareness of new technologies. On the other hand, it felt the credit is intended to encourage taxpayers to try an unfamiliar technology rather than to subsidize all applications. It therefore decided to allow a maximum credit amount to each taxpayer, and not to each building on which solar is installed.

Size of the Credit and Carryover Provisions. Income tax credits offered by other states for solar or renewable energy investments range from 5 to 55 percent of their cost. The maximum credit allowed for residential buildings ranges from $200 to $3,000.[24] The subcommittee felt that a substantial credit was needed to give real incentives to potential buyers, and recommended a credit of 30 percent of the cost of eligible systems, up to a maximum credit of $3,000. This would mean that some active solar and wind systems, eligible for both the state and federal credits, could return, in tax credits, 70 percent of their initial cost.

Unlike a deduction, a tax credit is subtracted from the amount of taxes due. The maximum credit recommended by the subcommittee exceeds by a substantial margin the average income tax paid by individuals filing Kentucky returns. In 1979, the average tax paid by liable taxpayers (those with income high enough to owe taxes) was $346. Even taxpayers earning $50,000 a year would not owe enough taxes to claim the maximum credit. Therefore, the subcommittee recommended inclusion of a provision allowing the credit to be carried over for a maximum of 3 years. A taxpayer eligible for a $1,200 credit, for example, but owing $500 in income taxes to the state each year, could take $500 the first year, $500 the second year, and the remaining $200 in the third year.

Termination. Most solar income tax credit measures are temporary. They are designed to encourage more people to invest in renewable technologies than otherwise might do so, in order to hasten commercialization and widespread acceptance of these technologies. The underlying assumption is that such systems as solar hot water heating, space heating, passive designs or wind systems are viable and can compete on their own merits, without subsidies, once they reach a certain point of development. However, as long as demand is low, production costs are relatively high. Demand will be low as long as people are unfamiliar with the availability of these technologies. If these assumptions are correct, special incentives are needed only to "get the ball rolling." If in fact these systems are not competitive or viable, then continuation of incentives for an indefinite period would merely distort the economy and lead to inefficient expenditures. The credits proposed by the subcommittee would terminate at the end of 1985.

Choice of Administrative Agency. Legislatures in other states have delegated authority for rulemaking and administration of solar financial incentives to tax departments, building code authorities, state energy and natural resource departments, consumer affairs departments, banking regulatory bodies, and specialized constituent service agencies.[25] The lack of clear guidelines and clear delegation of authority in most solar legislation has proven to be a serious obstacle in the implementation of some state programs. A recent survey of 11 state incentive programs concluded that the choice of administering agency was crucial to the successful implementation of the programs, but that

it was not the type of agency per se that mattered, but the atti-

tudes and backgrounds of its staff, its primary mission, and its location within the larger organizational structure of state government.[26]

The subcommittee considered the Department of Revenue, the Department of Energy, and the Department of Housing, Buildings and Construction as possible administering agencies. The Department of Revenue already administers the income tax laws, and could be expected to administer this credit in much the same way as other credits and deductions. Disagreements over the amount of credit or eligibility for credit could be taken to the Kentucky Board of Tax Appeals, as are other tax issues. The Department of Energy administers the state's solar programs generally, and should have the technical expertise to evaluate proposals and issue technical eligibility regulations. The Department of Housing, Buildings and Construction handles building codes and also should have the expertise to deal with questions of a technical nature. That agency also has a board of appeals, which could be used to arbitrate in cases where the eligibility of a system is questioned.

The subcommittee decided to propose a form of joint administration, with the Department of Revenue administering the tax, and the Department of Energy handling technical matters concerning the eligibility of specific systems. Two proposals were developed for consideration by the subcommittee. The first would delegate to the Department of Revenue primary responsibility for administering the tax, and use the negotiation and appeals process already in place to handle contested claims. The Department of Energy would assist Revenue in developing technical guidelines and also would assist Revenue by determining, from design or engineering standpoints, whether a specific system qualified for the credit claimed.

The second proposal, which was adopted by the subcommittee and included in the draft legislation, requires approval by the Department of Energy before the credit can be claimed, and requires that the Department of Energy promulgate the technical regulations. The Department of Revenue would administer the actual credit in this case too. This procedure would cost somewhat more to administer, since the Department of Energy would have to review each application, not just those questioned. However, experience with the federal credit has shown that many taxpayers mistakenly claim the renewable energy credit for energy conservation measures, or for such features as south-facing windows, which are not part of a system. The subcommittee felt that each claim should be reviewed to prevent misuse. A prior certification requirement also should generate needed information on solar, wind and hydrothermal applications in the state.

The proposed legislation allows the Department of Energy to charge a fee for reviewing and certifying a system for the tax credit, but limits this fee to ten dollars. It was felt that a fee was desirable to offset some of the cost to the Department and to discourage frivolous applications, but that it should not be so high that it would deter those with viable but fairly inexpensive systems from obtaining the credit.

Fiscal Implications of Solar Income Tax Credits in Kentucky

The most critical statistic for estimating the fiscal impact of a solar income tax credit is an estimate of the number of claims. In the absence of

prior experience in Kentucky, a reliable estimate for the first year's claims will be difficult to generate.

Two types of information may be helpful in preparing an original estimate: the experience of other states with similar income tax credits and the data on the number of solar and wind systems presently identified in Kentucky. In March, 1981, the Kentucky Department of Energy had knowledge of about 300 solar and 10 wind installations in Kentucky.

Two sources of information about other states are available for use. One conducted by Susan Perretta of the National Solar Center in Philadelphia has claims data from twelve states through tax year 1978. In addition, an LRC staff telephone survey has obtained data (including some from the 1979 tax year) from 13 states. At least 4 states have no data yet because the law didn't go into effect until the 1980 tax year. Also available are U.S. statistics for the tax years 1978 and 1979.

The number of solar claims reported in recent years ranges from 101 in North Dakota to 16,801 in California. Excluding those states that allow wood-burning equipment as a renewable energy credit, no state except Hawaii had more than 1% of its taxpayers making claims for renewable energy credits.

Arizona had an average claim of $333 for tax year 1978 and $520 for tax year 1979. A 35% tax credit was in effect for those years. The share of taxpayers making the claim rose from .3% in 1978 to .86% in 1979.

In Hawaii, which allows a 10% income tax credit, the average claim amounted to $209 in 1977, $276 in 1978, and $297 in 1979.

Minnesota, which allows a credit of 20% of the first $10,000 spent, had an average claim of $346. The total number of claims was 2,028. Minnesota's rather broad coverage includes active solar, passive solar, geothermal, earth-sheltered dwellings, and equipment producing ethanol, methanol or methane for fuel. The law expires at the end of 1982.

New Mexico, which has had solar credit law in effect since 1975, had 21 claims in its first year of existence and 312 claims in its fourth year of existence. During that period, the average claim ranged from $428 to $520. For tax year 1978, the total tax loss to the state was $133,420.

Vermont, which allows a 25% tax credit, had claims for tax year 1978 averaging $709.

The states summarized above were selected from the ones available because their solar legislation seems to offer the most comparability to the proposed Kentucky law.

The statistics from 1978 federal returns (the only year available) indicate that .076% of the taxpayers claimed the federal renewable energy credit. If it were assumed that the same percentage of households made the claim in Kentucky as the U.S. average in 1978, then Kentucky could expect about 1,000 claims. However, based on first-year experience in the states with credits, this figure may be a little high. Consequently, a reasonable estimate for Kentucky seems to be 500 - 1,000 claims under the proposed law, as now drafted.

Other factors influencing the number of claims actually submitted would

be the stringency of the administrative regulations and the extent to which all claims are audited or reviewed.

Fiscal Calculations. The average tax liability in Kentucky for tax year 1979 was $346. If it is assumed that this amount will increase about 5% a year until 1982, the average tax liability would average about $400 by 1982. It is more difficult to estimate what an average or typical expenditure for solar or wind energy property might be, since the possibilities are so varied. However, one application which is expected to be quite common if this incentive is passed is the installation of solar hot water heaters. A typical hot water heater currently costs about $2,500. Thirty percent of $2,500 is $750. Therefore, it seems reasonable to assume that a taxpayer making a typical claim would eliminate his full liability the first year.

Estimates

$400 (average liability) x 500 claims = $200,000
$400 (average liability) x 1,000 claims = $400,000

This would place the fiscal impact to the state in direct loss of revenue in the range of $200,000 - $400,000. This amount would probably increase by 25% to 50% the second year because of the carryforward provision. After that, it should increase only slightly or level off.

Economic and Indirect Fiscal Impact. There appear to be positive economic impacts of a tax incentive which are difficult to quantify with convincing statistics. One would have to determine how many installations were made as a direct result of the state tax incentive. Such a determination would be difficult, since a certain number of installations would be made regardless of whether the incentive is available.

However, to the extent that installations result from the incentive, increased sales and income tax would be generated. Using the water heater example, about 50% of the cost is for materials and about 50% for labor, yielding an average $60 sales tax received from each installation and approximately an equal amount in income tax from wages paid. Excluding any multiplier effects from the wages of installers and solar equipment businesses, it would appear that each claim would result in a minimum of $100 tax gain from the installation.

Major increases in the use of solar, coupled with investment in energy conservation, might eventually reduce overall fuel consumption, and thus reduce local revenues from the 3% school tax on sales of electricity and gas. It is not likely, however, that even major consumption reductions will offset the rising prices for these fuels and cause an absolute reduction in utility tax revenues. At the same time, solar installations will generate additional local property tax revenues, to the extent that they increase the value of homes or other buildings.

The long-term benefits of encouraging solar investment are extremely positive. Rising prices for conventional fuel will not affect the homeowner's cost for the solar system. The consequent savings can be spent by the homeowner in the local economy. A working solar installation will also probably increase the resale value of a house. These positive impacts are treated more thoroughly in Chapter III.

Research, Development, Education and Information

The subject area of the Subcommittee on Solar Energy Research and Development, Education and Information divides itself into related activities: the research and development activities, and the educational and informational ones. The subcommittee decided that it should take up the research and development aspect first, as findings in this area might prove useful in deciding what educational and informational activities are needed.

As the first step in determining what legislative proposals might most effectively facilitate solar research and development in the Commonwealth, the subcommittee spent considerable time evaluating the present sophistication of solar technology. The early meetings of the subcommittee were devoted primarily to discussions of the stage of this technology. In addition to the subcommittee members and staff, Professors Blaine Parker and Donald Colliver of the University of Kentucky's Agricultural Engineering Department and Mr. Claude Rhorer of the Kentucky Department of Energy contributed to the discussion.

After touching on such specific issues as photovoltaics, trombe wall construction, and materials design, the consensus of the subcommittee was that the state should concentrate on applied research and development and particularly on those aspects of research that would facilitate the adoption of existing technology for Kentucky's specific needs. The discussion indicated that basic solar research is already underway. Many breakthroughs can be readily transferred. By concentrating on applied and Kentucky-specific research, determinations could be made regarding what technologies and components work best, given our unique climate and energy needs. This focus would allow Kentucky to stress the research efforts necessary to bring about the broad acceptance of solar energy within her borders.

As was hoped, the review of research and development did point out, directly and indirectly, some of the educational and informational needs for further solar development. The subcommittee found, for example, that there is no statewide system in place to provide adequate information and training to homebuilders who might be called upon to install and service manufactured solar equipment. This same shortage applies in other areas of alternative energy, such as earth shelter, earth transfer, and wind power. Related to these technical information needs is information on the economics of the various energy sources. A wide range of impressions regarding the costs and savings of various solar and alternative energy sources seem to exist, but homebuilders and potential buyers are lacking either substantive cost data or a reliable source to assist them in making cost determinations. Much of the information needed to allow builders and buyers to make informed decisions might currently be known to experts in the solar field, but increased efforts in dissemination of this information are essential if it is to be made more widely available to the public.

As an extension of education and information, the subcommittee considered ways of bringing solar to the attention of the general public. One proposal was a state-sponsored design competition for architects and builders in which prizes and publicity would be given for practical designs with a potential for broad market appeal. The state could provide further encouragement by example, incorporating solar concepts into the design of new facilities and retrofitting some existing facilities. Some efforts have already been made in this latter area, with the installation of a solar energy system at a state

rest facility along Interstate 64 in Carter County. This is a high visibility structure, being located on one of the state's major traffic arteries, and it has attracted considerable public attention. Such projects are deemed to have a high payoff in terms of public awareness, and a fairly low cost, since any feasible project would have to offer savings in purchased energy.

In the process of identifying solar activities currently underway in Kentucky, the subcommittee requested that staff survey the state universities to determine what solar activities they are involved in. The results of this survey, contained in Appendix 4, indicate that nearly every university has some type of solar-related activity underway. These activities range from highly sophisticated research in trombe wall construction and materials design to very basic instructional and educational work. The survey confirmed earlier indications that there is a rapidly growing awareness of and demand for solar know-how and information. The universities reported a big demand by students and by the non-student community for basic information on solar energy. Their responses indicate that there is an immediate need for answers on "what works and how well."

As a result of its extensive deliberations, the subcommittee directed the staff to draft legislation creating an Alternate Energy Trust Fund to provide support for development projects designed to facilitate the use of solar and alternative energy in Kentucky. It was recommended that the Trust Fund be appropriated $250,000 for its first year and $500,000 for its second year of operation. The Fund could make loans of up to 50% of the project cost for 5 years, charging the tax-exempt interest rates available to the Kentucky Development Finance Authority, or it could make grants of up to 25% of the project costs. In both cases, in-kind contributions of the requestor might be considered in the total costs, and in neither case might any single project receive more than $40,000. A review committee, appointed by the Governor and chaired by the Secretary of the Kentucky Department of Energy, would be created to make funding decisions. Preference would be given to projects which showed consideration of the following factors: (a) applicability for contribution to low-income energy users; (b) potential for job or economic development; (c) transferability of the technology, particularly information which would assist in future designs; (d) opportunity to evaluate the progress and results of the project; (e) availability of ongoing technical assistance to the project; and (f) opportunity for documenting and disseminating project results to the public.

A second recommendation is that the Kentucky Department of Energy support and fund solar-related research activities. These activities would be directed, at least in part, toward identifying and overcoming obstacles to solar development in Kentucky. This support would be funded by a line item budget request of $150,000 for the first year and $300,000 for the second year of operation. This development would be accomplished through a joint resolution.

A third proposal is to direct the Department of Finance to consider life-cycle costing, including conservation and alternative energy concepts, in the state bidding process; also, that the state consider appropriate demonstrations of alternative energies in its building program.

The fourth major recommendation was that the Special Solar Energy Advisory Committee continue in existence after its current term expires and that any state agencies affected by the recommendations herein report periodically to the committee regarding progress and results.

Finally, the subcommittee directed eleven recommendations to the Kentucky Department of Energy. These recommendations involved administrative changes and it was felt that they could be accomplished without legislation. These Department of Energy recommendations, as well as the bills and resolutions implementing the other recommendations, are included in the Appendices.

Institutional Barriers and Incentives

In explaining why the implementation of solar installations has not been more successful, a major reason given is that professionals and organizations and the laws, regulations, and practices they have supported have not reflected sufficient consideration of the attributes and requirements of solar systems. Since the development of a state solar energy program would include an evaluation of institutional barriers and the methods of mitigation, as well as identification of institutional incentive programs, a Subcommittee on Institutional Barriers and Incentives was appointed. That subcommittee identified many barriers and incentives and chose to review the following commonly cited barriers.

Financing

The experiences of other states showed reluctance among lending institutions to allow adequate loans for solar construction, purchase, or solar business development. However, the Kentucky Bankers Association and the Kentucky Savings and Loan League say that solar homes have received financing but that, due to the current high interest rates, few homes of any type are being purchased. Applications for solar or earth-sheltered homes are being processed as any other application would be. The Kentucky Bankers Association completed a Solar Energy Financing Survey of 345 banks for the subcommittee. Of 192 banks responding, 170 reported no request for such loans; 22 banks reported 38 requests. Of these 38 requests, 24 were approved for financing; one bank reported that it offered special rates for solar energy financing. Some of the applications were for the conversion of an existing home's energy source to solar, and all such applications were approved.

A few solar homeowners did complain that the appraisal of their homes did not include the additional capital required for the solar installation and they suggest that appraisers need training. Many homeowners, builders and architects questioned whether the lenders were aware that the utility cost savings to the individual homeowner would mean he could better afford a home. Indeed, the subcommittee found that lenders in some states were utilizing "life-cycle cost analysis" of heating systems in their formula for determining the approval of a loan. Approximately one-third of the lending industry in the U.S. utilizes life-cycle costing estimates. Life-cycle cost analysis of a solar installation is the accounting of capital, interest and operating cost over the useful life of the solar home compared to those costs without the solar system. Individual banks in other states have introduced innovative solar energy system financial arrangements. One example is the following method for an additional loan on an existing mortgage for the cost of a solar system. At the current residential prime rate the mortgage may be re-written for up to thirty years so that monthly payments remain the same. No refinance fees or points are charged, with the exception of a flat fee of $200. The main requirement under the plan is that the system qualify for the state tax

credit. Lenders do report that many prospective homebuyers are as much or more concerned with the monthly utility bills as they are the mortgage payments.

Concerns for the housing needs of low-income citizens were expressed. The Kentucky Housing Corporation accepts applications for solar homes. It assisted with the Lakeland Wesley Village TVA project, a 96-unit solar housing development for the elderly, located in Marshall County, Kentucky. With the federal Solar Bank program in jeopardy and budget cuts being proposed, Kentucky should look for assistance to low-income housing within the state. Several builders in Eastern Kentucky discussed their proposed projects with the committee and their hope to obtain funding. It was reported that the Farmers Home Administration, a major funding source in rural areas, was reluctant to lend monies for new designs. The Kentucky Mountain Housing Development Corporation has completed a test solar home near McKee, Kentucky, which was financed by the Farmers Home Administration.

Insurance

According to a State Farm Fire and Casualty Company report on solar energy, solar homes are no more, and possibly less, of a hazard than those heated by conventional means. Many insurance companies, such as the Kentucky Farm Bureau Mutual Insurance Company, have established underwriting policies and procedures for earth-sheltered homes and/or solar homes. As the subcommittee received reports from representatives of insurance associations, it noted that some companies have set or are considering more favorable rates for solar heating systems, which are less likely to cause fires, and earth-bermed homes, which may be more resistant to storm damage and fires. On the whole, the insurance industry claims that experience with solar and earth-sheltered homes has been good. As this is a new area, data has not been available on such issues as resale for these homes, but as energy-efficient homes continue to be built, such issues will be resolved.

Building Codes

In review of state agency solar activities, it was reported that the Kentucky Energy Code, which sets limitations for builders, is still being updated. This code may have no effect on one-family residences, as they are left to local jurisdiction. The Commissioner of the Kentucky Department of Housing, Buildings and Construction informed the subcommittee that a Solar Code is not being considered at this time and expressed a concern for consumer protection while allowing room for innovation. This department is interested, however, in developing training programs for building code officials so that they will know how to apply solar standards in examining buildings; one training program is planned for this year. Solar installers questioned restrictive plumbing codes; one such issue was resolved by a meeting between departmental officials and installers during the time of this subcommittee's study.

Solar Access

There are two basic considerations regarding solar access. The first is

the ability to initially site a building to take advantage of climatic elements or to site collectors for optimal exposure to the sun's radiation. Second, there is the future security of unobstructed solar access. Current American common law does not recognize the right to sunlight. At present, Kentucky has no solar right legislation. In some states, private solutions exist, such as restrictive covenants by land developers or express easements between property owners.

An easement may be loosely defined as the right to the limited use of another's land or the right to prevent another from using his land in a certain manner (e.g., the placement of utility poles on private land is made possible by easements). An easement creating solar access must be described in terms of vertical and horizontal angles at which it extends over the property subject to easement.

State laws authorize and regulate easements. The first state to enact such legislation regarding solar installation was Colorado (1975); many other states patterned their legislation after the Colorado statute, which reads that a solar easement "shall be created in writing and shall be subject to the same conveyancing and instrument recording requirements, except that a solar easement shall not be acquired by prescription." Requirements of a written easement, recorded in real property records, have been incorporated in nearly all solar easement statutes. An easement "runs with the land" or assures transferability to subsequent purchasers if the easement clearly requires it. Other governments have required or encouraged sun rights through zoning ordinances.

Zoning/Land Use Planning

In Kentucky, zoning is not a state mandate but a function of local government. Also, zoning regulations cannot be administered before planning of land use has been accomplished. At the present time, no local government entities have dealt with solar in their comprehensive land use plans or zoning ordinances, but there are no barriers to prevent them from doing so. Solar easements would not be included in zoning regulations. Improper site orientation was identified as a problem by Kentucky solar builders and installers, particularly in cases of retrofit applications of existing homes.

Public Utility Company Regulation

In some states, utility companies have sponsored solar installation and energy conservation programs for their customers. The reason for this activity is that the cost of new or expanded facilities would cause such high rate increases to all customers that conservation and energy-efficient systems would be more economical to all concerned.

As required by federal law and regulation, Kentucky has submitted for approval the Residential Conservation Service plan which includes solar aspects such as lists of solar installers and financial lenders. Throughout the U.S. PURPA (the Public Utilities Regulatory Policies Act) is being implemented slowly. PURPA requires utilities to pay a fair rate of return on power sold back to them from excess-energy-producing residential systems, such as wind power. Approximately 25 states are working on their guidelines for

implementation of the PURPA law; many are presently holding public hearings on the matter. Issues raised relate to utilities selling power to or purchasing power from customers who own solar or wind energy systems, or utilities selling, installing or financing such systems.

Kentucky utility company representatives have appeared before the subcommittee to explain how alternate energy plans can affect their companies. Utility company problems are anticipated when users of alternative forms of energy require back-up service at peak demand periods. One problem cited was how to keep from subsidizing an individual solar operation at the expense of other rate payers. Utility representatives explained that many federal regulations have made it difficult for them to provide the physical facilities with sufficient energy supplies. Such federal requirements as the Residential Conservation Service Program are expected to be costly to the utility; for example, the required home energy audit may cost the utility more to do than the regulations allow them to charge. Some utilities reported a decrease in annual average consumption due to conservation, and this change affects cost to the utility.

Some Kentucky utilities have sponsored renewable energy workshops for consumers, contractors and builders. One utility publication distributed regularly to Kentucky rural electric consumers has included various informational articles on conservation and renewable energy systems.

Lack of Consumer Awareness

Solar architects, builders and installers suggested to the subcommittee that if the consumer demand is low in Kentucky, it is due to a lack of information. It was pointed out in reports on other state programs that as utility bills continue to rise, homeowners will seek such information. Several requests were made that the subcommittee propose renewable energy systems for public buildings as demonstration projects, as well as a cost-effective use of public funds.

The Kentucky Department of Energy provides renewable energy information upon request. Since the formation of the Division of Alternate Energy within the department (July, 1980), 100-150 information requests have been received each month over the toll-free phone line. Seminars and workshops are being finalized and, as these events are promoted, the department expects such requests to increase.

A Gallup survey conducted in October and November, 1980, indicates that 77 percent of the nation's homeowners favor the use of solar energy in residences and 58 percent would like to use solar systems in their own homes. However, homeowners are concerned about risks. The survey results show that perceived barriers of most concern are initial cost, dependability of solar firms, warranty coverage and operating liability. The Solar Energy Research Institute is currently involved in a detailed analysis of the survey results, but generally it appears that homeowners favor solar but want questions about cost and reliability answered.

Lack of Solar Expertise

The lack of trained general and mechanical contractors, builders and technicians has been noted by Kentucky solar architects, builders and installers. One response to this problem has just been implemented. Louisville is one of six cities in the nation chosen for a unique joint effort between government, labor and management. In April of 1981, a Louisville training center which will train instructors, contractors and apprentices in solar technology was opened. This program is funded by a $1.5 million grant from the U.S. Department of Energy, and volunteer labor is supplied from the sheet metal industry. The Home Builders' Associations in various sections of the state have provided design seminars on solar systems. The Louisville Home Builders' Association and the Southern Solar Energy Center co-sponsored such a design seminar in May, 1981.

The state programs applicable to training of specific trade skills are under the Bureau of Vocational Education. Including the skills necessary to the solar trades in the course offerings of Kentucky's vocational schools was an issue addressed by the subcommittee.

The final recommendations and legislation proposed by this subcommittee are contained in Appendices 4 and 2, respectively.

CHAPTER VI

A CALL TO ACTION

The citizen support expressed at the August 14th public hearing confirmed the direction chosen by the Special Solar Energy Advisory Committee to bring the solar program of the Commonwealth into the present. By being one of the few remaining states without solar legislation, Kentucky has the opportunity to catch up quickly by utilizing the findings of other programs, especially since it has the support of its citizens.

The final legislative proposals are:

(1) Tax Credit (82 BR 145): A tax credit bill, BR 145, creating a Kentucky income tax credit of thirty percent of the cost of qualifying energy property, up to a maximum credit of $3,000. The bill defines active solar, passive solar, wind and hydrothermal energy systems as "qualifying energy systems" eligible for the credit. The credit will be available only on systems completed before December 31, 1986.

(2) Alternate Energy Development Projects (82 BR 237): A bill creating an alternate energy development fund to make loans, grants and expenditures for approved alternate energy projects. The bill creates a seven-member review committee and establishes preference criteria for proposed projects.

(3) Solar Access (82 BR 512): In order to assure a solar homeowner a "right to light," legislation is proposed to allow the recording of a solar easement as an interest in real property. The solar easement must be subject to the same recording and conveyancing requirements as any other property easement, except that a solar easement cannot be acquired by continued use for a long period of time.

The following resolutions are recommended:

82 BR 236: A JOINT RESOLUTION extending the tenure of the Special Solar Energy Advisory Committee and directing certain state agencies to report to that committee.

82 BR 238: A JOINT RESOLUTION directing the Department of Finance to amend purchasing and bidding regulations in support of a strong energy conservation ethic.

82 BR 511: A JOINT RESOLUTION directing the Public Service Commission to study the feasibility of implementing the Residential Conservation Service Plan and Section 210 of the Public Utilities Regulatory Policies Act and methods to assure non-discrimination in utility rate structures for users of renewable energy.

As the findings of this committee point out, it is now up to the states to carry out the solar program. The Special Solar Energy Advisory Committee recommends the tax credit to aid the citizen who wishes to reduce his consumption of utilities and also to provide a positive economic impact on the solar industry and its effect on state revenue, a funding of alternative energy projects and a way to assure the solar homeowner a right to the sun. The resolutions direct the Public Service Commission to carry out federal mandates

and assure non-discriminating rate structures for uses of renewable energy, place the method of life-cycle-costing into the purchasing and bidding practices of the state Department of Finance, and extend the tenure of the committee.

All of these recommendations will become 1982 General Assembly bills to be prefiled by legislators serving on the committee. This proposed legislation will promote the development of components of a state solar program now absent in Kentucky. The vision of the committee is not only to catch up but to do so in a strong, practical way. In Kentucky's array of approaches to energy utilization this realistic plan deserves its chance now.

FOOTNOTES

1. Energy User News, February 9, 1981, p. 16.

2. Price data supplied by the Kentucky Department of Energy.

3. Monthly Energy Review, February, 1981, p. 8.

4. U.S. EPA Ohio River Basin Energy Study (ORBES): Main Report, (January, 1981), p. 6.

5. Kentucky Department of Energy, Kentucky Energy Statistics (Draft) Natural Gas: Table 21; Petroleum: Table 22.

6. Wall Street Journal, January 10, 1980.

7. "Waste Wood Boils 'On Steam' at Wickliffe," Westvaco CFM News, Winter/Spring, 1980.

8. "Bioenergy: The Lesson of Woodburning" Environmental Science and Technology, Vol. 4, #7 (July 1980), pp. 769-771.

9. Dean Flannery, "Wood for Fuel," Kentucky Department of Energy.

10. NARUC Bulletin, April 28, 1980, p. 19.

11. "Utility Concerns about Interconnected SWECS," Wind Power Digest, Spring, 1981, pp. 25-29.

12. Arthur McGarity, Solar Heating and Cooling, An Economic Assessment, NSF, Washington, D.C., 1977, B. F. Parker, D. G. Colliver, L. W. Turner, Assessment of Solar Heating Potential in Kentucky - Residential and Agricultural, U.K. Agricultural Engineering, 1980.

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15. "Economic Impact of HB 537," prepared by Solar Energy Industries Association of Georgia, Inc., Macon, Georgia, January 18, 1980.

16. "Employment Impact of the Solar Transition," Subcommittee on Energy, Joint Economic Committee, Congress of the United States, April 6, 1979.

17. Solar Energy Research Institute, "State Solar Energy Incentives Preview: A Guide to Selection and Design," pgs. 7, 22.

18. Ibid, p. 6.

19. Based on summaries in "State Legislation," National Solar Heating and Cooling Information Center, Rockville, Maryland. Revised 10/15/80.

20. Colorado, HB 1264 (1980), and Minnesota (Ch. 303, Laws of 1979), although those laws specify additional eligible systems.

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21. "Energy Memo," 10/10/80, Office of Energy Conservation, Renewable Energy Resources Division, 1600 Downing, Denver, Colorado 80218.

22. Based on summaries in "State Legislation," National Solar Heating and Cooling Information Center, Rockville, Maryland. Revised 10/15/80.

23. Solar Energy Commercialization at the State Level: The Florida Solar Energy Water Heater Program, Florida Solar Energy Center, March, 1977, p. 24; also Selling the Solar Home: '80 Market Findings for the Housing Industry, U.S. Department of Housing and Urban Development, January, 1980.

24. Based on summaries in "State Legislation," National Solar Heating and Cooling Information Center, Rockville, Maryland. Revised 10/15/80.

25. John H. Ashworth: "Implementing Solar Financial Incentives: The Experience of Selected State Programs," in Solar Law Reporter, p. 383.

26. Making Solar Laws Work, A Study of State Solar Energy Incentives, Solar Energy Research Institute, Golden, Colorado, 1980, p. 1.

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APPENDICES

GENERAL ASSEMBLY

COMMONWEALTH OF KENTUCKY

REGULAR SESSION 1980

House Resolution No. 42

March 6, 1980

The following bill was reported to the Senate from the House and ordered to be printed.

A CONCURRENT RESOLUTION directing the formation of a special solar energy advisory committee to determine the potential for the use of solar and other renewable energy resources in the Commonwealth.

WHEREAS, the nation continues to face a serious energy crisis, and a dangerous dependence on other countries which supply us with oil; and

WHEREAS, this crisis and this dependence need not continue if we take steps now to develop and utilize our abundant domestic energy resources; and

WHEREAS, Kentucky's coal is a tremendous asset to the state and the nation, and yet an energy policy focused exclusively on coal may be unwise in the long run if it ignores other energy resources which also could contribute to the future prosperity of the state; and

WHEREAS, solar energy in its many forms may, if properly developed, play a significant role in Kentucky and should be given fair and careful consideration;

NOW, THEREFORE,

Be it resolved by the House of Representatives of the General Assembly of the Commonwealth of Kentucky, the Senate concurring therein:

Section 1. The Legislative Research Commission is directed to appoint a Special Solar Energy Advisory

Committee to determine the potential for use of solar and other renewable energy resources in the Commonwealth. Two (2) members shall be appointed from the Senate and two (2) members shall be appointed from the House of Representatives to serve on the committee. In addition, the Legislative Research Commission shall appoint to the committee members recognized as experts in areas related to solar energy issues, members of environmental, consumer, business and industrial groups, but in no case shall total membership exceed fifteen (15) members. The committee shall choose a chairperson and vice-chairperson from the legislators serving on the committee.

Section 2. The committee shall assume an oversight role on behalf of the General Assembly on all matters pertaining to the development of solar and renewable energy sources during the 1980-82 interim. The committee shall meet at least quarterly and more often on the call of the chairperson.

Section 3. The committee shall develop a plan for the development of solar and renewable energy in Kentucky and shall develop legislative proposals and recommendations for submission to the General Assembly. The committee shall assess the short and medium range potential for solar energy, and the employment potential of solar development in the state during the next five (5) to ten (10) years. The committee shall report its find-

ings and recommendations to the 1982 General Assembly, and shall submit a report to the Legislative Research Commission on or before September, 1981.

Section 4. It is estimated that the operation of the committee and the provision of staff services will cost approximately $20,000. Such sum is merely an estimate pursuant to House Rule 63. Services are to be provided by the Legislative Research Commission.

KENTUCKY LEGISLATIVE RESEARCH COMMISSION

1980-81 Interim

BR 145 - PREFILED

August 26, 1981

Representatives Frank J. Smith and William R. Weinberg prefiled the following bill which was ordered to be printed.

Paid for from state funds

AN ACT relating to income taxes.

Be it enacted by the General Assembly of the Commonwealth of Kentucky:

SECTION 1. A NEW SECTION OF KRS CHAPTER 141 IS CREATED TO READ AS FOLLOWS:

As used in Section 2 of this Act, "qualifying energy property" means property used to generate power from solar radiation, wind, or hydrothermal energy. The term includes the components of active solar systems, passive solar systems, wind energy systems and hydrothermal energy systems, as defined in subsections (1) through (4) of this section.

(1) "Active solar system" means a system of equipment capable of collecting and converting solar radiation into thermal, mechanical or electrical energy, and of transferring these forms of energy to storage or the point of use. It includes water heating, space heating or cooling, and the generation of electrical or mechanical energy. Transfer or storage components are included, except for those which would be required regardless of the energy source being used.

(2) "Passive solar system" means a direct thermal system which utilizes the structure of a building and its operable components to collect, store and distribute

heating or cooling during the appropriate times of the year, by utilizing the climate resources available at the site. It includes those portions or components of a building that are expressly designed and required for the collection, storage and distribution of solar energy. Structural components of a building which also are used as part of the energy system, such as supporting walls used also for heat storage, are included only if and to the extent that their cost exceeds that of conventional construction. Multi-purpose components shall include but not be limited to windows or attached greenhouses, if designed as part of a solar system and if south facing. Multi-purpose components shall be included for half of their cost.

(3) "Wind energy system" means a system of equipment capable of intercepting and converting wind energy into mechanical or electrical energy and of transferring these forms of energy to the point of use or storage. It does not include those storage or transfer components which would be required regardless of the energy source being used. Wind equipment used to produce power for transportation is excluded.

(4) "Hydrothermal energy system" means a system of equipment necessary to transmit or use energy from ground or surface water to heat or cool a building or provide hot water for use within the building. It does not

include those storage or transfer components which would be required regardless of the energy source being used.

SECTION 2. A NEW SECTION OF KRS CHAPTER 141 IS CREATED TO READ AS FOLLOWS:

(1) There shall be allowed as a credit against the taxes imposed by KRS 141.020 and 141.040 an amount equal to thirty percent (30%) of the expenditures (including installation cost but excluding any finance charges) for qualifying energy property installed on premises in Kentucky which are owned or controlled by the taxpayer. The maximum credit which may be claimed by any taxpayer shall be three thousand dollars ($3,000) during the period specified in subsection (13) of this section. In no case shall a system or component or piece of equipment be eligible more than once for the credit provided in this section.

(2) The credit in this section may be claimed for the taxable year in which the installation is completed. The credit may be claimed only for expenditures made during the taxable year for which the credit is claimed or during the immediately preceding taxable year, but in no case for expenditures made before January 1, 1981.

(3) In the case of a husband and wife who file separate returns, the credit may be taken by either, or divided equally, but the combined credit shall not exceed three thousand dollars ($3,000).

(4) In the case of a partnership, of which one or more of the partners are liable for the tax imposed under KRS 141.020, the amount of the credit each partner may claim shall be allocated in the same ratio as profits and losses are shared in the partnership, but the combined credit shall not exceed three thousand dollars ($3,000).

(5) A builder who installs qualifying energy property in a building constructed for resale may elect himself to claim the credit allowed in this section, or may provide the purchaser with necessary documentation or certification so that the purchaser may claim the credit. In no case, however, shall the credit be claimed by both the builder and the purchaser.

(6) In the case where the credit allowed in this section exceeds the tax due for the taxable year, that portion of the credit which exceeds the tax due may be carried over to the succeeding taxable years until the allowable credit has been fully exhausted, or until the credit has been claimed for three (3) successive years, whichever comes first. If a taxpayer qualifies for a credit less than three thousand dollars ($3,000), he may claim part or all of the unused portion of the credit for a later taxable year if he installs additional qualifying property.

(7) This tax credit shall not apply to trusts or

estates.

(8) Before any tax credit can be claimed under the provisions of this section, the department of energy must certify that the taxpayer's system is a viable system for using solar, wind or hydrothermal energy and documentation must be provided that the system has been completely installed. Any fee charged by the department of energy for review and certification of a system shall not exceed ten dollars ($10.00).

(9) The department of energy may promulgate such rules and regulations as necessary to maintain commonly accepted energy equipment standards, to effectively conform to the definition of qualifying energy property in Section 1 of this Act and to administer the certification requirements in this section. The regulations (including those describing the application procedure) shall be written in nontechnical language understandable to lay citizens untrained in engineering, architecture, or other technical fields.

(10) With the exception of the certification requirements delegated to the department of energy by this section, the department may promulgate such rules and regulations as necessary to effectively administer the requirements of this Act.

(11) All regulations necessary to implement this Act shall be filed with the legislative research commis-

sion in accordance with KRS 13.087 by September 1, 1982.

(12) The department shall report as to the impact of this Act to the 1984 and 1986 General Assemblies and to the appropriate interim committee preceding those General Assemblies. Such report shall include the number and amount of the qualifying energy credits claimed, an estimate of the distribution by income group, the net revenue gain or loss to the Commonwealth attributable to the credits, and such other information as the department deems pertinent to an analysis of this Act.

(13) The provisions of this Act shall apply to all taxable years beginning on or after January 1, 1982, and ending on or before December 31, 1986, and no credit shall be allowed for any taxable year ending after December 31, 1986.

KENTUCKY LEGISLATIVE RESEARCH COMMISSION

1980-81 Interim

BR 237 - PREFILED

September 11, 1981

(CORRECTED)

Representatives Frank J. Smith and William R. Weinberg prefiled the following bill which was ordered to be printed.

Paid for from state funds

AN ACT relating to alternate energy development projects.

Be it enacted by the General Assembly of the Commonwealth of Kentucky:

SECTION 1. A NEW SECTION OF KRS CHAPTER 152A IS CREATED TO READ AS FOLLOWS:

As used in this Act:

(1) "Alternate energy" means passive and active solar, wind, biomass, low-head hydropower, and other renewable energy resources as deemed appropriate by the committee.

(2) "Committee" means the alternate energy project review committee.

(3) "Cost" means the expenditures for construction, all machinery and equipment, financing charges, interest prior to and during construction, engineering, and architectural expenses, legal expenses, plans, specifications, surveys, cost estimates, other expenses necessary or incident to determining the feasibility of practicability of any project, administrative expenses, and such other expenses necessary or incident to the construction of a project, the financing of such construction, and the placing of the project into operation.

(4) "Department" means the Kentucky department of energy.

(5) "Fund" means the alternate energy development fund.

(6) "Grant" means a financial award from the alternate energy development fund for the provision of a specified alternate energy development project.

(7) "Loan" means the provision of funding from the alternate energy development fund for financing of alternate energy development projects, to be repayed to the fund as specified in Section 7.

(8) "Project" means any building, facility, structure, equipment, or materials which the committee may deem necessary for the development and promotion of alternate energy technologies and all rights, property, and interests which may be acquired for the construction and operation of the project.

SECTION 2. A NEW SECTION OF KRS CHAPTER 152A IS CREATED TO READ AS FOLLOWS:

There is hereby established in the treasury of the Commonwealth a trust fund to be known as the "alternate energy development fund," herein referred to as the "fund." The fund shall consist of such amounts as may be appropriated by the general assembly, interest earned on moneys of the fund, grants or private contributions. The fund shall be managed by the committee and all expenditures therefrom must be approved by the committee or its designated representative or the successor positions.

Unexpended balances in the fund shall be invested in interest-bearing obligations of the United States or in obligations guaranteed as to both principal and interest by the United States, of maturities not in excess of five (5) years, and the interest on and proceeds from the sale or redemption of any investments held in the fund shall be credited to and form a part of the fund.

SECTION 3. A NEW SECTION OF KRS CHAPTER 152A IS CREATED TO READ AS FOLLOWS:

Loans, grants, and expenditures for the development, implementation, and construction of alternate energy projects shall be paid out of this fund. Payments shall be made in the same manner as other state expenditures.

SECTION 4. A NEW SECTION OF KRS CHAPTER 152A IS CREATED TO READ AS FOLLOWS:

(1) There shall be created an alternate energy project review committee, referred to hereafter as the "committee," organizationally located as an advisory body to the Kentucky department of energy. The committee shall consist of the secretary of energy as chairman and six (6) members each with equal representation appointed by the governor, with consideration given to their interest and experience in alternate energy and energy research. The members shall elect a vice chairman and other officers as deemed necessary. For the first committee appointed, two (2) members shall be appointed

for four (4) year terms, two (2) members for three (3) year terms, and two (2) members for two (2) year terms. All subsequent appointments shall be for three (3) years each. The respective appointments shall be made on July 1, of each year.

(2) Commission members shall receive no compensation for their services, but may be reimbursed in accordance with the provisions of KRS Chapters 44 an 45 for actual and necessary expenses incurred in the performance of their duties on this commission.

(3) The commission shall meet at the call of the chairman, but not less than twice during each calendar year. A majority of the members appointed to the committee shall constitute a quorum.

SECTION 5. A NEW SECTION OF KRS CHAPTER 152A IS CREATED TO READ AS FOLLOWS:

When it has been determined by the committee that the construction of an alternate energy development project will accomplish the criteria enumerated in Section 10, the committee may contract to grant or loan any county, city, public institution, private business, person, or group of persons, such amounts as in the discretion of the committee is needed in the development and completion of an alternate energy project as follows:

(1) Grants up to twenty-five (25) percent of the total project cost not to exceed $40,000 per project.

(2) Loans up to fifty (50) percent of the total project cost not to exceed $40,000 per project.

(3) Grants and loans in combination subject to the proportion in (1) and (2) and not to exceed a total of $40,000 per project.

SECTION 6. A NEW SECTION OF KRS CHAPTER 152A IS CREATED TO READ AS FOLLOWS:

Contributions to the total project cost by the proposer may include in-kind contributions as well as cash contributions.

SECTION 7. A NEW SECTION OF KRS CHAPTER 152A IS CREATED TO READ AS FOLLOWS:

Every loan of the fund shall be for a period of up to five (5) years and shall carry an interest rate equal to the Bond Buyer Index (twenty (20) bonds) as reported in the most recent issue of the Weekly Bond Buyer on the date the application is approved.

SECTION 8. A NEW SECTION OF KRS CHAPTER 152A IS CREATED TO READ AS FOLLOWS:

Any governmental subdivision, public institution, private business, person, or group of persons in the Commonwealth may apply to the committee for assistance in the development, construction, and operation of an alternate energy project. Application shall be made in a manner as prescribed by the committee.

SECTION 9. A NEW SECTION OF KRS CHAPTER 152A IS

CREATED TO READ AS FOLLOWS:

Applications will be judged and funding decisions made by the alternate energy project review committee.

SECTION 10. A NEW SECTION OF KRS CHAPTER 152A IS CREATED TO READ AS FOLLOWS:

The committee shall give preference to projects which show consideration for the following factors:

(1) Applicability for contribution to low-income energy users;

(2) Potential for job or economic development;

(3) Transferability of the technology involved, particularly technology which will assist in future project design;

(4) Ability to evaluate the progress and the results of the project;

(5) The availability of on-going technical assistance to the project; and

(6) The ability to document and disseminate project results to the public.

KENTUCKY LEGISLATIVE RESEARCH COMMISSION

1980-81 Interim

BR 512 - PREFILED

August 28, 1981

Senator Ed Ford prefiled the following bill which was ordered to be printed.

Paid for from state funds

AN ACT relating to interests in real property.

Be it enacted by the General Assembly of the Commonwealth of Kentucky:

Section 1. KRS 381.200 is amended to read as follows:

(1) Every deed, unless an exception is made therein, shall be construed to include all buildings, privileges and appurtenances of every kind attached to the lands therein conveyed.

(2) A solar easement may be obtained for the purpose of ensuring access to direct sunlight. Such easement shall be created in writing and shall be an interest in real property that may be acquired and transferred and shall be subject to the same recording and conveyancing requirements, except that a solar easement shall not be acquired by prescription.

KENTUCKY LEGISLATIVE RESEARCH COMMISSION

1980-81 Interim

BR 511 - PREFILED

August 28, 1981

Senator Ed Ford prefiled the following resolution which was ordered to be printed.

Paid for from state funds

A JOINT RESOLUTION directing the Public Service Commission to study the feasibility of implementing the Residential Conservation Service Plan and Section 210 of the Public Utilities Regulatory Policies Act and methods to assure non-discrimination in utility rate structures for users of renewable energy.

WHEREAS, rising energy costs affect all Kentuckians; and

WHEREAS, the use of solar and other renewable energy can contribute to a more secure future; and

WHEREAS, federal laws regarding utility companies and solar energy have been implemented by several states and are being considered by other states;

NOW, THEREFORE,

Be it resolved by the General Assembly of the Commonwealth of Kentucky:

Section 1. That the Public Service Commission shall study the feasibility of implementing the Residential Conservation Service Plan and Section 210 of the Public Utilities Regulatory Policies Act in the Commonwealth.

Section 2. That the Public Service Commission shall study methods which assure non-discriminating utility rate structures for solar/renewable energy users.

Section 3. That the Public Service Commission shall

report its findings and recommendations to the 1984 General Assembly and shall submit a report to the Legislative Research Commission on or before January 1983.

KENTUCKY LEGISLATIVE RESEARCH COMMISSION

1980-81 Interim

BR 238 - PREFILED

September 1, 1981

Representatives Frank J. Smith and William R. Weinberg prefiled the following resolution which was ordered to be printed.

Paid for from state funds

A JOINT RESOLUTION directing the department of finance to amend purchasing and bidding regulations in support of a strong energy conservation ethic.

WHEREAS, rapidly rising energy costs continue to demand a larger portion of state funds for building operations; and

WHEREAS, conservation of non-renewable energy resources is important in contributing to a more secure energy future for the Commonwealth and the country; and

WHEREAS, it is appropriate for the Commonwealth to lead the way in helping the public understand the importance of the conservation ethic;

NOW, THEREFORE,

Be it resolved by the General Assembly of the Commonwealth of Kentucky:

Section 1. That the department of finance amend appropriate regulations to include life-cycle costing in the bidding process for all new state facilities.

Section 2. That the department of finance amend appropriate regulations to require consideration of conservation and alternate energy demonstrations in state facility building programs.

KENTUCKY LEGISLATIVE RESEARCH COMMISSION

1980-81 Interim

BR 236 - PREFILED

September 1, 1981

Representatives Frank J. Smith and William R. Weinberg prefiled the following resolution which was ordered to be printed.

Paid for from state funds

A JOINT RESOLUTION extending the tenure of the Special Solar Energy Advisory Committee and directing certain state agencies to report to that committee.

WHEREAS, the Special Solar Energy Advisory Committee has set in motion several activities which are new to the Commonwealth; and

WHEREAS, many of these activities will need continuing oversight; and

WHEREAS, this committee offers valuable expertise and interest in solar activities;

NOW, THEREFORE,

Be it resolved by the General Assembly of the Commonwealth of Kentucky:

Section 1. That the Special Solar Energy Advisory Committee continue its existence through the 1982-1985 legislative interim.

Section 2. That all state agencies directly affected by the actions of the Special Solar Energy Advisory Committee report periodically to that body regarding the progress and the results of its directives.

APPENDIX 3

REPORT OF SOLAR ACTIVITY AT KENTUCKY UNIVERSITIES

This appendix is the result of a survey of Kentucky's state-supported institutes of higher learning to determine the solar energy activities currently underway. An effort was made to identify both the traditional academically oriented activities, such as for-credit course offerings and faculty/graduate research projects, as well as education and information activities directed toward the non-student population.

Since Kentucky does not have a centralized research office to coordinate and track university research going on around the state, nor is there a central office following solar research and information efforts, it was necessary to contact each university directly to determine the activities going on there. Even within each university, Kentucky schools have no single source charged with knowing all of the on-going research and information services within the school. The information thus obtained in this survey relies heavily on personal contact and informal information systems. As is the nature of such systems, there is a good chance that the information obtained is not complete, and there may well be solar activities going on in universities around the state which have not been identified.

University of Kentucky - As Kentucky's primary graduate school, U.K. is devoting more effort to solar research than are the regional universities. U.K. is unique in having a solar committee to promote and follow solar research activities on campus.

The Department of Engineering projects include a federally funded grant to study improved trombe wall construction, an engineering master's thesis on the collection of Kentucky solar data by region of the state and by time of the year; and a study of optimal material surfaces (to determine the best material for collectors). The Department of Agricultural Engineering offers two courses on solar utilization and is supporting research on hot air solar collectors, solar water heaters, and the design and testing of other solar collection equipment.

Through the Agricultural Extension Service headquartered there, U.K. provides an extensive solar and conservation outreach program that has contacted homeowners throughout the state with information on conservation and energy alternatives. They then provide further information through the county extension agents and the extension specialists. Among its services, the AES provides a home energy analysis, where the homeowner supplies some basic information about the house and receives a computer print-out showing probable energy consumption and cost savings by adopting any of the specified conservation recommendations.

University of Louisville - U. of L., primarily through its Speed Scientific School, has been engaged for a number of years in solar systems design and data collection. An astronomical observatory located just outside of Louisville is equipped with solar collectors and monitoring devices and has been providing data since 1977. In addition, U. of L. has been active in providing solar exhibits and small-scale demonstration projects.

Eastern Kentucky University - Oak Ridge National Laboratory funded a community solar energy project at Eastern which was directed by Ms. Janet Patton, of our committee. The project reportedly was quite successful and served as the inspiration for other such projects around the state.

Murray State University - Among the projects inspired by Eastern's efforts was a continuing education program at Murray State, where for one night a week for five weeks homeowners and homebuilders are instructed on various aspects of passive solar energy. Despite little public notification, 65 people signed up for the $10 course. The student fee paid for the instructors and facility utilization, and students received two books provided by the Solar Research Center.

Western Kentucky University - Western has no solar activities currently underway, but a chemistry professor has applied for a federal grant to design a chemical storage system to retain solar energy.

Morehead State University - Morehead hosts one of the more innovative solar projects - a demonstration project for commercial use of solar energy for catfish farming. Funded through the ARC, this project hopes to enhance the viability of catfish farming in cooler climates by artificially extending the warm water season. The chance of commercial acceptance appears good.

Morehead has also submitted to the Council on Higher Education a proposal for an interdisciplinary course of instruction centering around energy alternatives and conservation.

Northern Kentucky University - Northern has hosted some seminars on solar energy but currently has no research or education activities going on in that area.

Kentucky Department of Education - Though not directly involved with higher education, the Department of Education, in cooperation with the state Department of Energy, provides training and materials for classroom teachers, kindergarten through 12th grade, on energy conservation. The Department has sponsored workshops and energy fairs with up to 70 exhibits and works directly with schools to deliver energy education to the students.

Appalachian Community Services Network - The ACSN, an affiliate of KET, has presented a series of educational television programs featuring solar energy and conservation programs adaptable to eastern Kentucky.

RECOMMENDATIONS OF THE SUBCOMMITTEE ON RESEARCH, DEVELOPMENT, EDUCATION AND INFORMATION

1. That a monitoring program be created to evaluate the utility of residence-attached solar greenhouses to determine their performance in Kentucky. If warranted, a series of workshops/seminars would follow.

2. That the Kentucky Department of Energy (KDOE) establish a solar information center that would:

   a. Provide Kentucky-related solar energy data;

   b. Monitor progress and information coming from solar systems operating in Kentucky;

   c. Keep track of research and development of solar projects in Kentucky;

   d. Establish a solar heating ("insolation") index for Kentucky and issue it daily for educational and promotional purposes; and

   e. Provide publications on solar and alternative energy.

3. That the KDOE establish a solar evaluation center to evaluate solar projects, provide diagnostic services, and aid in planning of solar projects.

4. That KDOE develop a computer simulation model for subdivision developers and local planning and zoning commissions. The model would be directed at proper street and structure orientation and would provide cost and benefit estimates for both conventional and passive solar houses.

5. That KDOE provide solar energy seminars directed at Kentucky citizens to alert them to the pros and cons of solar energy.

6. That KDOE conduct hands-on workshops for builders and installers of solar equipment.

7. That KDOE develop solar energy visual aids for use in outreach and education programs.

8. That KDOE provide scientific product testing of commercially available solar energy devices and equipment.

9. That KDOE conduct a solar hot water system testing program whereby various commercially available solar water heaters are installed and monitored for performance in Kentucky for at least one year.

10. That KDOE conduct a demonstration project whereby an existing state government facility is retrofitted for solar hot water and space heating and is used for educational and promotional purposes.

11. That KDOE, in cooperation with and assistance from the state's builders'

and architects' associations, sponsor a design competition for solar structures. A competition such as this would raise the consciousness of those in the building trades and the Kentucky population in general regarding solar energy applications. A development package for the designed project might be offered as a reward.

RECOMMENDATIONS OF THE SUBCOMMITTEE ON INSTITUTIONAL BARRIERS AND INCENTIVES

1. Public awareness projects, including the use of public buildings for demonstration purposes as well as to save on costs, must be a primary goal of the state solar program.

2. The Public Service Commission (PSC) should review non-discriminating rate policies for renewable energy users, the Residential Conservation Service Plan and PURPA regulations, as they relate to renewable energy users, study the feasibility of their implementation, and report their findings to the Energy Committee.

3. The Department of Housing, Buildings and Construction should continue to allow input from Kentucky solar installers, engineers and other professionals regarding the approval of various building codes.

4. The Office of Community and Regional Development (formerly Local Government) should establish methods to provide solar information for local planning commissions. The Kentucky Department of Energy could provide valuable assistance toward this effort.

5. A state tax incentive should be available to deal with the high initial cost outlay problem for many Kentucky homeowners.

6. The Kentucky Department of Energy should include in the state solar plan an in-depth assessment of institutional barriers and a program to mitigate such barriers.

7. The solar homeowner should be afforded the opportunity to secure adequate solar access through state legislation allowing the recording of a solar easement.

A STATE PLAN FOR SOLAR/RENEWABLE ENERGY

PURPOSE: To focus on analysis and solutions in the utilization of state solar/renewable resources to assist in the meeting of energy needs for the greatest potential benefits to people, environment and economic development.

I. Introduction

(A summary of the state's energy situation and the plan methodology described.)

II. Background

A. Assessment of the state's energy situation to include projected trends in energy supply and demands;

B. Comparative analysis of costs of conventional and renewable energy technologies and applications;

C. Cataloging of federal programs available to the state, existing solar activities, existing companies and industries involved in solar development, and an analysis of their impact on the state's energy supply, demand and costs; and

D. Assessment of institutional and legal barriers to solar use.

III. Institutional Resource Assessment

A state's institutional capabilities should be identified. The institutional capabilities include those of:

1. Universities, for their research, testing, data collection, analysis, and independent viewpoints;

2. The solar industry, for professional and trade associations;

3. Utility renewable resource programs;

4. Grass roots organizations; and

5. The political structure, for an outline of the Governor's emphasis on energy, the placement of renewable energy efforts within specific state agencies, and local government activities.

All of these resources should be assessed and made a part of a solar program design.

Representation of these groups should be identified in planning efforts, as they can identify problems and areas of need as well as strengthening the state program.

IV. Goals

Program areas and their respective goals are the responsibility of administrative officials and serve as directives for administrative action. The goals should reflect the findings as stated in Part II, Background.

Specific timetables for objectives are then established for program activities.

EXAMPLE: One of the Southern Solar Energy Center's program goals is

100,000 passive/hybrid buildings by 1985.

Some objectives are:

*Develop price incentives and methodology to improve working relationships between designers and builders.

*Generate locally adapted passive/hybrid residential designs for construction of prototype structures in specific regions.

*Initiate programs to modify or retrofit at least 60 residential and commercial structures to include passive features.

V. Summary: Action to be Taken

APPENDIX 6

SSEC LOUISVILLE HOUSE

PASSIVE SOLAR DESIGN/BUILD PROJECT

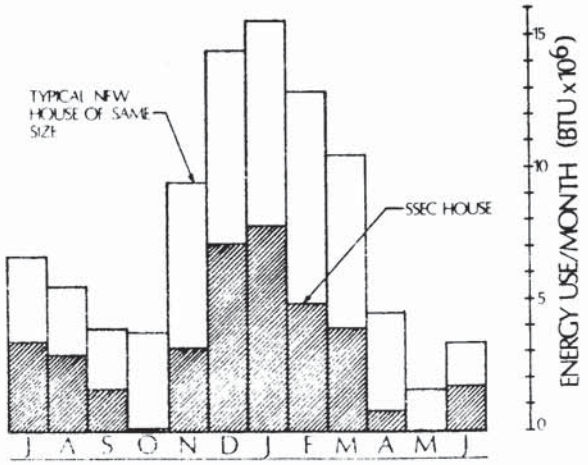
SOUTH VIEW

ABOUT THE HOUSE

The Louisville passive solar home is the product of a cooperative effort between the Southern Solar Energy Center, Omikron Construction Company, and Chrisman, Miller, Wallace, Architects. Significant support was also provided by the Homebuilders Association of Louisville and a team of prominent local advisors.

This 2000 square foot home receives a major portion of its heating needs from the sun and this, combined with other energy saving features, reduces annual energy use by approximately 60% over a typical new home. The home is bright, comfortable, and fits well with the prevailing style of homes in suburban Louisville.

A contemporary version of this house is also being developed to provide maximum aesthetic and marketing flexibility for the design.



PROJECTED ENERGY CONSUMPTION
FOR HEATING AND COOLING

Southern Solar Energy Center is operated for the U.S. Department of Energy

SSEC/SP-41140

ABOUT SOUTHERN SOLAR

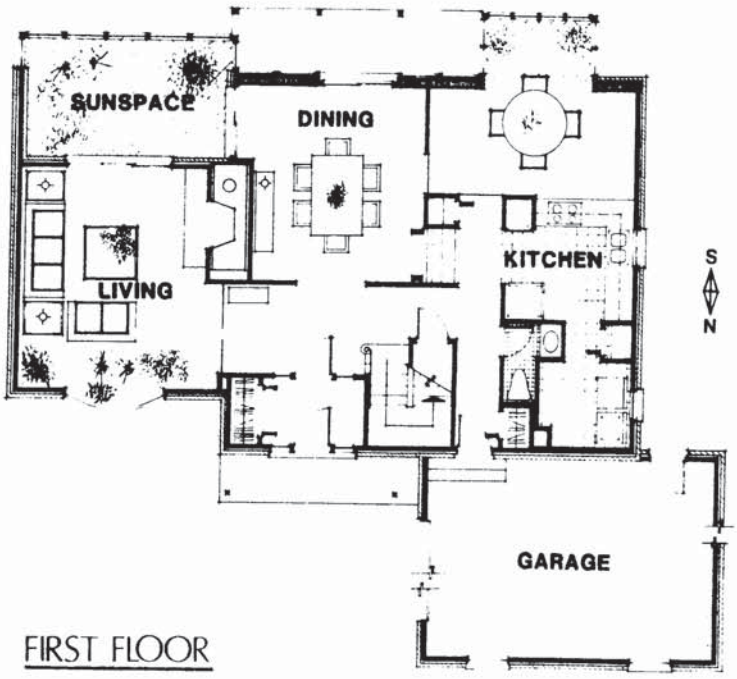
The Southern Solar Energy Center (SSEC) was established in May, 1979, as one of four regional solar energy centers funded by the U.S. Department of Energy. SSEC's function is to help commercialization of solar technologies and to facilitate the South's transition to renewable energy sources.

SSEC has assembled a professional staff with broad experience in dealing with the unique characteristics and needs of the southern region. Commercialization programs, though consistent with national planning, are structured to meet regional needs. Efforts are concentrated on those solar technologies which offer the most promise to the nineteen states and jurisdictions which comprise the SSEC region.

NORTH VIEW

PASSIVE ENERGY FEATURES for heating and cooling

		heat	cool
1.	Trombe wall for solar heat collection, storage and distribution.	X	
2.	Sunspace for solar heating.	X	
3.	Two story solarium for heating and heat distribution to both floors.	X	
4.	Wide overhangs for solar exposure control.	X	X
5.	Trellis for seasonal heating control of trombe wall.	X	X
6.	Masonry floors to store solar heat.	X	
7.	Solar air redistribution system to circulate heated air to lower level.	X	
8.	Site orientation for proper solar exposure.	X	X
9.	High insulation standards throughout.	X	X
10.	Tight shell construction for infiltration control.	X	X
11.	Vestibule serves as an entry heat lock.	X	X
12.	Room layout design with non-habitable spaces grouped along northern exposure.	X	
13.	Garage location on northeast side protects living spaces from cold winter winds.	X	
14.	Special landscaping (earthberm and trees) on north side provide winter wind break.	X	
15.	Windows with dual glazing and wood frames.	X	X



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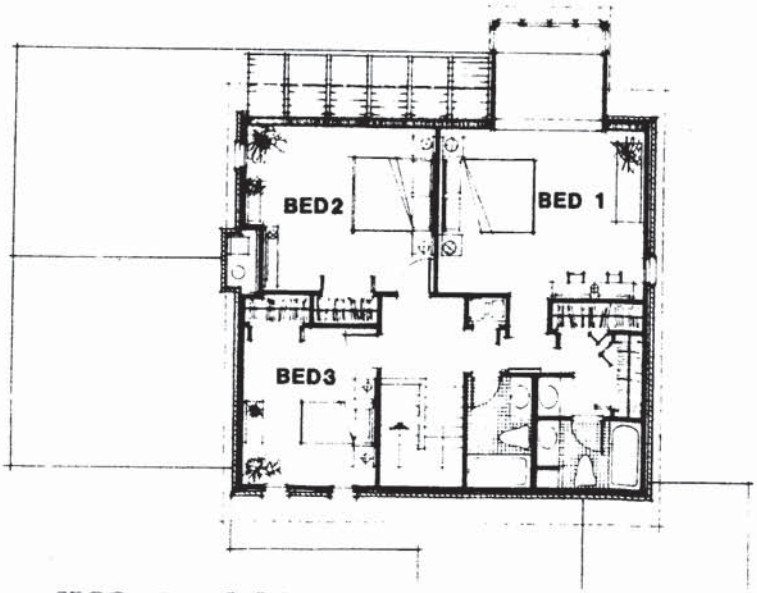

SECOND FLOOR

Southern Solar Energy Center