To the Graduate Council:

I am submitting herewith a thesis written by Gerald Joseph Yuknavage entitled "The State of Solar Access Legislation in the United States." I recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science in Planning.

Kenneth B. Kenney, Major Professor

We have read this thesis
and recommend its acceptance:

Accepted for the Council:

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Graduate Studies and Research

THE STATE OF SOLAR ACCESS LEGISLATION IN THE UNITED STATES

A Thesis

Presented for the

Master of Science in Planning

Degree

The University of Tennessee, Knoxville

Gerald Joseph Yuknavage

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DEDICATION

To my parents, without whose faith, patience, and sacrifice this thesis would not have been completed.

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ABSTRACT

The energy crisis has compelled many states to pass solar energy legislation to aid in the use and development of an alternative residential energy source. Many bills deal with land use laws and concern easements, covenants, zoning, land use planning, and other land use controls. This thesis surveyed energy use, solar energy, and solar access legislation within the United States.

From a literature search and a questionnaire, a survey of solar energy use, policy, and legislation was developed. The literature search reviewed studies on the energy crisis, solar energy, solar energy and the law, and private and public methods for protecting solar access. The questionnaire was used to investigate state policy toward solar energy use and solar access in particular. The questionnaire was sent to state energy officials and included questions in solar energy use, covenants, easements, zoning, and other land use controls.

The survey found that easements may presently be the most effective means of gaining and protecting solar access rights, especially in heavily developed areas. Restrictive covenants can be the most important private land use tool for protecting solar access in new communities. The law of prior appropriation, eminent domain, transferable development rights, nuisance laws, and especially zoning and subdivision regulations, are public devices that may be used to protect solar access. Many states have passed solar zoning and subdivision legislation. A combination of private agreements and zoning seem to be the most effective method of protecting solar access.

The questionnaire revealed that most state energy offices feel that solar energy will have an important role in their state's energy future and that solar energy is being considered in their state's present energy policy. Many state and local governments are considering proposals which can overcome existing laws that may prohibit access to solar energy. At the present time, state solar legislation is basically concerned with creating and recording private easements and covenants. State recognition of private and public methods for protecting solar access helps enforcement, recording, and the creation of standards.

The survey also revealed that the states vary in their attitudes toward solar energy development and solar access. Many states do not feel that it is necessary to pass state solar access legislation because their local governments have considerable "home rule" powers. These local governments can create their own solar legislation. The states that are most affected by the energy crisis, those that have to import energy for residential use, are generally the leaders in creating solar access legislation.

The conclusion drawn from the study was that solar energy use is considered important for the future but its present impact is small. However, in the past few years, a large amount of solar access legislation has been passed throughout the nation. Many states are now allowing local governments to change their zoning and subdivision regulations to accommodate solar access. This may have an important influence on land development in the future. As a result, land use planning will have to change to meet this change in development patterns.

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CHAPTER I

INTRODUCTION

Purpose of the Study

The purpose of this thesis is to evaluate energy use, solar energy, and solar access legislation within the United States. As a result of the energy crisis many states have passed legislation to aid in the development of solar energy as an alternative domestic energy source. Much of this legislation deals with land use law and affects easements, covenants, zoning, land use planning, and other forms of land use controls.

Legislation for solar access is necessary because there is a need for legal rights to solar energy which crosses a neighbor's property. There has never been a need to acquire this solar right until alternative energy use became an important national goal. The traditional land use policy of allowing a property owner great freedom to use his land as he wishes may be changing. The need to protect solar access may limit the use of private property airspace.

The power to change land use policy resides in the state.[1] The courts, which are involved in many land use cases, can only make their judgments according to the laws of the country and the state. When a state legislature acts on the solar access question it can affect many land use controls that are very important to urban planning. This

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[1] U. S. Constitution, Amendment X.

thesis will look at how the solar access question is being dealt with throughout the United States.

Statement of the Problem

Many different sources of energy have been used by Americans for domestic use. Wood, coal, oil, gas, and hydroelectric power have been sources of energy for many years. Now the major source of domestic energy, oil, is being depleted. Foreign sources of oil have to be imported at rising prices. This is creating an interest in developing alternative forms of renewable energy. Solar energy is one of the most important.

Solar energy is seriously being considered by the states as a viable new domestic energy source. In 1980 there were over forty states with solar tax incentives. Twelve states promoted solar energy by providing grants and loans. Twelve states set solar standards and regulations for construction. And over twenty states had passed solar land use legislation.[2]

As solar energy use grows and laws are created to accommodate its development, many land use problems may arise. Solar rays rarely strike the land from directly overhead but generally at angles to the earth. Thus, objects on neighboring property can interfere with solar energy collection. In older residential areas, which tend to have a high density of buildings, solar energy collection can meet with many problems. Mixed building types and lot sizes with various heights and

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[2]U. S. Department of Housing and Urban Development, State Solar Legislation (Rockville, Md.: National Solar Heating and Cooling Information Center, 1980).

setbacks can interfere with roof top collectors. Since a roof top collector may be the only feasible type of collector in this kind of area, many land use disputes can occur.

In less developed residential areas buildings may not be as great a problem. In these districts restrictive covenants and trees may prove to be the major obstacles to solar energy use. Restrictive covenants may prohibit the addition of solar collectors for aesthetic reasons. Trees and vegetation may cast shadows on collectors which can reduce the efficiency of a solar system.

The number and type of problems that can be encountered with increased solar energy development will vary according to location, density, environment, and political climate. Each state should develop legislation according to its particular needs and problems. This state solar legislation may significantly affect future land use patterns in the United States.

Organization of the Study

Chapter I explains the purpose of this study. The statement of the problem is briefly presented and the organization of the report is described. Finally the limitations of the study are discussed.

Chapter II surveys domestic energy resource use in America's history. The chapter describes the forms of energy resources available in America today and the benefits and disadvantages of each.

Chapter III focuses on solar energy and its relationship to man and the earth. Solar energy systems are classified and described. The siting of solar collectors and the need of protecting solar access is discussed.

Chapter IV discusses solar energy use and the law. The private land use devices of easements and covenants are described and proposed as possible legal devices for protecting solar access.

Zoning and solar access is the subject of Chapter V. Zoning, as a public form of land use control, is analyzed in respect to the solar access question. The comprehensive plan and subdivision regulations are also discussed in this regard.

Chapter VI looks at nuisance law and the judiciary. The chapter seeks to explain how the courts may use nuisance law to protect solar access. Public policy questions are also discussed in this chapter.

In Chapter VII state solar access legislation in the United States is analyzed. The methodology used in researching the topic is also described. This chapter interprets and analyzes the questionnaire results and attempts to describe present and future solar access laws.

Finally, in Chapter VIII, general conclusions about solar access legislation, and future research work is discussed.

Limitations of the Study

The major limitation of this study is that although legislation on the state level is very important, many states have constitutional provisions providing for local "home rule." These states feel that solar access questions can best be settled on the local level. As a result of this policy of local home rule, little state solar legislation is enacted in these states. Therefore, it is difficult to determine the development of local solar legislation in these states.

In order to correctly gauge solar access legislation in the United States, a survey of local governmental action is necessary. The

resources and time needed for such a survey are beyond the scope of this thesis.

CHAPTER II

THE ENERGY CRISIS

The Setting

The lack of inexpensive and plentiful energy is a major problem that faces the United States today. A crisis of supply and demand exists, particularly for crude oil sources which are greatly depended upon for heating purposes.[1] Crude oil is no longer in such supply that its inefficient use can go on.[2] Depleting reserves of oil in the next three decades may eventually force a switch to energy sources that are more abundant and less expensive.[3]

The energy crisis is a mixture of scientific, technological, social, economic, and political forces which have been acting in this country since the end of World War II. The major energy source for residential use gradually switched from coal to oil.[4] This switch from a large national resource to a largely imported comodity is central to our understanding of the energy crisis.

Historical Background

Various sources of energy for residential purposes have been used

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[1] The Washington Post, 9 May 1978, p. A-4.

[2] President Carter's National Energy Plan Address, April 1977.

[3] Ibid.

[4] U. S. Energy Information Administration, Annual Report to Congress, 1977, Vol. III, p. 604.

in this country since its settlement. Wood, coal, oil, and hydroelectric power have been used at various times throughout the nation's history depending on their availability and potential use. As one source failed to meet the demands of society a search was conducted for another. It is important to understand that today's energy crisis is a result of decisions made by our predecessors in answer to their particular needs.

Wood

Wood was at one time the most important fuel in America.[5] There were huge forests which covered the new nation. With a small and scattered population the nation had, with wood, what appeared to be an unlimited energy supply.

This was the case until the advent of the Industrial Revolution in America. The population of the country was growing and so were energy demands. Cities were growing and the forests around them began to thin. Wood no longer could be depended upon to supply the growing needs of the nation for industry or the home.

Coal

In the 1850's the use of coal as an industrial fuel grew rapidly. Coal consumption surpassed the use of firewood by 1885.[6] Coal was also becoming widely used for home heating purposes. By 1930, bituminous coal provided more than half of the fuel used in the United States. This switch to coal seemed to be a logical choice because of large

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[5]Charles A. Berg, "Process and Innovation and Change in Industrial Energy Use," Science, February 10, 1978, p. 608.

[6]Ibid.

national coal reserves which were accessible to the major industrial and population regions.

Fuel Oil

Fuel oil's accessibility and handling convenience became attractive to many industries and homeowners. As a consequence, oil began to replace coal. Fuel oil was first used on a large scale for heating buildings in the early 1920's. In the next decade oil made important inroads on coal in supplying energy to large houses and buildings. The advantage of oil over coal became obvious.

Oil is cleaner, easier to control, and burns automatically under the control of a room thermostat. In comparison, coal is notorious for being the dirtiest and least convenient of the fossil fuels. Air pollution from sulfur oxides and particulates made cities dirty and caused health problems. Coal's bulk created storage problems, which helped to convince many that oil was a more practical replacement fuel.

Natural Gas

Domestic coal and oil markets also were challenged by natural gas in the 1950's.[7] In the 1960's most new homes built in America were supplied with gas. A portion of its growth was attributed to the desire of people to curb air pollution. Also, natural gas became widely available due to the construction of pipe line networks throughout the country. Natural gas was also known to be clean and reliable. Gas proved easier to burn and control than oil. It needed no storage tank

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[7]U. S. Department of the Interior, Energy Perspectives (Washington, D. C.: Government Printing Office, 1975), p. 34.

and consumers paid for it after use, not before. Within its system of of underground pipes, gas was protected from adverse weather conditions. The mechanisms which control gas are easier to repair than those of oil. But gas is similar to oil in that they both are limited resources.

Electricity

Electricity, either generated by hydroelectric dams, coal, or fuel oil stations, is easily controlled by a simple mechanism. In the past, its high cost prevented its widespread use for heating. However, its use began to increase when the demand for summer air conditioning grew. Since it would be used for both heating and cooling, many people began to use electricity year round. The increasing cost of generating electricity is reducing its attractiveness for residential heating purposes.

The Fossil Fuels

Conventional Forms of Fossil Fuels

Large deposits of coal exist in this country. Research and development is being carried out to determine how coal or coal products can be used for future energy use. Possibly the liquefaction of coal, which has been understood for many years, may be promoted on a large scale. At the present time the process for liquefaction is still very expensive.[8]

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[8]G. Tyler Miller, Jr., Living in the Environment-Concepts, Problems, and Alternatives (Belmont, California: Wadsworth Publishing Co., 1975), pp. 227-228.

Natural gas, petroleum, and coal have been the major sources of energy in the United States for the last century. Aside from furnishing energy, petroleum and natural gas are heavily depended upon for transportation and industrial products. Plastics and synthetic fibers are two very important byproducts of petroleum. Therefore, conservation of these resources is important, not only for heating but for the economy as well.

The demand for oil in the world may exceed the supply by 1985 if the current usage rate is continued.[9] This world wide shortage may force more dependence on America's already dwindling oil reserves. Natural gas supplies in the United States are much larger but as a finite resource it cannot be relied upon.[10] Dependence on petroleum and natural gas as major sources of energy is expected to continue for the next few decades. This may intensify the search for other forms of energy which would help to conserve our existing supplies of oil.[11]

Alternative Forms of Fossil Fuels

Coal, oil, and natural gas are part of an energy group called the primary chemical sources of energy. This group uses organic or former organic material as the energy source. Because much of the material is found in fossilized form it is called fossil fuel. Other primary chemical sources are wood, oil shale, and tar sands. Because

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[9] "World Oil Shortage Seen Within Six Years," Knoxville News-Sentinel, 17 January 1980, p. 3.

[10] James H. Hill, Energy in Perspective--Three Years Later (Oak Ridge: U. S. Department of Energy, 1978), p. 5.

[11] Ibid., p. 4.

the latter two have largely been ignored and undeveloped but exist in large deposits in this country they are seen as a possible solution to some of our energy problems.

Oil shale. Oil shale is basically an underground rock formation that contains a hydrocarbon mixture known as kerogen.[12] The shale rock can be mined like coal and processed to yield low sulfur shale oil. This shale oil can be refined to produce crude oil and other petrochemical products. Enormous deposits of oil shale lie in the western states of Colorado, Utah, and Wyoming. This area, known as the Green River region, may yield more oil than exists in Saudi Arabia.[13] However, several problems are associated with oil shale.

High extraction costs and oil shale's low net useful energy yield prohibit it from competing successfully with other fuels.[14] Large amounts have to be mined for a moderate oil yield. The processing and mining of it also produces large amounts of solid waste and air pollution. Water is also needed for its production and water is a scarce resource where the shale is found.

Oil shale is not likely to be a major contributor to the nations' energy supply in the near future.[15] The production of oil from coal and tar sands seem a more probable means of energy supply. The conversion

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[12]Miller, pp. 225-226.

[13]Hill, p. 11.

[14]Ibid.

[15]Ibid.

technologies for coal and tar sands are better developed and the raw material more useful than shale oil.

Tar sands. Tar sands are huge areas of fine clay and sand mixed with water and variable amounts of high sulfur tar called bitumen, or heavy oil.[16] Canada has the largest known deposits, located in north central Alberta. Large deposits are also found in Colorado, Utah, and Wyoming. This source of fuel must be mined as a solid, processed at high temperatures to yield oil and then still undergo further refining to produce a useful product. Problems which keep tar sands from being readily utilized are difficulty in handling, distance from markets, and the dependence on steam and electricity for mining and processing.

Nuclear Energy

Since primary chemical sources of energy are largely finite and involve special and expensive techniques for development, other sources of energy may be used in the future.[17] After the Second World War, much hope was placed on the atom. Nuclear energy was expected to bring a cheap and unlimited source of power to the world. This belief led to a tremendous amount of time and capital being utilized to develop nuclear energy. After years of research, development, and publicity, nuclear energy has not proven to be what it was hoped to be. There has even been a drop in nuclear produced electric power in the last few years.[18]

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[16]Miller, pp. 231-232.

[17]David Crabbe and Richard McBride, The World Energy Book (New York: Nichols Publishing Co., 1978).

[18]U. S. Department of Energy, Annual Report to Congress, Vol. 2 (Washington, D. C.: U. S. Department of Energy, 1979), p. 154.

The use of nuclear fission as a generator of electric power is now a very controversial subject.[19] Many questions have been raised about its safety. It is widely believed that nuclear fission is potentially the most hazardous of all energy sources.[20] Many believe that the safety of nuclear power plants has to improve considerably before the public will accept further development. Dangers also exist in the shipping and storage of nuclear materials. Uranium provides the fuel used in nuclear plants, but available resources may be in short supply in the United States.[21]

The Breeder Reactor

The breeder reactor is supposed to alleviate the problem of limited nuclear fuel.[22] Unlike conventional nuclear reactors, a breeder does not waste any uranium while converting the fuel into plutonium.[23] The breeding of more fuel from a limited amount of uranium is an attractive feature of the breeder. But the production of radioactive waste is still a problem and the breeder is not exempt from the difficulties associated with conventional nuclear plants. Besides, the prospect of a breeder reactor coming on line in the near future is not assured because of the danger of plutonium being used for weapons and

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[19]Tom Wicker, "No Nuclear Credibility," New York Times, 27 February 1979, p. A17.

[20]Barry Commoner, "The Solar Transition," The New Yorker (April 23, 1979), p. 53.

[21]National Research Council, Energy Modeling for an Uncertain Future (Washington, D. C.: National Academy of Sciences, 1978), p. 17

[22]Hill, p. 12.

[23]Ibid.

public opposition. Nuclear energy will grow in its present state of technology only if a major fuel emergency develops and the public is willing to overlook its problems. This can happen if other viable sources of energy are not made available for public consumption in the next two decades.

Alternative Forms of Energy

It seems that unless nuclear power becomes safer to use, new sources of energy may have to be developed. The development of environmentally safe and renewable energy sources is ultimately the long range solution to the energy crisis. In the future oil, natural gas, and uranium will probably be depleted to such an extent that they will no longer be able to satisfy the needs of society. The pressure to develop alternative sources of power is increasing yearly as conventional fuel costs rise and nuclear energy is not satisfying the public's needs.

Primary Physical Sources of Energy

Primary physical sources of energy are the natural forces that exist in the universe which can provide a tremendous amount of energy to man. Hydroelectric, solar, geothermal, wind, waves, tidal power, and ocean thermal gradients are a few examples of this form of energy. These energies have been known and used by man for ages.

Hydroelectric power. Hydroelectric power has been used for many years in the production of electricity. Natural terrain and water supply limit the sites where this power is generated. Only where there is a tremendous amount of water available can hydroelectric power be

economical. Most of these sites are already being utilized.[24]

Geothermal power. Geothermal energy is created when materials in the earth's crust are heated to high temperatures by physical, chemical, and/or nuclear reactions.[25] Molton rock from the earth's interior is then carried to the surface by conduction and volcanic action. Steam occurs at the surface when ground water mixes with the hot material from the ground. This steam can be directly used to generate electricity by feeding it to a turbine.

Hot water fields are primarily used for space heating. Dry steam fields can also be used. The Geysers steam field in California has been providing electricity to San Francisco for twenty years.[26] Wet steam fields and hot dry rocks, two other forms of geothermal energy, have not been researched or developed to any large extent. Geothermal power is best utilized by residential areas accessible to the energy source.

Wind energy. The wind has been used for centuries by man for grinding, pumping water, and propelling ships across the seas.[27] Toward the end of the 19th century generators were attached to wind machines to create electricity. A windmill produced power for those who lived in rural and isolated areas without access to any centralized power grid.

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[24]Hill, p. 7.

[25]Miller, p. E154.

[26]Miller, p. E155.

[27]"Alternative Energy for Britain," The Elements--A Journal of World Resources 35 (November 1977), p. 4.

Local climate and topography have a great influence over the wind's speed, direction, and constancy. Local conditions must be studied before any thought is given to any high powered electric wind generation. Suitable areas can be found in mountain regions such as the eastern foothills of the Rocky Mountains or in the Green and White Mountains of New England. Recently a high powered wind generator was constructed at Boone, North Carolina which is capable of generating 2,000 kilowatts of energy.[28] Other favorable locations for wind generation are the plains and coastal areas.

The economics of wind generated electricity seem to be marginal at the present time but development is continuing because of its great potential. The main advantage of wind power is that it is a clean and renewable resource. Even if used on a limited scale it would conserve fossil fuel and reduce air pollution.

Sources of energy from the ocean. The tides, waves, and thermal gradients of the ocean are constant sources of energy. Experiments have been carried out to harness these ocean energies. Tidal energy is presently used by France and the Soviet Union.[29] Ocean thermal gradients and wave energy is also being developed to a limited extent. The present state of technology, high costs, and limited areas of power generation reduce the immediate impact of these forms of energy.[30]

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[28]"Tall Perch for a Giant Windmill," New York Times, 15 July, p. E7.

[29]D. S. Halacy, Jr., Earth, Water, Wind, and Sun (New York: Harper and Row, Publishers, 1977), pp. 63-64.

[30]Hill, p. 17.

Energy Conservation

Energy conservation can reduce the demand for more energy and ameliorate the energy problem of this nation.[31] If consumption of limited energy sources is diminished then these sources can last longer. More efficient cars, machines, and buildings can be designed to use less energy. The lifestyles of many Americans may also change to reduce energy use.

The residential and commercial sectors of the country account for about 40 percent of all the energy consumed in this country.[32] One half of this can be saved by more rational energy conserving building techniques.[33] This would call for a change in how buildings are designed, constructed, and used. Energy savings through conservation methods would also benefit the economy and the public by avoiding the need to build new or convert existing power plants to produce cheaper energy.[34]

Efficient insulating and retrofitting methods can aid conservation in residential areas. New construction can be designed to take maximum advantage of the natural environment.[35] This means designing

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[31]Demand and Conservation Panel of the Committee on Nuclear and Alternative Energy Systems, "U. S. Energy Demand: Some Low Energy Futures," Science 200 (14 April 1978), p. 142.

[32]Donald Watson, ed., Energy Conservation Through Building Design (New York: McGraw Hill Book Co., 1979), p. 13.

[33]Ibid.

[34]Amory B. Lovins, Soft Energy Paths (Cambridge: Ballinger Publishing Co., 1977), p. 134.

[35]Victor Olgyay, Design with Climate (Princeton: Princeton University Press, 1963), pp. 84-112.

buildings which take advantage of the sun, wind, natural vegetation, and local climate. The reductions in energy use can be dramatic. But changes in the way we presently use our energy sources can be difficult and rational solutions to the energy crisis may not be used due to cultural inertia.[36]

Conclusion

This country now faces an energy crisis mainly brought on by depending on limited sources of fossil fuels and using them in an inefficient manner. A shift to use more renewable energy sources and conservation may be the best policy for the nation's needs. But cultural change is not easy. Many social, political, economic, technological, and scientific forces affect the country's energy policies. More modest and gradual approaches to the energy crisis may be needed. The development of solar energy is one of these approaches.

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[36]Watson, p. 20.

CHAPTER III

SOLAR ENERGY

Introduction

Solar Energy and Man

Solar energy is potentially the most important source of energy known to man.[1] Without solar energy there would be no wind, waves, fossil fuel, plants, or light. The sun is the life source of the earth. This has been recognized by man for centuries. The sun was no important to early man that it was worshipped as a god.

In the near future man may make great use of the sun to heat buildings. As a limitless source of free and clean energy it is a wonder modern man has not tried to develop its power to the fullest extent possible. In the past men used the sun to heat and light his home with little fear of its power being cut off. Man can again use the power of the sun to light and heat his home.

Solar Energy and the Earth

Solar energy originates from the thermonuclear reactions that take place on the sun.[2] These reactions have been occurring for thousands of millions of years. The energy from these reactions leaves the sun and reaches the earth as electromagnetic radiation.[3] The major

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[1]Hill, p. 9.

[2]Halacy, p. 148.

[3]Miller, p. 45.

wavelengths come to us in visible light and infrared radiation. The earth retains about two-thirds of this energy as heat. The hydrological cycle absorbs most of the rest in the form of evaporating water. A smaller amount cause ocean and atmospheric convections, circulation, and ocean waves.

When passing through the earth's atmosphere the solar rays are scattered, reflected, or absorbed by water, gases, and dust. The direct radiation which reaches the surface of the earth is called sunshine. The rest appears as diffuse radiation. When the skies are cloudy all the radiation reaching us from the sun is diffuse.

The composition and depth of the atmosphere are important factors in determining the quantity of radiation being received at a certain location. Since the earth tilts as it rotates, the depth of atmosphere that solar radiation passes through will vary with the time of day and month of year. The angle the sun's rays make with a surface will determine how much energy that surface receives. Even if the surface is 25 degrees off from perpendicular to the sun, it still can receive over 90 percent of the direct radiation. The total amount of radiation energy intercepted by a surface includes direct, diffuse, and reflected radiation.

Solar Energy Systems

Classification of Systems

Active. There are two methods used to capture solar energy for domestic heating purposes: active and passive. An active solar system

needs mechanical support to collect and transport solar heat.[4] The principle components of an active system are a flat plate or focusing collector and a storage area. Solar heat is trapped by the collector and transferred to the storage area by air, water, or another medium like antifreeze. A pump or fan is commonly used to propel the transfer medium through the system.

Passive. A passive system uses no mechanical means of collection and transport.[5] Solar energy, in the form of heat, moves through a passive system by natural radiation, conduction, and convection. Basically the building structure serves as the solar collector and storage area. A passive system functions on available natural energy while an active system uses mechanical aids in its operation.

Hybrid. A hybrid solar system uses components of both active and passive systems. If mechanical aids are used for storage or collection, but not both, the system is a hybrid.[6] A system of this type is employed to aid a passive solar system to increase its medium flow. The addition of a small fan or pump would change the classification of a passive system to a hybrid.

Photovoltaic. Photovoltaic cells are devices that convert solar

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[4]Louis Gropp, Solar Houses (New York: Pantheon Books, 1978), p. 56.

[5]Edward Mazaria, The Passive Solar Energy Book (Emmaus, Pa.: Rodale Press, 1979), p. 28.

[6]U. S. Department of Housing and Urban Development, A Survey of Passive Solar Buildings (Washington, D. C.: U. S. Government Printing Office, 1979), p. 17.

energy into electricity. They have been widely used to power space craft and provide energy to remote military and scientific installations on the earth. However, the cost of these cells is very high. Only when their cost is reduced dramatically can they be considered feasible for home electrical purposes. Photovoltaic cells are not considered further in this thesis.

Active Solar Systems

Characteristics

An active solar system is constructed of equipment to trap the sun's heat and to use that heat for hot water or space heating. Unlike passive designs, active systems use automatic controls with their fans or pumps. Active systems may also use a conventional hot water or heating unit as a backup source of energy.

Active solar systems use a forced heat and delivery system which is relatively independent of the building structure. Pumps, fans, automatic controls, and other mechanical devices in the active system give to its owner an independence from the operation of the system. Because of its adaptability to conventional heating systems, active collectors are commonly used on older houses in retrofit situations. This retrofitting is primarily done for hot water heating purposes.

Flat plate collectors are widely used with active systems. This collector is basically a covered container with a glass cover and an absorber plate. The plate absorbs the solar radiation passing through the glass. Air, water, or antifreeze passes through the container and circulates the heat to different areas of a building. These collectors can function using direct or diffuse sunlight. The major requirements

for the collector is a clear southern exposure and an orientation which would capture the largest possible amount of solar radiation available. The size and design of the house; type and size of the system; and local climatic conditions all help to determine the cost of a solar arrangement. Figure 1 shows an active system with a flat plate collector.

Passive Solar Systems

Characteristics

A passive solar heating system can supply a significant percentage of a building's energy requirement. Achieving the full potential of passive solar heating depends on an awareness of the relationship between climate, human comfort, and the thermal characteristics of

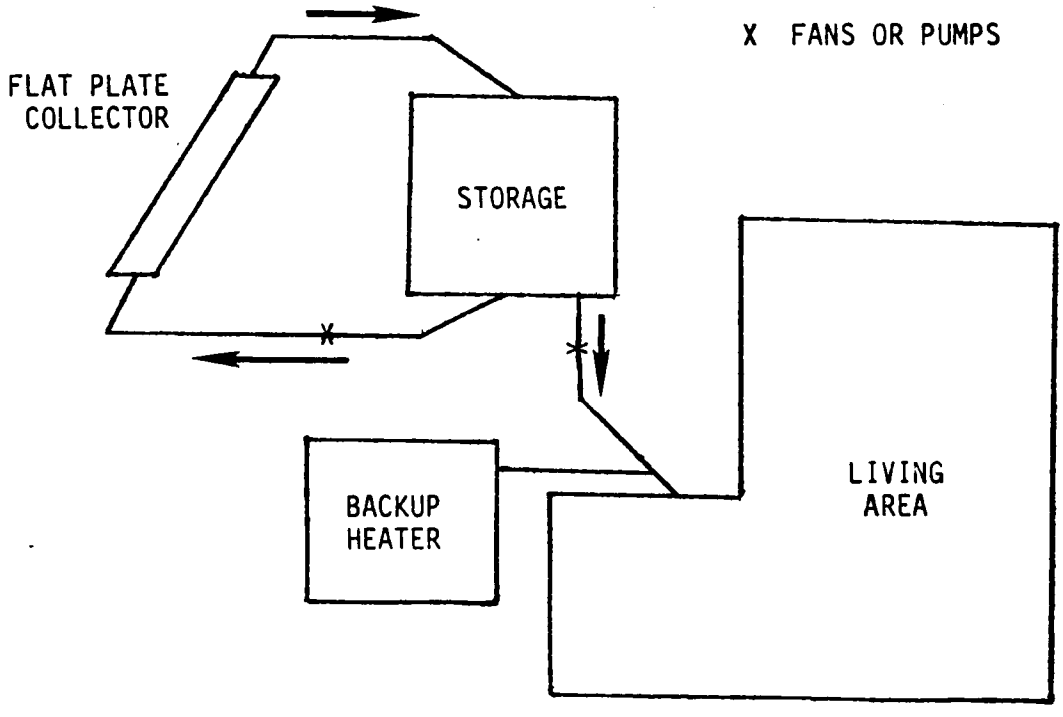


Figure 1. Active System with a Flat Plate Collector.

buildings and materials.[7] Two primary characteristics of any passive solar energy system are south facing glass and a thermal mass. The south facing glass acts as the collector and the thermal mass absorbs, stores, and distributes the thermal heat. Direct gain, indirect gain, and isolated gain are three types of passive solar energy systems.[8]

Direct Gain

A direct gain structure is one in which solar energy directly heats the living area. Direct gain buildings use large quantities of south facing glass. For winter use the glass is situated to collect the highest amount of solar energy possible. In the summer the glass is protected from the hot summer sun by roof overhangs and shades to prevent overheating. Behind the glass a large thermal mass is used to absorb solar heat and store it for night use. In direct gain buildings the floor and walls are best suited for this function. Figure 2 is an example of a direct gain building type.

Masonry or water are ideal for heat storing purposes and are frequently used as the thermal mass. Masonry can take the form of concrete, concrete block, brick, stone, or adobe.[9] The type of material used will be determined by local building sources and the local climate. Water walls must be constructed of materials capable of holding its heavy weight.

The direct gain system is not suited for climate zones which

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[7]Olgyay, p. 17.

[8]Mazaria, p. 29.

[9]Ibid., p. 29.

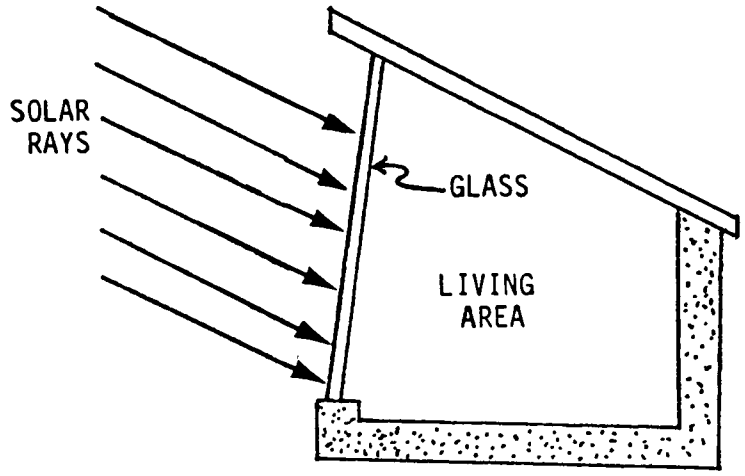


Figure 2. Direct Gain Building.

experience extreme heat or very cold temperatures because of the large amount of glass used in building this passive design.[10] The glass can be difficult to insulate. If not properly insulated the interior of the building would overheat in hot weather or lose heat in the winter.

Indirect Gain

Indirect gain is another approach to passive heating.[11] This system uses a thermal mass, located between the solar radiation and living area, to store and transfer heat to the interior. Thermal storage walls and roof ponds are two types of indirect gain buildings.

Mass trombe. Thermal storage walls, or the mass trombe building,

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[10]American Institute of Architects Research Corp., Regional Guidelines for Building Passive Energy Conserving Homes (Washington, D. C.: U. S. Government Printing Office, 1978), p. 279.

[11]Mazaria, p. 44.

use the wall as the storage mass.[12] The mass trombe structure requires south facing glass for winter heating with the storage mass located bhind the glass. A masonry wall will absorb sunlight on its outer surface and then conduct the heat it obtains to the living area. Vents are sometimes placed on the wall to direct a natural heat flow during the day. Open vents will cause convection from the outside wall to occur.

Water trombe. A water trombe building uses water instead of masonry to store and transfer solar heat. Since the mass is water it is heated by convection and distributed into the building by radiation. Figure 3 is an example of a mass or water trombe indirect gain building.

Attached greenhouse. An attached greenhouse blends elements of the direct and indirect passive systems. The greenhouse is attached to a south facing wall which separates it from the interior of the house.

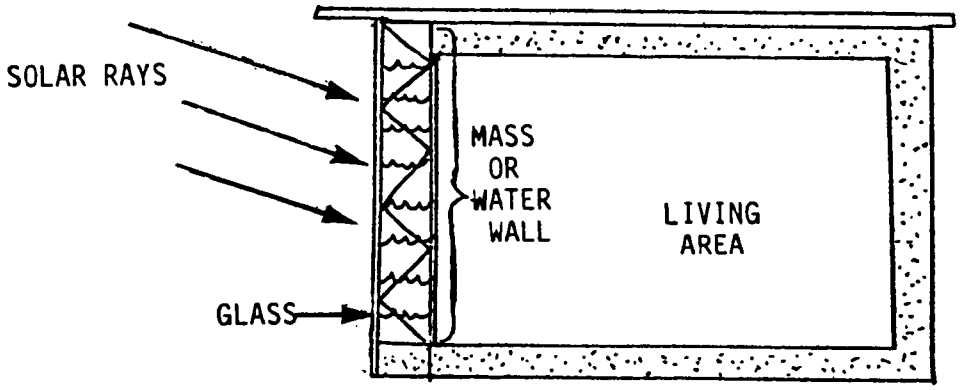


Figure 3. Mass or Water Trombe Building.

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[12] Ibid.

When sunlight passes through the greenhouse it strikes the mass wall and converts to heat. A portion of this heat reaches the living area.[13]

Roof pond. The second indirect gain building type is the roof pond. Water is stored on top of or in the roof. This water can act as a heating or cooling agent when it is controlled by exterior movable insulation. During the winter, in areas with little snowfall, solar heat can be collected during the day by exposing the pond to solar radiation. This heat is retained for evening use when the pond is covered by insulation.

During the summer the pond is protected from the sun during the day and exposed at night. This would keep the building cool during the day because the water would act as an extra layer of insulation against the hot summer sun. In the evening the insulating cover is removed. This action releases from the pond any heat it may have acquired during the day. The night air will cool the water in the pond and provide a pleasant temperature to the interior of the building.[14] A roof pond is represented in Figure 4.

Indirect gain systems may be superior to direct gain buildings because they can be used in more climate zones.[15] The mass and water trombe solar buildings need large amounts of sunshine to build up heat gains for reradiation. The roof pond is suited for climates with little snowfall and areas which receive high overheat winter sunlight. These

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[13]Ibid., p. 52.

[14]Ibid., p. 56.

[15]American Institute of Architects, p. 281.

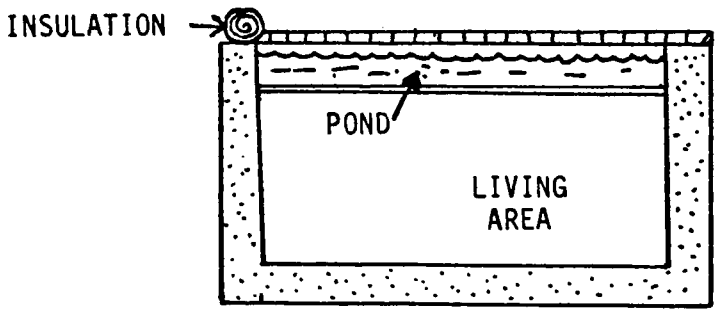


Figure 4. Roof Pond.

areas are found in the lower latitudes of the United States.

Isolated Gain

The third approach to passive solar heating is the concept of isolated gain. The solar collector and storage area of this system are not part of the main building. The most common example of this system is the natural convection loop or thermosiphon.[16] When the air or liquid in a flat plate collector is heated it rises and enters the top of the storage tank. When the heated material rises, cooler water or air is pulled from the bottom of the tank to the collector. This creates a natural flowing motion. Since the collection and storage devices are separated from the main building they can be controlled without interferring with the living area. The isolated gain system can be used in most climate zones. Figure 5 is an example of an isolated gain system.

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[16]Sandia Laboratories for the U. S. Department of Energy, Passive Solar Buildings (Albuquerque, N. M., Sandia Laboratories, 1979), p. 17.

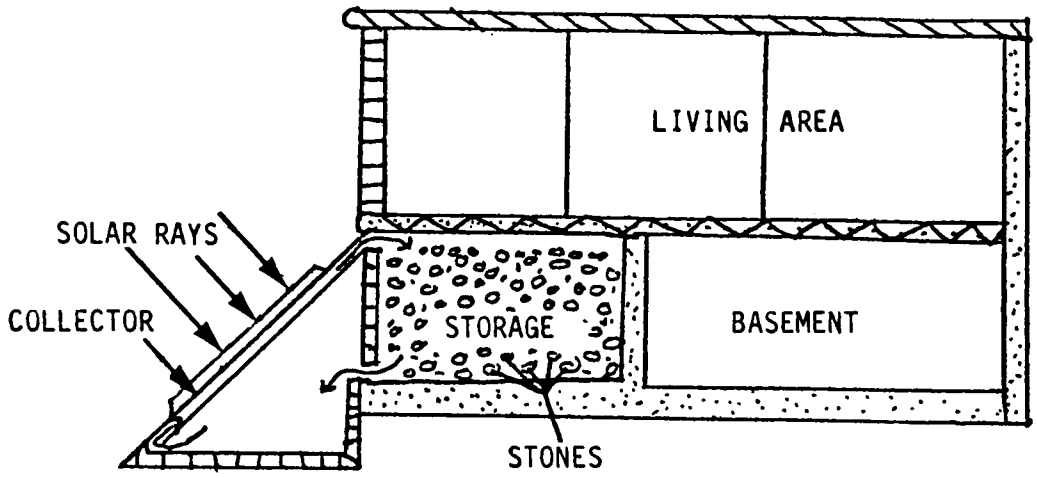


Figure 5. Isolated Gain System.

Site Selection

The Environment

Access to sunlight is very important to the performance of a solar energy system. A solar collector must have clear access to the sun. This makes the selection of a collector site a major decision. The sun's movement across the local sky and the environment are important factors in this selection. The natural and man made surroundings, topography, building shape, latitude, and the local microclimate all will have some effect on a solar energy system.

The Microclimate

The microclimate is the physical condition of the area surrounding a solar collector site.[17] Topography, weather, geographic location, temperature variance, humidity, wind, precipitation, solar

[17] Olgyay, p. 44.

radiation, and landscaping all combine to form a microclimate.

Latitude and topography determine the amount of sunlight falling on a collector site. This is important because when the earth rotates and tilts through space the sun changes position in the sky. During the summer the sun appears higher in the sky than in the winter. The farther north or higher the latitude a solar system is located, the lower the angle of the sun will be on the horizon. When the sun gets lower in the sky, shadows get longer. At high latitudes this becomes very important when siting a solar collector. The near presence of a neighbor's lot or large local trees and vegetation take on more importance than a collector situated at a lower latitude.

The Solar Window

One important factor in siting a solar collector is the solar window. The solar window is the area of the sky a solar collector must have access to if the solar system is to operate properly. The window delimits the area which receives the most important solar radiation. This skyspace is measured by solar angles determined by the sun's azimuth and altitude.[18] The position of the sun from east to west is the azimuth. The height above the horizon is the altitude.

Certain hours of the day are more important for solar energy collection than others. A collector with a solar window free from obstructions between the hours of 9 A.M. and 3 P.M. during the winter solstice should have a clear solar access for the entire year. The

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[18]Martin Jaffe and Duncan Erley, Protecting Solar Access for Residential Development (Washington, D. C.: Government Printing Office, 1979), p. 17.

winter solstice, or December 21st, is the day when the sun is at its lowest point in the sky. Shadows on this day are longer than at any other time of the year. If there is no shadow problem on this day then a clear solar window can be expected the rest of the year. Figure 6 is an example of a solar window.[19]

Direction Siting

During the winter about 90 percent of the sun's energy output occurs between 9 A.M. and 3 P.M.[20] Most of this solar energy comes from the south. A building which is located on the optimum east-west axis should receive most of its solar heat source from the south. During the summer, when heating is less essential, the south side receives much less sun than the east and west because the sun is higher in the sky.

The south side of a lot or building is very important for solar

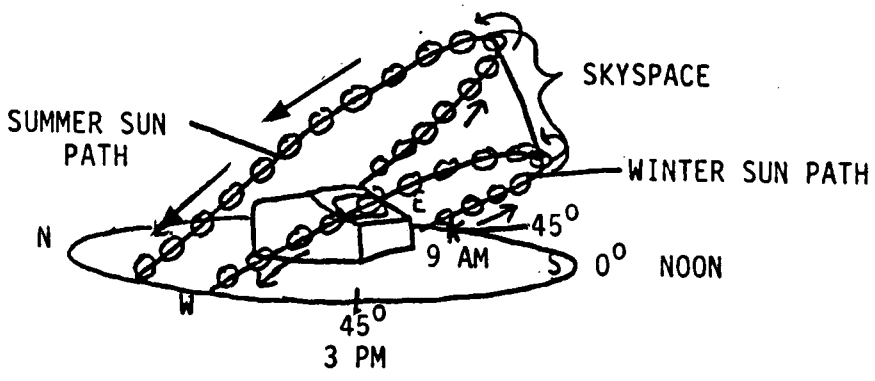


Figure 6. Solar Window.

[19]Ibid., p. 19.

[20]Mazaria, p. 73.

collection purposes. The east and west sides are not as significant. The north side is the least important for it receives no direct sunlight all winter. All solar collectors need a clear solar window to the south. This makes collector and building siting important. Problems arise when vegetation and structures block solar energy from reaching the collector.

Protecting Solar Access

Site location is very important when looking for ways of protecting solar access. A solar energy system can be used in low and high density residential, business, and industrial areas. Siting will vary with location.

Some communities will not need to develop any solar access regulations. The design of the community may preclude the necessity of creating any solar access laws. Areas subdivided and zoned into large lots may provide enough room to avoid undesired shading.[21] Densely populated areas with mixed land uses present situations which may need complex solutions.

Prior to building a collector a property owner can determine a location where it will not be interferred with. This decision may influence the type of collector he will set up. An isolated gain collector may avoid certain obstructions a direct gain building cannot avoid. In some locations only one type of collector can be used. In areas with small lots, a roof-top active collector may be the only feasible type.

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[21] "Wilson County: First in Solar Zoning?", The Tennessee Conservationist (March/April 1980), p. iv.

After a collector is sited and constructed to avoid existing shadows, what can be done if new shadows are created? A tree or vegetation can grow to such a height that it can cast a shadow on an existing collector. A neighbor may build something on his land that interferes with the collector. What rights does a collector owner have in order to prevent this from happening? This is a legal question which has to be answered through legislation and by the courts.

Conclusion

Solar energy is the most important source of energy known to man, but its potential power has hardly been tapped. Many types of solar collectors have been developed to capture and use this energy for domestic heating and cooling purposes. Active, passive, and hybrid systems are now in use across the country.[22] But in order for a solar energy system to work, a clear solar window is necessary. Obstructions such as trees, buildings, and other structures can interfere with a collector's reception of solar radiation. This can be avoided if a collector is carefully sited. However, a collector can be shaded by obstructions from across a neighbor's property line. This may occur frequently in areas with small lot sizes. How can a person protect a clear access to his solar collector? The legal options open to a solar collector owner are discussed in the following chapters.

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[22]William A. Shurcliff, Solar Heated Buildings of North America: 120 Outstanding Examples (Harrisville, New Hampshire: Brick House Publishing Co., 1978).

CHAPTER IV

SOLAR ENERGY AND THE LAW

Introduction

For many years the Latin maxim, "Cujus est solum ejus est usque as coelum et ad infernos," had been accepted in English and American law. It means, "The owner of soil owns also to the sky and to the depths."[1] A landowner, under this law, was given title to the airspace above and the land below his property. A landowner also received the right to all sunlight which struck his land from directly overhead. As we have seen in the last chapter sunlight rarely strikes the land from directly overhead. In many cases sunlight must cross neighboring lots before it reaches the earth.

Under the old Latin law a person would have no right to these solar rays which slanted across his neighbor's property. But the need to gain access to these solar rays is important to the development of solar energy. It also was important for lighting purposes 400 years ago. Solar light was very important for interior lighting and reading. A sixteenth century English court was one of the first to deal with the problem of solar access.

In Bury v. Pope, Bury was sued because he prevented light and air from reaching Popes' window.[2] The court, citing the Latin law,

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[1]Sand F. Kraemer, Solar Law (Colorado Springs, CO.: Shepard's Inc., 1978), p. 132.

[2]Bury v. Pope, 1 Cro. Eliz. 118,78 Eng. Rep. 375 (Ex. 1586).

ruled that Bury's right to build on his own property was proper even if it did prevent light from reaching Popes' property. The fact that Bury constructed a building right next to the property line was not considered material to the court. This decision set a standard in cases involving light and air in England for many years. This law came to America as part of English Common law and was retained by American courts after the Revolution. Only in the 20th century, with the advent of aviation, have private land use rights been weakened in questions of unlimited use of airspace.

The second legal rule from English law dealing with solar rights is the Doctrine of Ancient Lights.[3] The Doctrine allowed property owners a limited right to receive light across adjacent land up to the amount needed for reasonable use and enjoyment of their land. They must have received that light, without interruption, for a certain amount of time before they could claim a right to it. In England today the time period is 27 years. The law does not state that the light allowed by this proscriptive right has to be direct sunlight. But, in any case, the Ancient Lights Doctrine has been consistently rejected in the United States.

The Doctrine was rejected in New York by the legal case of Parker b. Foote in 1838.[4] The Doctrine was considered by the American court as being contrary to the public policy of the nation. The United States was a young and growing nation and any limitations placed on private property rights was regarded as a barrier to this growth. The

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[3]Kraemer, p. .131.

[4]Parker v. Foote, 309, 317 (New York, 1838).

full and unlimited development of property was considered more important than a right to light.

This policy has been continued into the 20th century. For example, in Florida, the Fontainebleau Hotel Corporation was allowed to construct an addition to its building, even though the addition cast a shadow over the swimming pool area of the adjacent Eden Roc Hotel. This shadow plunged the swimming area into darkness during the height of the winter tourist season. The Eden Roc owners brought suit against the Fontainbleau owners, claiming the shadow was a nuisance which deprived them of the full use and enjoyment of their land. The court, once again rejecting the Ancient Lights Doctrine, declared in favor of the defendants.[5]

Landowners in America have a right to sunlight from directly overhead but not to sunlight crossing from adjacent property. Nevertheless, solar energy systems need to have access to these slanting rays. What are the existing private and public land use laws that can be used to aid and protect access to these solar rays? The currently used institutional devices of restrictive covenants, zoning ordinances, and especially easements may be very important in the near future for the protection of solar access.

Easements

Introduction

Easements may presently be the most effective means of gaining

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[5]Fontainebleau Hotel Corp. v. Forty-Five Twenty-Five, Inc., 114 So. 2d 357 (Fla. App. 1959).

and protecting solar access rights. By definition, an easement is an interest in property which belongs to another and gives the easement holder a limited use of that land.[6] Easements are agreements between property owners and can be sold, leased, and taxed. An "affirmative easement" allows its owner to do something on his neighbor's land which, if no easement existed, would not be legal. A "negative easement" limits the neighbor's use of his land.[7]

A right of way over a neighbor's property is an example of an affirmative easement. Negative easements are usually applied to light and air passing to one's property over another's land and as such may be used to protect solar access. The lands to which an easement is attached is called the "dominant tenement;" the land upon which the burden is laid is called the "servient tenement."[8] The solar collector owner who obtained a negative easement from his neighbor would hold the dominant tenement.

Easements can be "appurtenant" or "in gross." An appurtenant easement is an easement that is connected with and attaches to the ownership of the land.[9] There has to be a dominant tenement or else the easement is considered "in gross." An in gross easement is attached

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[6]American Law Institute, Restatement of the Law of Property, sec. 450 (St. Paul: American Law Institute Publishers, 1944), pp. 2901-2902.

[7]Jacob H. Beucher and Robert R. Wright, Land Use Cases and Materials (St. Paul: West Publishing Co., 1969), p. 120.

[8]Ibid.

[9]Ibid., pp. 109-110.

to the easement owner, and not to the land.[10] If the owner of the in gross easement dies the easement expires.

Most easements created today are appurtenant. This increases the value of the estate holding the easement. Since the easement attaches to the land it cannot be terminated unless it is expressly authorized by the easement agreement.

Express negative easements. Since there is no common law or prescriptive easement for solar energy in this country, express negative easements may be used for protecting solar access. Easements have permancy. Being real property interests they can last indefinitely. This would make a solar access easement the strongest existing legal device for protecting access to a solar collector.

An express easement involves the intentional and voluntary bargaining between two or more property owners.[11] It usually involves a monetary purchase of the easement. The easement, in most cases, would be appurtenant to the land. In the case of a solar easement, a written contract with terms of grant, conditions, and compensation can legally protect the agreement. The easement, so recorded, becomes a property right in which damages and compensation may be required if violated.

Light and air easements. Easements for light and air have been unheld in various state courts and are eligible for damages and

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[10] Ibid., p. 111.

[11] Kraemer, p. 40.

compensation if disregarded.[12] But easements for solar energy are new and there may be questions whether they can be considered as offshoots of light and air easements. If the term "solar energy" is used in the text of the easement then the easement holder would gain a solar right.[13] If accepted by the courts, the solar access easement would be a very valuable asset for solar energy development.

Limitations. There are limits to the use of easements for the protection of solar access. Easements, by their nature, are voluntary agreements. If one party refuses to enter into an agreement then no easement is possible. Frequently easements are purchased. The price can range from a minimal sum to a very large amount. If the price of a solar access easement is too expensive, the savings which could be achieved by reduced energy consumption are nullified. Even if the price of the easement is low there still may be problems if more than one neighbor is involved. This can readily occur in high density urban areas.

Easements for solar access are so new that legislative backing may be necessary to insure judicial support in legal disputes. Courts are wary of making judgments on subjects that the legislative branch has not decided, feeling that it is not their place to "legislate." Because of the difference between solar easements and easements for

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[12]Melvin M. Eisenstadt and Albert E. Utton, "Solar Rights and Their Effect on Solar Heating and Cooling," Natural Resource Journal (April 1976), p. 369, and Brzozowski v. Boutinger, 180 Misc. 52, 43 N. Y. S. 2d 57 (1943); Liddick v. City of Council Bluffs 252 Iowa 197, 5 N. W. 2d 361 (1942); and Beckman v. Calif., 64 Cal. App. 2d 487, 149 p. 2d 296 (1944).

[13]Ibid.

light and air, specific statutory recognition from state legislatures may be desirable. If a public policy clause was attached to state solar easement laws, there would be no legal question concerning the validity of solar access easements.

Solar Access Easements

In recognition of possible future judicial difficulties, over thirty states have passed, or have pending, legislation which would support solar energy by the recognition of voluntary solar access easements.[14] Most of these state acts declare that a solar access easement is a property interest which is appurtenant to the land and will continue to run with the land upon transfer of title.[15] Many of the state statutes require that the easement by in writing and recorded. This is to assure the easement owner that his easement can be enforced by injunction or other civil action. The states of Missouri and New Mexico have exceeded other states in their protection of solar rights by declaring that the right to use solar energy is a property right.[16]

Conclusion

There has been a tendency in this country to limit the amount of restrictions placed on the development of private property. This policy is now being questioned because of the need to acquire access to solar

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[14] U. S. Department of Housing and Urban Development, Solar Data Bank Report (Rockville, MD: Solar Heating and Cooling Information Center, 1979).

[15] Ibid.

[16] Section 442.021 of the Missouri Code; New Mexico Statute 291, 1977.

property owners, are now receiving legislative recognition across the nation. This recognition, coupled with judicial support, provides one method of protecting solar access to solar collectors.

Restrictive Covenants

Introduction

Restrictive covenants can be the most important private land use tool for protecting solar access in new communities. Restrictive covenants are mutual promises between land owners to limit or restrict certain land development opportunities.[17] Covenants generally contain statements on the general nature of land use, setbacks from streets, side and back lot boundaries, aesthetics, lot size, building size and height, landscaping and trees, architectural or design control, enforcement provisions, and an amendment procedure to deal with unforseen circumstances.[18]

The covenant is often created by the developer at the time the subdivision or development is approved by a local government. The restrictions are written into property deeds which a buyer should be aware of. If the restrictions are written in clear and precise language the covenant can be better defended if brought to court.

Covenants are not useful unless they are observed and enforced. Developers, property owners, or home owner associations may be allowed to enforce the covenant. These groups or the developer may delegate power to an architectural review board to oversee community development. The review board may also be allowed to make adjustments in the

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[17] Beuscher and Wright, p. 129.

[18] Ibid., p. 173.

community plan when changes are considered necessary.

Solar Covenants

Property owners wishing to promote solar energy use may create covenants which protect solar access corridors. Restrictions on building height and location, lot size, orientation of streets, vegetation and trees, and structures that may interfere with solar access, can be placed in deeds and clearly defined. If the community is in the design stage a well planned solar development can be created. Streets, lots, and buildings can be sited to take full advantage of the sun. If designed with the local environment and climate in mind a very pleasing and energy efficient community can be formed.

Limitations

Restrictive covenants designed to protect solar energy systems can have limitations. Creating them in existing neighborhoods can be difficult. In new developments enforcement may be a problem. The home owners or review body must take action if a violation occurs. If violations are not curbed the purpose of the covenant is thwarted.

Even if suit is brought against an offender, court action may be very time consuming and costly.[19] Also the decision of the court may be unfavorable. This would be the case if an injunction is denied. In some cases only money damages may be awarded.[20] This type of decision can void the intention of the covenant.

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[19]Kraemer, p. 62.

[20]Charles M. Haar, Land-Use Planning (Boston: Little, Brown and Company, 1971), p. 637.

Existing covenants in older subdivisions may also hinder solar energy development. Restrictive covenants have been used for years to protect aesthetics and property values in subdivisions. Many communities have restrictions on building height or additions that may be considered unsightly. These restrictions may prevent people from adding an active or passive solar system to their home.

Some of these older covenants can restrict tree cutting or trimming. This may prevent proper siting of solar collectors. Changes in the covenant to make new energy systems acceptable may be difficult to obtian if opposition emerges in the community. Apathy can be another stumbling block. A covenant cannot be changed unless a majority of the homeowners agree to a modification. There have even been cases of an architectural control board refusing to allow the construction of a solar collector.

Kraye v. Old Orchard Association[21] involved the refusal of an architectural review board to allow a resident to install a solar collector on his home. The claim by the board was that the collector was not aesthetically pleasing and thus violated the covenant of the community. The California court stated that alternative energy development was a stated policy of the state[22] and declared the covenant invalid and unenforceable.

This California law and subsequent case, as well as a similar

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[21]Kraye v. Old Orchard Association, No. C209453 (Superior Court Court of California, 1978).

[22]Chapter 1154, Laws of 1978.

law in Colordao,[23] has given notice that solar energy development is more important than aesthetics. Oregon has declared that any private restriction on a solar energy device is unenforceable.[24] However, in other states, no such stated public policy exists. The courts in these states can only make rulings in cases like Kraye according to the existing laws of their respective states. In some areas this can limit the growth of solar energy use.

Conclusion

Easements and restrictive covenants are useful private agreements which can aid in the protection and development of solar energy. Easements can help to solve access problems in developed areas. Restrictive covenants may be best suited in new residential developments. Both of these private land use agreements would benefit by state laws favoring the development of solar energy. Public laws protecting solar access can bolster these private agreements. A solar zoning law would eliminate the need of seeking easements from each neighbor in an urban area and can make it easier for people to build solar collectors.

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[23]Chapter 358, Laws of 1979.

[24]Chapter 671, Laws of 1979.

CHAPTER V

PUBLIC METHODS FOR PROTECTING SOLAR ACCESS

Introduction

Easements and restrictive covenants are two private forms of legal mechanisms that can be used to protect solar access. However, easements may be difficult to obtain and enforce while restrictive covenants seem more suitable for new residential developments. If solar energy use continues to grow, these private mechanisms may prove inadequate in meeting an escalating demand for solar access protection. If this happens some public form of land use regulation may become necessary. A solar zoning ordinance may meet this need.

Zoning Defined

Zoning is an exercise of the police power in which a municipality is divided into districts for the purpose of regulating the use and development of land.[1] Zoning also regulates the height, setback, frontage and bulk of buildings, lot size, and population density.[2] As a part of the police power, which a state legislature can delegate to local political units, zoning is used to promote the community welfare by protecting public health, safety, and general welfare. It is through these regulations that zoning helps to implement municipal comprehensive

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[1]Beuscher and Wright, p. 25.

[2]William I. Goodman, ed., Principles and Practice of Urban Planning (Washington, D. C.: International City Manager's Association, 1968), p. 403.

plans. A municipality may not need a comprehensive plan to zone but in most cases a plan helps to justify comprehensive zoning as complying with legislative policy.[3]

Planning and Zoning

Planning and zoning are closely associated but they do not cover the same municipal functions. While planning may include zoning the opposite is not true. Zoning is concerned with the regulation and use of property. Planning is a continually changing process which endeavors to promote the systematic and orderly development of a community. Planning goals can be found within a comprehensive plan which deals with the public welfare as a whole and consequently covers a much larger spectrum than zoning.

The Comprehensive Plan

Many states require that zoning and subdivision regulations be in accordance with a comprehensive plan. A comprehensive plan is a document which represents long range general policies for the physical development of the community. The plan is customarily adopted by resolution. Since it is not a piece of legislation it has no power to regulate private property. Zoning and subdivision regulations, which are statutes, implement the policies set forth in the land use plan. These policies, in turn, help to secure judicial support for zoning and subdivision controls.

The comprehensive plan attempts to prepare for municipal

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[3]Emmet Yokely, Zoning Law and Practice (Charlottesville, VA: Michie Publishing Co., 1967), p. 123.

developments twenty to thirty years in the future. Solar energy may be an important domestic energy source in the next few decades and if plans exist to accommodate this energy, many future land use difficulties may be avoided. Recognition of solar energy in adopted public policy documents would help to gain support for regulations which would aid in solar access protection.

History of Zoning

Zoning was created primarily because existing laws were unable to protect American cities from undesirable urban development. When America was primarily a rural country, land disputes were settled by judicial case law based on nuisance laws.[4] These laws proved inadequate in meeting the demands of fast growing urban America in the nineteenth century.

With few or no laws regulating building and land use, many social and economic problems grew to dangerous proportions.[5] The courts, ever the protectors of private property rights, could not prevent land values from decaying due to the mixing of incompatible land uses. Buildings became massive and were constructed very near lot lines which reduced the amount of light and air available in the cities. This crowding helped to create serious social problems. The need for some form of land use regulations became more apparent each year.

Zoning was created to regulate land use and end the haphazard growth patterns of American cities. But the courts were wary of any

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[4]Beuscher and Wright, p. 36.

[5]Ibid.

arbitrary governmental action which infringed upon the individuals' private property rights. Zoning was at first regarded as unconstitutional control of private land by the government.

The importance of private property rights was firmly established in the Bill of Rights. The Fifth amendment states that private property cannot be taken for public use without due process and just compensation. The Fourteenth amendment added that a state cannot deny to any person within its jurisdiction the equal protection of the law. Only when proponents of zoning proved in court that it could meet these constitutional requirements was it accepted.

The benefits of zoning became apparent to some courts, especially when it was able to preserve property values and protect the community welfare. But the acceptance of zoning varied from state to state. Some states made great use of this regulatory device while others remained skeptible. Most major cities welcomed zoning as a necessary device in controlling land use development.

Zoning became widespread when the United States Department of Commerce prepared the Standard State Zoning Enabling Act in 1924.[6] This model zoning enabling legislation formed the basis of zoning statutes in many states. The Act provided a general delegation of power to a community to regulate and control the use of property in zoning districts which were established by ordinance.

The validity of zoning was still questioned by many state courts until 1926 when the United States Supreme Court decided in Euclid v.

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[6]U. S. Department of Commerce, Advisory Committee on City Planning and Zoning, A Standard State Zoning Enabling Act (Washington, D. C.: U. S. Government Printing Office, 1924).

Ambler[7] that a municipality has the right to enact a comprehensive zoning ordinance as part of its police power. After this decision, zoning was accepted on both the legislative and judicial level.

The Law and Zoning

Authority to Zone

The authority to zone comes from a state's constitutional police power and that power can be delegated to cities, towns, and other political subdivisions of the state. Local governments cannot zone unless there is express enabling authority to do so. This authority can come from the state's constitution; a state enabling statue; or a municipal charter.[8]

Zoning becomes law when a local legislative body passes a zoning ordinance. When an old zoning law needs amending, a planning commission prepares the changes and recommends them to the municipal legislative body for enactment and codification. A zoning board of adjustment is commonly given authority by the local government to grant variances and exceptions to the zoning ordinance. The ordinance is enforced by a zoning enforcement officer and the board of adjustment.

Solar Zoning

Zoning for Solar Energy

Light and air has been protected by zoning for many years.

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[7]Village of Euclid v. Ambler Realty Co., 272 U. S. 365, 47 Sup. Ct. 114, 71 L.Ed. 303 (1926).

[8]Beuscher and Wright, p. 352.

However, only the visual and esthetic aspects of sunlight were recognized as being protected. Solar energy, as an important energy source, was not considered. Now that its importance is being noted, can solar access protection be applied to standard zoning laws? Can a zoning ordinance protecting solar access meet the legislative and constitutional requirements necessary for its acceptance by the courts? These questions need to have a positive answer before solar energy can be considered a viable alternative domestic energy source.

Solar access zoning must bear a rational relationship to the health, safety, and general welfare of the public. It must not be arbitrary or discriminatory. When placed in the context of the energy problem, a solar zoning ordinance does seem to be reasonable. If the protection of light and air is valid under the police power then solar energy should be also. The use of a clean, safe, and unlimited energy source, which reduces reliance on scarce and imported energy sources, would seem to meet the public purpose requirement.

The Taking Issue

Zoning laws must comply with the Fifth and Fourteenth amendments which protect citizens from arbitrary governmental action. Private property, or its value, cannot be taken without just compensation or else it is considered a violation of the constitution. If the skyspace over a person's property is to be regulated by a solar zoning ordinance, certain requirements must be met. According to Michaelman[9] taking can

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[9]Michaelman, "Property, Utility, and Fairness: Comments on the Ethical Foundations of 'Just Compensation' Law," 80 Harvard Law Review (1967), p. 1165.

be broken into four separate parts: Physical invasion; diminution of property value; a balancing of social gain against social loss; and private fault against public benefit.

Physical invasion would not apply to a solar zoning ordinance. In the second case a property owner would give up part of his airspace rights and receive a solar right in return or the right to use the airspace over a neighbor's lot. The minor diminution of his property value does not seem to be sufficient enough to constitute a taking. The balancing of social gain against social loss would compare the great advantages of solar development against regulation of private property. The use of a potentially great energy source that can benefit all citizens can be related to present zoning ordinances that protect light and air. The last part of the taking issue, private fault versus public benefit, does not seem to be applicable to solar access rights. The creation of this right should treat everyone equally.

This analysis[10] attempts to show that solar zoning can be used by the states to create solar rights without violating federal and state statutes and may be used under the police power of the state. In fact ten states have already validated the use of zoning for solar access.[11] By accepting solar access zoning as a part of state public policy, judicial acceptance for this type of zoning may be assured.

A Solar Zoning Ordinance

A solar zoning ordinance can take several forms, area-wide or

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[10] Eisenstadt and Utton, p. 384.

[11] U. S. Department of Housing and Urban Development, State Solar Legislation, pp. 1-24.

lot by lot, but each form would regulate airspace over the affected properties. The ordinance would have to be constructed carefully, with strict requirements on height, setback, grade, frontage, and collector placement. These requirements could set the limits and define the area to which solar energy collectors, active or passive, would have legal access. Since lots vary in size according to location a uniform set of standards needs to be established for each district. A low density district would have different siting requirements than an older high density area. When a collector is sited according to the established solar zoning regulations the collector system should be protected from interference.

The zones must be in accordance with a comprehensive plan, meet the general welfare requirement, and have explicit standards. The Planning Commission and Zoning Board should administer the solar zones. The Board, as in traditional zoning, would be delegated authority to judge the possible consequences that a solar zone could have on a desired location and determine if it would be compatible. The Zoning Board would also determine if the solar zoning request meets the purpose and intent of the comprehensive plan.

Possible Forms of Solar Zones

Solar zones can take several different forms. An areawide zone can be established which regulates several districts or, in contrast, a lot by lot permit approach can be taken. The decision on the form would be up to the local government. Factors weighing on the decision will differ from community to community. An areawide zone may work well in a uniform large lot subdivision. The lot by lot approach may

work best in a district of mixed housing. Following is a description of the possible forms of solar zones.

Solar overlay zone. A simple way to create an areawide solar zone would be to lay a solar zone over the established zoning map.[12] The land lying within both zones would have to conform to the standards of both. The overlay zone would create a uniform set of standards over a large number of structures. The exact boundaries of the zone may be hard to determine. Also, many non-conforming uses may be present in a proposed zone. However, in uniform areas this may be the best form of solar zone.

Floating solar zone. An alternative to the comprehensive solar overlay zone is the floating solar zone. This type of zone can be described as "a special use area of undetermined location where the proposed kind, location, size, and form of building must be pre-approved."[13] The solar zone must be first accepted by the local legislative body, which would set the conditions for its implementation.

To obtain a floating zone, an application to the local planning commission must first be made. Then the application will come before the local governing body which has the power to rezone the property and establish its boundaries. The zone must be in accordance with the comprehensive plan.

A floating solar zone would bring flexibility to a standard

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[12]Gail Boyer Hayes, Solar Access Law (Cambridge, MA: Ballinger Publishing Co., 1979), pp. 87-89.

[13]Kraemer, p. 81.

zoning ordinance. If a permit system is set up for floating solar zones, solar access protection may be applied on an individual basis, thus avoiding the cumbersome details an overlay zone may entail.

Contract solar zone. Contract zoning allows changes in the existing zoning use on request but the property owner must agree that the land will be developed according to certain conditions or deed restrictions.[14] The agreement would be with the local legislative body. There have been several questions raised on the legality of contract zoning concerning due process, equal protection, and use of the police power. But if a solar contract zone can be used, a developer can create an area where homes would have solar access protection.

Cluster zoning. Cluster zoning is another zoning technique that provides flexibility by allowing lot size, setbacks, and other restrictions to be changed to allow for more open space.[15] The density requirement would remain the same, but with the relaxation of the other rules innovative site designing can be implemented.

The cluster zone would permit buildings to be grouped so that an efficient solar energy development could be created. This clustering of buildings may be served by one integrated solar collector system. The siting of the collector, storage area, and buildings can be designed to provide easy and efficient collection and energy transfer to living quarters.

The local planning board may be given power to approve this form

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[14]Goodman, ed., p. 422.

[15]Goodman, p. 430.

of zoning. The board would have to determine the suitability of the land for clustering, the effects it would have on neighboring areas, and the zone's compatability with the overall planning goals of the community.

Planned unit development. The planned unit development or P.U.D. presents a useful zoning device which could be very practical for large scale solar developments. This type of development allows prescriptive regulations on lot size and structure siting to be altered to allow greater flexibility in design.[16] Instead of blocks being divided into standard lots and buildings, a proposed large subdivision may be developed into an integrated community. This would be very helpful for communities wishing to use solar energy.

The procedure for creating a solar planned unit development may be similar to the one used for standard P.U.D.'s. A proposal for a solar development would be brought before a local planning board. If the board feels that the proposal meets the standards set for a P.U.D. then the local legislature would have to approve it. Performance rather than prescriptive standards may be more appropriate for a solar oriented P.U.D. The establishment of this type of development would greatly aid the growth of solar communities.

Solar envelope. A solar zone which can be used on a lot by lot basis is the solar envelope.[17] A solar envelope would determine the

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[16] Ibid., p. 480.

[17] Ralph Knowles, "Solar Ethics-Urban Form," paper delivered at the Passive Energy Conference, Philadelphia, PA, 16 March 1978.

shape of a building by creating regulations for the envelopes' measurements. The standards would take into account sun and shadow movement in relation to stationary elements like structures and trees. Consideration would also be given to daily and year round conditions in the area. The envelope would help to protect solar units from shading in heavily built up areas while providing lot by lot protection. It would be a very useful type of zone if used in large tract developments. Figure 7 is an example of a solar envelope. Angles will vary with latitude.

Subdivision Regulations

Subdivision regulations may also be changed to accommodate residential solar energy development. The local subdivision regulations can permit solar considerations to be included in subdivision design. Solar building orientation, lot orientation, and road planning would

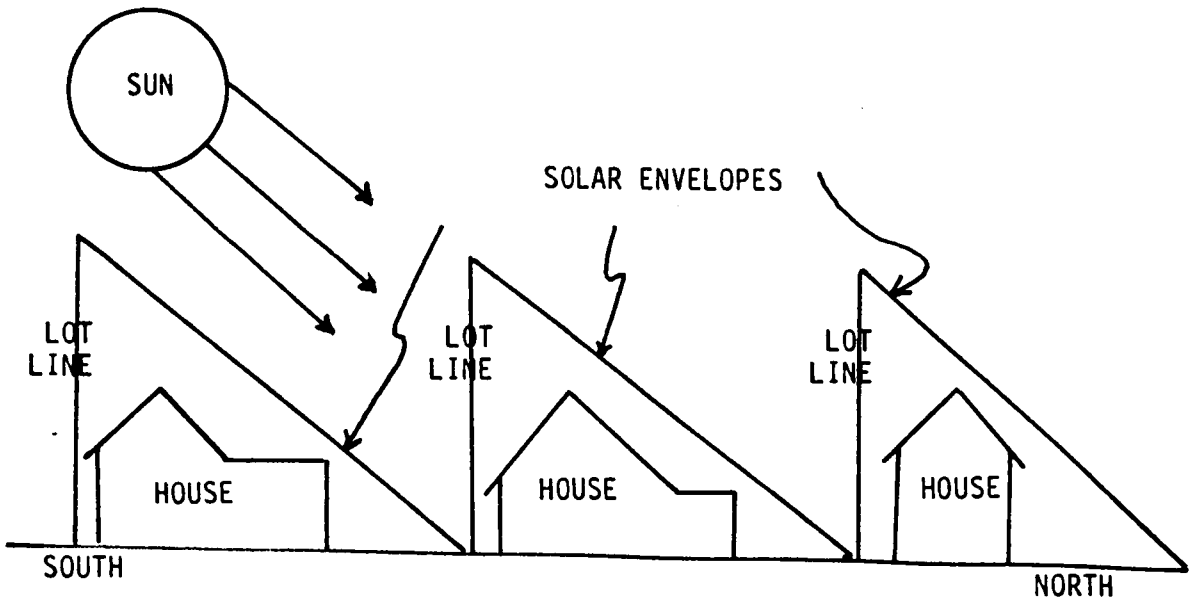


Figure 7. Solar Envelopes.

provide the opportunity to create new subdivisions which can take full advantage of the natural energy sources of the area. Solar energy can be collected on an individual basis, or gathered by one or more centralized collectors, serving many homes.

Solar Rights

An ideal solar zone would satisfy the needs of a solar system while minimally interfering with a neighbor's rights. If a solar zone was created, solar rights would also exist. These rights would become property rights and like easements could be bought, sold, and leased. They would also be subject to zoning and eminent domain.

After a solar zoning law is passed a collector should be protected from interference. But objects casting shadows prior to the ordinance may create difficulties for solar collection. One solution to avoid shadow problems is selective siting. But even if this is done shadows may still cause problems. Solar rights would have to acquire a certain value.

The value of a solar right may be determined by a zoning board by combining prices of fuel used in the surrounding area with the value and efficiency of a solar system. This may be necessary in cases of eminent domain.[18] The cost of oil, gas, and electricity may be compared with the savings realized from the use of a solar energy system. The estimated value would also be important when dealing with non-conforming uses.

Non-conforming uses. The creation of a solar zone, especially

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[18]Kraemer, pp. 147-148.

in densely build up areas, may result in structures or vegetation that do not conform to the new zone. Large buildings may create shading problems within the area. These large buildings, following traditional zoning practice, may be treated as prior non-conforming uses. The structure would not be permitted to expand or be rebuilt once it was removed.

The non-conforming use may be given a time limit before it has to be removed. A zoning board may be given authority to determine the time period or amortization time. This would be done on a case by case basis to conform with existing land use statutes. The time period allowed would be based on investment and a balancing of public gain against private loss. If a tree or some other form of vegetation creates a shading problem, a judgment on its removal or trimming may be left to the zoning board. Since the collector owner would benefit by the action he may be charged with the cost of cutting or trimming. Specific enabling legislation and court action in each state will help to clarify what constitutes a non-conforming use and the amoritization process.[19]

Variance to a solar zone. Variances, as in traditional zoning, can be used to deal with unpredictable changes within a solar zone. Compensation may be required if the variance should interfere with another's solar right. Even if the property owner affected does not own a solar unit, compensation may be necessary. To avoid problems, a

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[19]Jaffe and Erley, p. 110.

governmental body should carefully examine a variance request before it is granted.

Enforcement of a Solar Zone

A good zoning ordinance provides for its enforcement. Many municipalities employ an enforcement officer to provide strict and impartial implementation of the statute. A solar zoning ordinance may require an enforcement officer to have special training in solar energy. This would help to insure that the solar ordinance is justly and properly enforced.

Violations of a zoning ordinance are traditionally treated as a municipal misdemeanor or a public nuisance. Transgressions would result in a fine or imprisonment, or both, although in solar zoning cases an injunction or fine may be sufficient.

The courts tend to allow municipalities to impose penalties if ordinances are violated, as long as the government does not overstep its authority. The manner of enforcement is prescribed by the ordinance and must be adhered to. A private citizen cannot bring a civil suit if the ordinance does not allow him to. It has to be explicitly stated that a private citizen can initiate a public nuisance suit.

Potential Weaknesses of a Solar Zone

A solar zone may have several weaknesses.[20] In an area wide solar zone the problem of non-conforming uses, whether vegetation or structures, may create many difficulties. The changing of an existing

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[20]Robert C. Ellickson, "Alternatives to Zoning: Covenants, Nuisance Rules, and Fines as Land Use Controls," University of Chicago Law Review 40 (1973), pp. 681-702.

zoning ordinance will require a new design which may take time and money a local government may not have. Zoning boards are also unpredictable and may be influenced by special interest groups or politics. A person depending on a solar zoning ordinance to protect access to his collector may be disappointed if a neighbor receives a special exception or variance to the ordinance. Zoning authorities, which may offer resistance to change, may be hard to challenge in court and expensive to appeal. Since zoning is proscriptive in nature and would involve a highly complex bureaucratic machine to administer, a solar zone may be difficult to implement. Litigation may also be complicated if a solar zone is violated.

Trees and Vegetation

Trees and other forms of vegetation may present problems for solar zones. Trees are considered valuable for esthetic and shading reasons. Opposition to their removal may hinder solar energy collection. Since trees are valued objects, some equitable solution to the problem is needed. The value of the vegetation to the owner would have to be balanced against the energy savings a collector owner would obtain if the obstruction was altered.

A solar collector should be carefully sited before it is permanently set up. The siting should make allowances for trees and vegetation to avoid any conflict of interest with neighbors. A knowledge of trees and vegetation, including their growth habits, may become necessary in solar collector siting and site design. With this knowledge a collector can be constructed which would then obtain energy without disrupting the local environment.

In case of disputes a zoning board or other governmental body may have to arbitrate a solution. If a tree should be required to be cut or trimmed the cost would be paid by the beneficiary. Judgments would vary from case to case. A tree may be allowed to shadow part of a collector or one tree of a stand may have to be removed. The local government may have to establish some uniform guides to make judgments. Perhaps the state legislature can issue guidelines that can be followed by local governments.

Eminent Domain

Eminent domain is another governmental power that can be used to protect solar access. But it would be a measure of last resort because of the difficulties involved in using it. Eminent domain is a power of government which can be used to take private property in return for just compensation.[21] It is used when the government feels that the public welfare is at stake. While the police power is used to regulate private property, eminent domain takes private property for the public use. The question is, can solar access be considered a public use where private property can be taken for its protection? This can be a difficult question.

The legislature can decide what is a public use or purpose but the courts make the final decisions concerning specific cases. Eminent domain cannot be used merely to further the public interest. Attempting to use eminent domain to protect solar access is unlikely. Just compensation and procedural requirements dealing with due process would

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[21] Beuscher and Wright, p. 709.

also limit its usefulness for solar access.

Transferable Development Rights

Transferable development rights or T.D.R.'s may be used to create solar access lanes to solar collectors. This device is used in some areas to provide compensation to land owners damanged by land use restrictions. In cases where regulation or taking is hard to define the T.D.R. is sometimes used.[22] Transferable development rights separate the right of land ownership from the right to develop. The development right can be sold and used on other properties.

If a land owner is prevented from using his air space by a public agency for solar access purposes, he can be given a solar T.D.R. This right may be sold to another property owner or to a special public body set up especially for this purpose. The use of this system is unlikely in the near future. The concept of transferable development rights is new and there are many legal and constitutional questions concerning it. To use it for solar access protection at this time is not anticipated.

Prior Appropriation

The law of prior appropriation is a legal device used in arid states to allocate scarce water resources. The law simply states, "first in time, first in right." In other words the first person who uses the resource has priority in its use. Because sunlight is used and not captured or sold, it has been suggested that solar energy rights

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[22]Beuscher and Wright, pp. 739-742.

may be modeled after the prior appropriation doctrine.[23]

New Mexico has passed a law which makes the right to use solar energy a property right. Disputes regarding access rights are to be settled by the rule of prior appropriation.[24] The basic requirements for this rule are: intent to appropriate the solar energy; notice of this intent; compliance with state laws; the actual use of the resource; and its application, in reasonable time, to a beneficial use.

The advantage of using prior appropriation for solar access protection is that in some states people are familiar with this water law. Instead of creating a new law many feel that altering an old law to deal with a new situation is preferable. Having a solar law on the books would eliminate unpredictable judicial decisions and inform potential solar users of their rights. A solar energy user can claim a solar right by simply using the energy. New Mexico's solar right bill seems to make solar energy use easy without having to turn to nuisance suits or easements.

The disadvantages of this doctrine are many and seem to outweigh the benefits. The New Mexico law has been criticized as being unclear as to what constitutes prior appropriation and beneficial use.[25] They need to be clearly defined as to when the right is acquired and how it is to be used. Without clarification a development rush may result which can lead to unplanned urban development.

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[23]Mary D. White, "The Allocation of Sunlight: Solar Rights and the Prior Appropriation Doctrine," University of Colorado Law Review 47 (1976), pp. 421-447.

[24]1977 New Mexico Laws, Chapter 169.

[25]Hayes, p. 190.

Prior appropriation can work in areas with little shadow problems but would be difficult to implement in areas of heavy development or vegetation. The use of the doctrine can also hurt the use of passive solar systems. Because of the difficulties New Mexico is having with its law, the widespread use of this law is not advised.

Conclusion

Zoning, subdivision regulations, eminent domain, transferable development rights, and the law of prior appropriation are public devices that may be used to protect solar access. Many states are currently using zoning and subdivision regulations to protect solar access. Their use helps to supplement and strengthen private agreements like easements and restrictive covenants. Eminent domain and transferable development rights seem to have many legal and constitutional problems which will limit their use. The same can be said for New Mexico's solar rights act. A combination of private agreements and zoning seem to be the most effective method of protecting solar access.

CHAPTER VI

NUISANCE LAW

Introduction

Public and private nuisance laws have been used for many years to control land development and protect private property rights. Long before zoning and comprehensive plans were used in America private citizen land use questions were settled in the courts.[1] Only when private court action proved incapable of dealing with the many social, economic, and health problems accompanying urban growth in the last century did statutory land use controls become necessary.

Nuisance laws are now used to supplement public and private land used devices. They may also be used to protect solar access.[2] But using nuisance laws for this purpose may be difficult because of their complex nature.[3] Only if there are no other legal devices protecting solar access are people likely to use the courts.

A nuisance arises when something or someone on one property (a) interferes substantially with the use, enjoyment, or value of anothers' property, (b) interferes with life, health, or safety, (c) obstructs

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[1] Beuscher and Wright, p. 170.

[2] Hayes, p. 170.

[3] William L. Prosser, Law of Torts, 4th ed. (St. Paul: West Publishing Co., 1971), ch. 86, p. 571.

free passage or use of public property or rights.[4] A nuisance may exist as a result of an intentional act; negligence; or absolute liability.[5]

Private Nuisance

A private nuisance is the interference with an individual's right to use or enjoy his or her land, aside from direct physical invasion.[6] In a private nuisance suit a court must find a balance between the right of a property owner to use his land as he wishes and his social duty not to use the land to injure a neighbor.[7] There must be an intentional and unreasonable invasion which creates substantial harm. In nuisance law the harm created by the nuisance is given more weight than any benefits to the property owner creating the nuisance.

The courts base private nuisance decisions on the extent of harm done; the social value placed on the land interferred with; and the burden on the person harmed. Since there is no universal standard of social value or need, the courts must rely on existing legislation and public policy for their decisions. Injunctions, abatements, or damages are common remedies in private nuisance cases.

The courts have had a policy of refusing to recognize the

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[4]Peter W. Schroth and Zygmunt J. B. Plater, Nature, Law and Society V (Knoxville, TN: By the Authors, 1974), p. 4.01.

[5]Beuscher and Wright, p. 39.

[6]Ibid., p. 37.

[7]John Eddie Williams, Jr., "The Dawning of Solar Law," Baylor Law Review, no. 29, 1977, p. 1021.

obstruction of light and air as a private nuisance.[8] The refusal has been based on the policy, which rejected the English law of ancient lights, that land development is more important than access to sunlight.[9] The Fontainebleau hotel case was the standard by which the common law right to light was rejected. Only in special cases of spite or malice has a private nuisance been upheld for light.[10]

Since the courts can only make decisions based on existing laws and policy, nuisance laws are not widely used to protect solar access. This is changing because of the need to use new energy sources. State legislatures are now considering making solar energy development a policy of the government. California has already passed a nuisance law protecting solar energy systems.[11] Colorado, Delaware, Minnesota, and New Mexico have also contemplated passing solar nuisance laws.[12] This change in state policy can have an important influence on how courts rule on solar access questions in the future.

Private nuisance laws cannot be used by the courts to protect solar access without specific state legislation. This is not the case in public nuisance questions. In a private nuisance case a court can be flexible in their choice of remedies. Instead of damages being a reward a court can order an injunction.

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[8]Fontainebleau Hotel Corp. v. Forty-Five Twenty-Five, Inc.

[9]Franklin Gevurtz, "Obstruction of Sunlight as a Private Nuisance," California Law Review, 65 (January 1977): pp. 94-119.

[10]Prosser, p. 598.

[11]Chapter 1366, Laws of 1978.

[12]Hayes, pp. 171-172.

The major difficulty with using private nuisance laws for solar access protection is meeting the legal requirements that interference with the use and enjoyment of property must be substantial. The courts interpret substantial interference by the values of the common property owner, not of a few who are "hypersensitive."[13] Courts have not yet been called upon to decide if a solar collector owner is hypersensitive compared to the ordinary property owner.

One solution to this question is to have a legislative body pass legislation declaring that interference with a solar collector is a public nuisance.

Public Nuisance

A public nuisance can be described as ". . .the doing of or the failure to do something that injuriously affects the safety, health, or morals of the public or causes hurt, inconvenience, or damage to the public generally."[14] As the desires and needs of society change, so should the laws of the land. A state can declare solar collector shading a public nuisance. The courts would have to abide by this legislative intent.

The traditional remedies for a public nuisance are abatement, injunction, or damages. In order to obtain an injunction, a solar collector owner must show to the courts that his need for solar access is more important than the object casting the shadow. This can be hard to prove if the annoyance is a building. If the obstruction is of

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[13]Prosser, p. 578.

[14]Kraemer, p. 117.

lesser value, such as some form of vegetation, the injunction may be granted. Otherwise only damages may be granted. Remedies can vary according to the case and the jurisdiction.

Using public nuisance statutes to protect solar energy systems can be difficult. In each case a lawsuit is needed to prove a nuisance exists. A plaintiff has to prove that he had standing to sue, which means he has to have a collector that is being interferred with. A private citizen may not be allowed to use public nuisance laws unless he can do so in the public's interest. Also, like private nuisance, public nuisance laws can be very complex.

Conclusion

Nuisance laws may not be widely used tools for solar access protection. Public and private nuisance laws are complex and can be unpredictable if used. Public nuisances, in many cases, can only be initiated in court by a public official. Proving a private nuisance is substantial may be hard to do in states with no solar nuisance laws. To date only California has passed such legislation.

Nuisance laws may be used to protect solar access if no other methods are available. They may also be used to refine existing solar laws. But nuisance laws can create more problems than they solve and this may limit their use.

CHAPTER VII

STATE SOLAR ACCESS LEGISLATION

Introduction

This chapter analyzes solar access legislation in the United States. From a literature search and the use of a questionnaire a description of solar energy use, policy, and legislation in the county is developed. Forty states have solar tax incentives; twelve states offer grants and loans for solar energy use; and twelve have set standards and regulations for solar construction.[1] Twenty four states have passed land use regulations providing for solar access.

Questionnaire

Introduction

The questionnaire was used to investigate state policy toward solar energy use and solar access in particular. (See Appendix A.) The questionnaire was sent to state energy officials who were felt to be the most competent respondents. The questionnaire attempted to gain a current evaluation of solar energy development, solar access legislation, and state solar energy policy. The results were to be evaluated as to what states were concerned with solar energy use and why. The questionnaire sought to determine the rate of solar energy growth in

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[1] U. S. Department of Housing and Urban Development, State Solar Legislation, pp. 1-23.

the future and the states and areas most interested in solar energy use. In states that have solar legislation the survey tried to discover the types and kinds. The questions used terms that professionals concerned with state energy legislation should be familiar. Most questions dealt with covenants, easements, and other land use control devices.

Questionnaire Design

The questionnaire contained 23 multiple choice and four open-ended questions. All but one of the multiple choice questions asked for a yes or no answer. The one question with three possible answers asked for a choice of large, varying, or minor. The question asked for a rating of solar energy's role in their states' present energy policy. One of the four open-ended questions asked which state government agency promotes the use of solar energy. The other questions asked about future solar access bills, solar energy development, and state policy toward solar energy.

The first three multiple choice questions asked about solar energy use in the respondent's state. Questions five through nine were generally concerned with restrictions on solar energy development. Questions ten through fourteen asked about state delegation of power to local governments for solar energy development. Fifteen through nineteen concerned solar easements. The last six multiple choice questions dealt with zoning, prior appropriation, and nuisance law.

Questionnaire Results

Fifty questionnaires were sent to state energy offices, one to each. After twenty-seven questionnaires were returned a second

questionnaire was sent to each state energy office that had not yet responded. A total of forty-one questionnaires were finally returned.[2] This was a 82 percent response rate. The heading on the questionnaire left spaces for the respondent to fill in the names of his state, position, and name if he wished to identify himself. Of the forty-one responses, thirty-three respondents gave their name and thirty-two gave their positions. From this information it was possible to determine that nineteen were directly involved with solar energy; five were energy specialists; two were planners; two were program specialists; two were information specialists; one was a technical expert; and one was a law clerk. These results indicate that most questionnaires reached the people they were intended to reach.

Questionnaire responses.* The first question asked if the respondent thought that solar energy will have an important role in their state's energy future. All of the respondents answered yes to this question. The second question asked if solar energy played a current role in their state's energy policy. Only Michigan and Illinois answered no. This would seem to indicate that solar energy development is considered important across the country.

The third question tried to separate the states into three categories, according to the amount of interest shown in solar energy development. The question asked the respondents to rate the role solar

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[2]Alaska, Arizona, Delaware, Kansas, Nebraska, New Mexico, North Carolina, Pennsylvania, and South Carolina did not return the questionnaire.

*The reader will find it useful to use the Appendices A and B in conjunction with this section.

energy played in their state's energy policy. Eight respondents marked large; twenty-two varying; and nine minor. Massachusetts, Connecticut, Missouri, Georgia, Idaho, Nevada, Montana, and California were states that showed a large interest in solar energy. All of these states, except for California, are poor in natural energy resources and have to import energy supplies for residential heating purposes. This would account for their interest in alternative energy sources like solar energy.

The states which place a minor role on solar energy development all have large deposits of other energy sources within their borders. Texas, Oklahoma, Louisiana, Wyoming, and Utah are energy exporters. Petroleum and natural gas production are important in these states. West Virginia is a coal state and, to a lesser degree, Alabama. Alabama and Mississippi also have deposits of natural gas and petroleum. Maryland has some coal deposits in the west. All of the other states, to a greater or lesser degree, are concerned with energy problems.

Questions five through nine dealt with restrictions on solar energy development. Question five asked if existing solar ordinances hindered the development of solar energy. Nineteen state respondents answered yes; eighteen no; and four did not respond. Question six asked if restrictions, based on aesthetic considerations, were prohibited by state law from interferring with solar energy devices. Thirty-five said no and two did not respond to the question. The Colorado, California, Maryland, and Alabama respondents said that their states have laws which would prohibit restrictive covenants from preventing the construction of a solar energy device. California and Colorado do have state laws stating this but there is no supporting

evidence for Alabama and Maryland. This would seem to indicate that a person wishing to build a solar collector in a residential area governed by restrictive covenants may be prohibited from doing so in most states.

The next question asked if local or state bodies considered proposals which could alter existing laws restricting solar devices. Twenty-nine said yes; ten no; and two did not respond. In response to the question of whether state laws existed that authorized the removal of restrictive covenants detrimental to solar devices thirty-one said no and ten said yes. These ten are Oregon, Vermont, Tennessee, New Jersey, Connecticut, Minnesota, Montana, California, Maryland, and Colorado. From the literature review only Oregon, California, Vermont, and Colorado can be verified. Because solar energy development is not far advanced, covenants are not causing a major legal problem at this time. If more people begin to use solar collectors there is a good possibility that a conflict of interest with aesthetic restrictive covenants may result. The last question in this series dealt with covenants protecting solar energy devices. This was not a good question because, in most states, legislative support is not needed for this type of private agreement. The question was responded to with eighteen yes answers and twenty-three no.

Responses to questions five through nine indicated that about half of the respondents were aware of land use devices that hindered the development of solar energy in their states. Only four states were limiting restrictive covenants which prohibited solar units. However, 70 percent of the respondents felt that something was being done to change existing laws that restrict solar development. Since there is recognition of a problem in these states, there may be future

legislation in these states addressing the question. If these energy departments have any influence upon their state legislatures then future laws protecting solar energy devices may be anticipated.

Questions ten through fourteen dealt with state delegation of power to local governments for the purpose of protecting solar access. Question ten asked if the state authorized local governments to consider solar access problems when approving land use regulations, including the comprehensive plan. Sixteen states said yes, twenty-two said no, and three did not respond. Question eleven asked if state enabling legislation allowed local governments to enact solar zoning ordinances. Twenty states responded yes, twenty no, and one did not respond. The next question asked if solar access could be considered in subdivision regulations. The results were twenty-four yes; fifteen no; and three no answers. Question thirteen meant to ask if restrictive covenants, height restrictions, and setback requirements were included in the subdivision regulations. Fifteen of the twenty-four said yes and five said no. The question was not appropriate because subdivision regulations are created by local governments which may differ from town to town. The question should have been made clearer. The last question in this series dealt with whether state laws allow the amending of subdivision regulations for solar orientation standards. The answers were ten yes; twenty-seven no; and four did not respond.

Maine, Vermont, Connecticut, Tennessee, Iowa, Oregon, Nevada, Colorado, Washington, Minnesota, Illinois, Indiana, Louisiana, North Dakota, South Dakota, and California are states that allow local governments to consider solar access questions in their comprehensive plans. All of the above states, except for North Dakota, allow their local

governments to enact solar zoning ordinances. Louisiana, Virginia, Massachusetts, and New York also allow solar zoning. This indicates that in about forty percent of the states local governments can promote the use of solar energy. Although this does not mean that there are solar oriented communities in these states, it does mean that solar laws have state approval and support if challenged in the courts. The other states have not passed specific enabling legislation allowing their local governments to create solar land use controls. This may be because the solar question is not important or that specific state legislation is not necessary.

The states that allow planning boards to create or amend subdivision regulations for solar access are Massachusetts, Vermont, Tennessee, Connecticut, Ohio, Minnesota, New Hampshire, Kentucky, California, and South Dakota. Twenty-four states in all allow local governments to include solar access requirements in their subdivision regulations.

The results from this series of questions were mixed. Many states have strong "home rule" governments which do not need to have state authorization to alter their laws. This is especially true in New England and the midwestern states. Thus, even though no state legislation exists allowing local governments to alter their statutes for solar purposes, there are no state laws forbidding it. The state survey section in Appendix D will help to clear up this question of local "home rule" powers.

Questions fifteen through nineteen deal with solar easements. In many states legislative support for solar easements are needed in case they are challenged in court. Question fifteen asked if the state

recognized easements, covenants, or other private devices used for protecting solar access. Twenty-seven states yes and fourteen no. Twenty states have specific state legislation recognizing solar easements. Many of the other states, although they do not specifically recognize solar easements, treat them like any other easement. The following question asked if their state courts had validated these solar easements. Only Oregon and Maine indicated that these easements have been upheld in the courts. The other states have not had any cases challending these type of easements.

Question seventeen asked if the solar access easements were appurtenant to the land. Nineteen yes; two no; and six no responses were recorded for this question. Question eighteen asked if there were authorized remedies for interference with these easements. The answers were fourteen yes; nine no; and four did not respond. The last question in this group asked if the easement could be termined upon expiration or release. Fifteen answered yes; four no; and eight did not respond.

In Oregon, Virginia, Tennessee, Ohio, Montana, California, Utah, and New York solar easements are appurtenant to the land, but there are remedies for interference with them and they can be terminated upon expiration or release. In Florida and North Dakota the easement does not have to be appurtenant to the land. The four states that do not allow easements to be terminated are Idaho, Missouri, Rhode Island, and North Dakota. In many states where solar easements are recognized they may be interferred with and can be terminated. This suggests that if a solar easement is created it should be specific and clear in its language in order to prevent it from being overturned in court.

Question twenty asked if any state law prohibited the granting

of special exceptions or variances to local zoning ordinances that could interfere with an existing solar collector. Six answered yes; thirty no; and five did not respond. Iowa, Virginia, Vermont, Tennessee, Rhode Island, and Arkansas responded yes to this question. There is no literature supporting the answers of these six respondents. Tennessee has a solar zoning law that allows an existing zoning ordinance to be altered for solar access purposes, but not one prohibiting variances that would interfere with an existing collector. Local zoning boards in these six states, and others, might be influenced in their decisions if there existed a state policy favoring solar energy use.

Question twenty-one was based on water rights law, or the law of prior appropriation. The question asked if solar rights can be based on this law. New Mexico, which does base its solar rights law on prior appropriation, did not respond to the questionnaire. The three states that the questionnaire revealed can base solar laws on prior appropriation are Nevada, Arkansas, and California.

The next question asked if nuisance laws can be used to protect solar access. The respondents who checked the yes column were from Vermont, Colorado, Minnesota, Wyoming, Arkansas, Kentucky, and California. Sixteen no answers were also noted. There have been no known test cases to see if nuisance laws can be a viable method of protecting solar access. Question twenty-three asked if shade control ordinances could be used to protect access to solar collectors. Indiana has a shade control law and along with California responded yes to the question. Thirty-five respondents said no and four did not answer the question.

The last question asked if air pollution laws can be used as a

base for a nuisance action. Since a test case is needed before such a question can be answered, few responses were expected. California's respondent felt that an air pollution law may be used but no court tests on the matter have been heard. All of the other respondents knew of no test cases in their states.

Question five asked for the name and the state government agency that promotes solar energy use. All but North Dakota and Tennessee answered this question. Tennessee does have the Tennessee Energy Authority which is supportive of solar energy use. The list of state government agencies is listed in Appendix C.

The last three open-ended questions of the survey asked for personal views on future solar access bills, solar energy development, and state policy toward solar energy. The responses to these questions helped to form the state by state analysis found in Appendix D.

Conclusions from the Questionnaire

Using the questionnaire results, one can now examine solar legislation by regions. In the south, which here will include Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, Oklahoma, Tennessee, Texas, Virginia, and West Virginia, solar access or solar energy legislation is not prevasive. Alabama, Arkansas, Mississippi, West Virginia, and Oklahoma have no solar legislation. Georgia, Florida, and Tennessee have solar easement laws and Kentucky and Texas may also use them, but without specific legislative support. Virginia permits solar land use regulations. Although Louisiana has no specific state solar legislation, the respondent said that local governments can enact their own. Overall there seems to be little interest in solar energy

development in this part of the country at this time. This may be because of climate, natural energy abundance, or disinterest in general.

New England is an area composed of Massachusetts, Maine, Vermont, New Hampshire, Rhode Island, and Connecticut. This area is home to the independent "home rule" tradition in government. Most legislation is left up to the town with little state interference. Nonetheless several states have passed solar legislation. Maine has state laws concerning solar zoning and subdivisions and Connecticut has a solar zoning law. Vermont permits solar zoning and land use planning as well as prohibiting anti-solar covenants. Massachusetts is anticipating action at the state level but New Hampshire is not. This area, which has cold winters and few local energy resources, is looking carefully at alternative energy sources.

The Middle Atlantic states of New Jersey, New York, and Maryland also have little local energy sources. All three of these states have solar easement laws. New York also has a solar zoning law. These states are heavily populated and industrialized, with cold winters. Because most of the domestic heating sources have to be imported additional solar legislation is anticipated in the future.

The Midwest is composed of Illinois, Indiana, Iowa, Michigan, Minnesota, Missouri, Ohio, and Wisconsin. This area also has fairly cool winters. Illinois, Indiana, Ohio, and Michigan have local supplies of coal and fuel oil. Iowa, Minnesota, Missouri, and Wisconsin do not. Iowa, Minnesota, and Ohio have passed solar easement laws and Missouri has a solar rights statute. Minnesota also has a solar zoning law. The other states have not passed any solar legislation. These states, like New England, have strong home rule powers. It can be seen that

the states most interested in solar energy are the states with little natural energy resources.

The western states of Idaho, North Dakota, Montana, Nevada, Utah, and Wyoming vary in their climates and supplies of natural fossil fuel energy. Wyoming and Utah are energy self-sufficient states. The others are not. Idaho, Montana, North Dakota, Nevada, and Utah have solar easement laws. The trend is apparent here also of energy poor states being more aware of the potential of solar energy. Since these states can be considered underpopulated, with few large cities, solar laws may take longer to be implemented here. The sparce population and the relative lack of trees and vegetation in the region may reduce the need for strong solar legislation immediately.

The west coast states of Oregon, California, and Washington have passed a great amount of solar legislation. Oregon, California, and Washington have land use planning, zoning, easement, and anti-solar covenant laws. California also has a solar nuisance law and a statute allowing cities and counties to require the dedication of solar easements in land use planning. These states generally have advanced laws concerning the environment and the legislatures are aware of energy problems. This attitude may be seen by the amount of solar legislation passed in the last few years.

The questionnaire revealed that state legislation across the country is basically concerned with creating and recording private easements and covenants. Many states do not have to pass laws protecting solar access because local governments have the power to do this on their own. State recognition of solar easements helps enforcement, recording, and in some cases, sets standards. Although solar energy

use is considered important for the future, its present impact is small. States may become more involved as solar energy develops in technology and use and local governments begin asking for guides.

CHAPTER VIII

SUMMARY AND GENERAL CONCLUSIONS

State Solar Access Legislation

This thesis surveyed energy use, solar energy, and solar access legislation within the United States. The energy crisis has compelled many states to pass solar energy legislation to aid in the use and development of an alternative residential energy source. Many bills deal with land use laws and concern easements, covenants, zoning, land use planning, and other land use controls.

This country is in the midst of an energy crisis partly because of a dependence on limited sources of fossil fuels and their inefficient use. The country would be aided by conservation and the use of renewable energy sources. The development of solar energy is one of these methods.

Solar energy is the most important source of energy known to man, but it has not been developed to any large extent. Many solar collector systems exist today which can be used for residential heating and cooling. Active, passive, and hybrid systems are presently being used across the United States. But these solar collectors need to have clear access to the sun's rays. This can raise legal problems because solar radiation may have to cross a neighbor's property before reaching a solar collector.

Easements and restrictive covenants are private legal agreements that can be used to protect access to solar collectors. Easements can

be used anywhere but would be most helpful in heavily built up areas. Restrictive covenants can be very useful to protect solar access in new developments. State legislative support would aid these private land use devices in case of court challenges.

Zoning, subdivision regulations, eminent domain, transferable development rights, and the law of prior appropriation are public devices that may be used to protect solar access. Several states permit local governments to use zoning, subdivision regulations, and land use planning to aid in solar energy use. Solar access can be given strong protection by a combination of solar easements and solar zoning. Eminent domain, transferable development rights, the law of prior appropriation, and nuisance laws have too many legal problems to be useful for solar access purposes in the near future.

The questionnaire revealed that all of the respondents who were concerned with solar energy use felt that solar energy will have an important role in their state's energy future. But the states vary in their approaches toward solar access.

The states that are most affected by the energy crisis, those that have to import their energy, are generally leaders in creating solar access legislation. In New England states, which have few natural energy resources, the state legislatures generally favor solar energy use. Local governments have considerable powers in these states by which they can promote solar energy use. Nonetheless, many states have passed laws recognizing the need to protect solar access by passing laws recognizing easements, zoning, subdivision controls, land use planning, and the removal of anti-solar covenants.

In the Middle Atlantic states only Delaware, Pennsylvania, and

West Virginia have not passed solar access laws. Pennsylvania and West Virginia are states rich in energy resources, like coal, and as a result seem to be unconcerned with alternative energy sources.

Among the south Atlantic states Virginia, Georgia, and Florida have passed solar easement or land use laws. The mild climate of this region may reduce the concern for solar energy development in the other states.

In the deep south, where crude oil and natural gas are plentiful, very few solar bills have been passed. Again, because of the climate and the abundance of natural energy resources, there seems to be little concern for alternative energy.

Most states in the midwest have strong home rule powers which allow local governments to pass solar energy statutes on their own authority. Minnesota and Ohio have passed state laws allowing solar zoning and easements. If local governments do not respond to a demand for solar laws, the states in this region may pass state legislation.

Most of the western and mountain states have passed laws recognizing solar easements. Colorado also allows local governments to consider solar access in planning and zoning. New Mexico considers the right to use solar energy as a property right and Arizona authorizes local governments to regulate solar access. Even Texas, an energy rich state, is considering the passage of solar access laws in the near future.

The west coast states have the most impressive solar access laws. Oregon, Washington, and California provide local governments the authority to consider solar access in comprehensive planning, zoning, and subdivision regulations. Solar easements are recognized and

covenants that may interfere with solar collectors are prohibited in Oregon and California.

In the last few years a tremendous amount of solar access legislation has been passed throughout the states. Most of it concerns private easements. However, many states are now allowing local governments to change their zoning and subdivision regulations to accommodate solar access. This may have an important influence on land development in the future. As a result, land use planning will have to change to meet changing circumstances.

Future Research

This thesis has dealt with the energy crisis, solar energy, and solar access legislation. Major emphasis has been placed on private agreements like easements, and public land use devices, like zoning, which can be used to protect solar access.

At the present time there is not enough information to determine if these public and private methods of protecting solar access are effective. This may be determined in the future if solar energy use expands to the point where land use conflicts arise out of its utilization. In the next few decades enough information may be available to make an accurate assessment.

A future research project should look at the development of new forms of solar zoning and land use controls, if they are needed. This can be done on the local, regional, or state level to determine if any similar patterns exist throughout the nation that are considered the most effective means of protecting solar access. The changes that solar energy use can have on zoning may change urban development patterns

in the future. This would have a major effect on urban planning methods.

State solar access legislation should be researched in the future to check any changes in state policies across the nation. The different state energy offices can again be contacted to determine if changes have or have not occurred in their state and why. Future respondents may have a clearer understanding of solar energy use and of solar access protection.

Research is also needed to see how local governments are approaching the solar access question. State legislation traditionally acts as a guide to local governments, but it is up to local legislatures to implement state legislation. Another area for future research concerns private solar access agreements. Since private contracts are very strong legal devices for the protection of solar access, it would be interesting to see if they are being utilized.

The study of solar access legislation is still a very new and growing area of research. As the years go by a more accurate assessment of solar energy use and its impact on state and local land use regulation can be made. The future will determine if solar energy will have a major impact on land use patterns in the United States.

Conclusion

The continued development of solar energy in this country can bring about a decentralized form of home heating not dependent on utility companies or affected by changing costs. This stability may create more interest in solar energy use. People can build single solar homes or develop solar communities where several homes use one solar

collector. Many new forms of private agreements between homeowners can arise out of solar energy development. This development can be planned for and aided by solar planning.

Land use planning, and controls to guide future growth, are now beginning to include solar energy considerations. More states each year are passing laws allowing local governments to consider solar energy development. Many of these laws deal with solar access. If this development continues a change may occur in the existing patterns of land development and urban building. Public and private land use controls will have to adjust. Zoning for solar energy use is one that is legal now in many states. These changes must be prepared for by urban planners.

The next few decades may see new construction and urban development grow in accordance with the natural environment and climate. This will become very important for a clean, healthy, and aesthetically pleasing living environment using an energy source which is not in danger of being cut off or overpriced in the foreseeable future.

Solar energy can be used on an individual lot by lot basis or several homes may use one centrally located collector which would allow homes to be designed in a cluster form. Many new and innovative designs can be developed using solar energy. Existing urban developments may use vacant land in the future as a major collector site. This would avoid the problem of obtaining solar access for each individual building. The creation of an isolated gain collector system aided by mechanical devices may be necessary in the future. The development of such a system will take time and cooperation between many neighbors. This thesis has dealt with laws that can be used in the near future to protect solar access to individual structures. Since property owners are

jealous of their land rights, and cooperation between neighbors is not always easy, the first steps in solar energy development will probably occur on an individual basis.

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APPENDICES

APPENDIX A

Solar Access Legislation Questionnaire

STATE_____

POSITION_____

NAME_____ (For Study Results Only)

Yes 41 No 0
No response 0

1. Do you think solar energy will have an important role in your state's energy future?

Yes 39 No 2
No response 0

2. Does solar energy play a role in your state's present energy policy?

Large 8
Varying 22
Minor 9

3. How would you rate this role?

4. What state government agency promotes the use of solar energy? (Answers in Appendix C)

Yes 19 No 18
No response 4

5. Do present zoning ordinances, restrictive covenants, or building codes hinder the development of solar energy?

Yes 4 No 35
No response 2

6. Is there a state law prohibiting any unreasonable restrictions on real estate, based on aesthetic considerations, that effectively prohibit or restrict the installation or use of a solar energy device?

Yes 29 No 10
No response 2

7. Have local and state bodies considered any proposals which can overcome existing laws that may prohibit access to solar energy?

Yes 10 No 31
No response 0

8. Has your state passed any laws which authorize the removal of restrictive covenants which may restrict solar energy devices?

Yes 18 No 23
No response 0

9. Has your state passed any laws which authorize the creation of covenants to protect solar access?

Yes 16 No 22
No response 3

10. Does your state authorize local governments to consider access to sunlight for solar energy systems when designing various land use regulations, including the comprehensive plan?

Yes 20 No 20
No response 1

11. Does your state enabling legislation provide authority to local governments to enact zoning ordinances to protect access to direct sunlight for solar energy devices?

Yes 24 No 15
No response 2

12. Do your state laws permit planning boards to protect solar access in new developments through subdivision regulations?

Yes 15 No 5
No response 4

13. Do they include restrictive covenants, height restrictions, and setback requirements if permitted?

Yes 10 No 27
No response 4

14. Do your state laws provide for the amending of subdivision regulations for orientation standards?

Yes 27 No 14
No response 0

15. Does your state recognize easements, covenants, and other restrictions on the use of real property, created to protect access to sunlight?

Yes 2 No 23
No response 2

16. Have your state courts validated the enforceability of easements for light, which in some states receive mixed judicial reviews?

Yes 19 No 2
No response 6

17. If solar access easements are permitted are they appurtenant to the land?

Yes 14 No 9
No response 4

18. If solar access easements are permitted are there authorized remedies for interference with them?

Yes 15 No 4
No response 8

19. Can solar access easements be terminated upon expiration or release?

Yes 6 No 30
No response 5

20. Do your state laws prohibit the granting of special exceptions or variances to local zoning ordinances if these variances would allow the construction of a building or structure which would cast a shadow on an existing solar collector?

Yes 3 No 24
No response 14

21. In your state can solar property rights be based on the analogy of water rights law, or the law or prior appropriation.

Yes 7 No 16
No response 18

22. Can nuisance law be applied to solar collector shading in your state?

Yes 2 No 35
No response 4

23. Do shade control ordinances exist in your state that specifically cite shading caused by vegetation?

Yes 1 No 31
No response 9

24. Can air pollution laws be used to protect solar access by citing collector interference as a public or private nuisance?

Open-ended questions.

Do you foresee future state bills which will aid in protecting solar access for solar energy systems?

Do you believe enough is being done in providing for an increase of solar energy use in your state?

What is your state's policy toward solar energy? Does your state legislature favor its growth?

APPENDIX B

QUESTIONNAIRE RESULT

State	Question																						States with Constitutional Home Rule
	1	2	3	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
Alabama	Y	Y	M	Y	Y	N	N	N	N	N	N	-	N	N	-	-	-	-	N	N	N	N	N	
Arkansas	Y	Y	V	N	N	N	N	N	N	N	N	-	-	N	-	-	-	-	Y	Y	Y	-	-	
California	Y	Y	L	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	N	Y	Y	Y	Y	X
Colorado	Y	Y	V	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	N	Y	Y	-	N	N	Y	N	N	X
Connecticut	Y	Y	L	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	-	N	Y	N	-	-	N	N	
Florida	Y	Y	V	Y	N	Y	N	Y	N	N	Y	-	N	Y	N	N	Y	Y	N	-	-	-	-	X - Dade County
Georgia	Y	Y	L	N	N	-	N	N	-	-	-	-	-	Y	-	Y	N	Y	-	-	-	N	N	X
Hawaii	Y	Y	V	-	N	Y	N	N	N	N	N	-	-	N	-	-	-	-	N	-	-	N	-	X
Idaho	Y	Y	L	Y	N	Y	N	N	N	N	Y	Y	N	Y	N	Y	-	N	N	N	-	N	-	
Illinois	Y	N	-	Y	N	Y	N	N	Y	Y	Y	N	N	N	-	-	-	-	N	N	N	N	N	
Indiana	Y	Y	V	N	N	Y	N	Y	Y	Y	Y	Y	N	Y	N	Y	N	Y	N	N	N	Y	N	
Iowa	Y	Y	V	Y	N	Y	N	N	Y	Y	Y	Y	N	Y	N	-	Y	-	Y	N	-	N	N	
Kentucky	Y	Y	V	-	N	-	N	N	N	N	Y	Y	Y	Y	N	-	-	-	N	N	Y	N	N	
Louisiana	Y	Y	M	N	N	N	N	N	Y	Y	Y	Y	N	N	-	-	-	-	N	-	N	N	N	X
Maine	Y	Y	V	Y	-	Y	N	N	Y	Y	Y	-	N	Y	Y	-	-	-	N	-	-	N	N	
Maryland	Y	Y	M	Y	Y	Y	Y	N	-	N	-	-	-	Y	N	-	-	-	-	-	-	-	-	X

APPENDIX B (Continued)

State	Question																							States with Constitutional Home Rule
	1	2	3	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
Massachusetts	Y	Y	L	Y	N	Y	N	N	N	Y	Y	Y	Y	Y	N	Y	Y	Y	N	-	-	N	-	
Michigan	Y	N	-	Y	-	Y	N	N	N	N	N	-	N	N	-	-	-	-	N	N	N	N	N	X
Minnesota	Y	Y	V	Y	N	Y	Y	N	Y	Y	Y	Y	Y	Y	N	Y	N	Y	-	-	Y	N	N	
Mississippi	Y	Y	M	N	N	N	N	N	N	N	N	-	N	N	-	-	-	-	N	N	-	N	N	
Missouri	Y	Y	L	Y	N	Y	N	Y	N	N	N	-	N	Y	N	Y	Y	N	N	N	N	N	N	X
Montana	Y	Y	L	Y	N	Y	Y	Y	N	N	N	-	N	Y	N	Y	Y	Y	N	N	N	N	N	
Nevada	Y	Y	L	N	N	Y	N	Y	Y	Y	Y	N	N	Y	N	Y	N	Y	N	Y	N	N	N	X
New Hampshire	Y	Y	V	N	N	N	N	N	N	N	Y	Y	Y	N	-	-	-	-	-	-	-	N	N	
New Jersey	Y	Y	V	N	N	Y	Y	Y	N	N	N	-	N	Y	N	Y	N	-	N	N	N	N	N	
New York	Y	Y	V	-	N	Y	N	N	N	Y	N	-	N	Y	N	Y	Y	Y	N	N	N	N	N	X
North Dakota	Y	Y	V	N	N	N	N	Y	Y	N	N	-	N	Y	N	N	N	N	N	-	-	N	N	
Ohio	Y	Y	V	-	N	Y	N	Y	N	Y	Y	N	Y	Y	N	Y	Y	Y	N	N	-	N	N	X
Oklahoma	Y	Y	M	N	N	N	N	N	N	N	N	-	N	N	-	-	-	-	N	N	N	N	N	X
Oregon	Y	Y	V	N	N	Y	Y	Y	Y	Y	Y	-	N	Y	Y	Y	Y	Y	N	N	N	N	N	X
Rhode Island	Y	Y	V	N	N	N	N	N	-	N	N	-	N	Y	N	Y	N	N	Y	N	N	N	N	X
South Dakota	Y	Y	V	N	N	N	N	Y	Y	Y	Y	Y	Y	Y	N	-	-	-	-	-	-	-	-	X
Tennessee	Y	Y	V	N	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	-	-	N	-	X

APPENDIX B (Continued)

State	Question																							States with Constitutional Home Rule
	1	2	3	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
Texas	Y	Y	M	Y	N	Y	N	N	N	N	N	-	N	Y	N	Y	N	-	N	N	-	N	N	X
Utah	Y	Y	M	Y	N	Y	N	Y	N	N	Y	-	N	Y	N	Y	Y	Y	N	N	-	N	-	X
Vermont	Y	Y	V	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	N	-	-	-	-	Y	N	Y	N	N	
Virginia	Y	Y	V	N	N	Y	N	Y	N	N	Y	N	N	Y	N	Y	Y	Y	Y	N	-	N	N	
Washington	Y	Y	V	Y	N	Y	N	Y	Y	Y	Y	N	N	N	-	-	-	-	N	N	N	N	N	X
West Virginia	Y	Y	M	N	N	N	N	N	N	N	N	-	N	N	-	-	-	-	N	N	N	N	N	X
Wisconsin	Y	Y	V	Y	N	Y	N	N	N	N	N	-	N	N	-	-	-	-	N	N	N	N	N	X
Wyoming	Y	Y	M	N	N	Y	N	N	N	N	Y	Y	N	N	-	-	-	-	N	-	Y	N	N	

States with home rule. States not returning the questionnaire: Alaska, Arizona,* Delaware, Kansas,* Nebraska,* New Mexico, North Carolina, Pennsylvania,* and South Carolina.

APPENDIX C

STATE ENERGY OFFICES

ALABAMA. Alabama Solar Energy Center; Alabama Department of Energy.
ARKANSAS. Arkansas Department of Energy.
CALIFORNIA. California Energy Commission; Solar California Council.
COLORADO. Colorado Office of Energy Conservation.
CONNECTICUT. Energy Division, Office of Policy and Management.
FLORIDA. Florida Solar Energy Center; Governor's Energy Office.
GEORGIA. Georgia Office of Energy Resources.
HAWAII. Public Utilities Commission.
IDAHO. Idaho Office of Energy.
ILLINOIS. Illinois Institute of Natural Resources.
INDIANA. Indiana Department of Commerce Energy Group.
IOWA. Iowa Energy Policy Council; Iowa Solar Office.
KENTUCKY. Kentucky Department of Energy; Kentucky Department of Agriculture; Kentucky Department of Education.
LOUISIANA. Louisiana Department of Natural Resources--Research and Development Division.
MAINE. Maine Energy Office.
MARYLAND. Maryland Energy Office.
MASSACHUSETTS. Massachusetts Energy Office.
MICHIGAN. Michigan Department of Commerce.
MINNESOTA. Minnesota Energy Agency.
MISSISSIPPI. Mississippi Office of Energy; Department of Natural Resources.
MISSOURI. Department of Natural Resources--Division of Energy.
MONTANA. Department of Natural Resources and Conservation.
NEVADA. Nevada Department of Energy.
NEW HAMPSHIRE. The Governor's Council on Energy.
NEW JERSEY. New Jersey State Department of Energy.
NEW YORK. New York State Energy Office.
NORTH DAKOTA.
OHIO. Ohio Department of Energy.
OKLAHOMA. Oklahoma Department of Energy.
OREGON. Oregon Department of Energy.
RHODE ISLAND. Governor's Energy Office.
SOUTH DAKOTA. Office of Energy Policy.
TENNESSEE. Tennessee Energy Authority.
TEXAS. Texas Energy and Natural Resources Advisory Council.
UTAH. Utah State Energy Office.
VERMONT. Vermont State Energy Office.
VIRGINIA. Office of Emergency and Energy Services; Office of Uniform Building Code.
WASHINGTON. Washington State Energy Office.
WEST VIRGINIA. West Virginia Fuel and Energy Office.
WISCONSIN. Wisconsin Department of Administration--Division of Energy; Mid-American Solar Energy Center.

WYOMING. Wyoming Energy Conservation Office; Wyoming Energy Extension Service.

APPENDIX D

STATE SURVEYS

This appendix surveys all the states in the nation in relation to its energy needs and potential for solar energy development. The states of Alaska, Arizona, Delaware, Kansas, Nebraska, New Mexico, North Carolina, Pennsylvania, and South Carolina did not respond to the questionnaire, but were included because several of them have solar legislation. Information on these states is thus much less complete than for the other forty-one states.

A description of each state's location, climate, and energy resources is presented. This information was obtained from the state section of the World Almanac and Book of Facts--1980. The information in this book was derived from the Geography Division of the Bureau of the Census; the Bureau of Mines; and the Department of Energy. Natural gas, bituminous coal, and crude petroleum is included under the term "mineral fuels."

The sources for the state solar laws listed in the text were found in the U. S. Department of Housing and Urban Development's State Solar Legislation report for 1980, compiled by the National Solar Heating and Cooling Information Center.

The questionnaire respondent's views were used to give a picture of solar legislation in their state. They were also used to point out specific problems related to solar energy development that is peculiar to their state. This information helped to clarify the answers that were indicated on the yes/no section of the questionnaire.

The survey begins in New England and ends in Alaska and Hawaii.

New England

Maine. Maine is a New England state at the northeastern tip of the United States. The southern interior and coastal areas are influenced by air masses from the south and west. The northern part of the state has very harsh winters. The state has a large amount of forest land but little mineral energy sources. A large amount of electricity is obtained from nuclear energy.

Maine has passed two land use laws concerning solar access protection. Local governments are permitted to enact zoning ordinances to protect access to direct sunlight for solar energy use (Chapter 418, Laws of 1979). Also planning boards are permitted to protect solar access in new developments through subdivision regulations. These may include restrictive covenants, height restrictions, and setback requirements (Chapter 435, Laws of 1979). The state has not passed any law recognizing solar access easements but they are permitted.

The respondent felt that because of the low population density throughout the state, statewide legislation for solar energy is not warranted. It was felt that local level legislation was probable. Most people within the state like solar energy, but the legislature has to do something about it.

Vermont. The climate of Vermont is temperate with considerable temperature extremes. Heavy snowfall is found in the mountains. The state has no mineral energy resources for domestic use. Nuclear, hydroelectric, and imported mineral sources produce electricity in the state.

The respondent noted that the state legislature just passed a law that enables local governments to review zoning ordinances for solar energy devices (H.731, Laws of 1980). The bill also authorized the removal of anti-solar covenants. Consideration of solar energy in land use planning was also permitted. But a solar easement bill failed to pass.

The respondent stated that future enabling legislation would probably allow towns to deal with the solar access issue independently. He felt that enough was not being done to promote solar at the local level. The legislature favors the growth of solar energy but does not fully understand the urgency of the energy situation.

New Hampshire. The climate of this New England state is highly varied due to its nearness to high mountains on the west and the Atlantic Ocean on the east. Coal and oil are imported for domestic energy use.

The New Hampshire respondent was very informative about his state's solar energy policy. No state solar laws exist in New Hampshire but local governments have the power to protect solar access by subdivision regulations. Zoning is not a popular issue in this traditionally conservative state. The respondent felt that only heavy lobbying would create solar access laws.

Since the state is very conservative and has a non-regulation, home rule ethic, very few state-wide programs or laws are implemented. Counties, towns, and citizen groups are favorable to solar development and are working with solar questions. The state, within its traditional framework, also favors solar energy.

Massachusetts. This state has a temperate climate, with colder and drier conditions in the west. The Atlantic Ocean on the east influences the climate of the rest of the state. Massachusetts must import mineral sources of energy for domestic use.

The respondent said that solar energy was important in the energy policy of the state. The state has passed no specific legislation dealing with solar access, but Massachusetts local governments have strong home rule powers. Local governments can pass solar access laws which the state will recognize. State bills are seen in the future dealing specifically with solar access because the state legislature is highly supportive of solar energy.

Rhode Island. The climate of this state is tempered by its northern latitude and the Atlantic Ocean. These make the climate changeable. The state has no mineral energy sources and has to import its residential energy fuel.

There are no state land use laws concerning solar energy but the respondent noted that easements and covenants can be used. The governor and the energy office see the possibility of a "solar rights bill" for the 1981 session of the Assembly. If the governor chooses to sponser such legislation, chances of passage are good. Most members of the state legislature favor the development of solar energy.

Connecticut. The climate of this state is moderate with below freezing winters and warm, humid summers. There are small amounts of mineral sources of energy in this state. Connecticut must import energy for home heating purposes.

The respondent said that solar energy plays a large role in his

state's energy policies. The state passed a law that authorizes the zoning commission of each city, town, or borough to regulate development to encourage energy efficiency and the use of renewable forms of energy, including solar (Public Act 78-314).

Local governments in Connecticut have strong powers by which they can promote solar energy use. This includes the power to void restrictive covenants if they interfere with solar energy devices. The respondent felt that no additional state legislation was anticipated at this time. Local bodies are capable of handling any future developments. Connecticut has an ongoing program to promote increased use of solar energy. The state legislature strongly supports the use of solar energy.

Middle Atlantic

New York. The climate of this state is moderate with the southeast tempered by the Atlantic Ocean. A limited amount of natural gas is found in New York but because this state is highly industralized much energy has to be imported.

New York recognizes solar easements (Chapter 705, Laws of 1979) and passed a law amending local enabling powers to allow solar access zoning as a valid public purpose (Chapter 742, Laws of 1979). The respondent anticipates that a future bill dealing with solar access in new developments and subdivisions will pass, although a similar bill did not pass in the 1979 legislative session. Official policy is in favor of solar utilization. Specific actions follow policy with some caution, but are gaining momentum.

Pennsylvania. The climate of Pennsylvania is continental with wide fluctuations in seasonal temperatures. The state has large deposits of mineral fuels, especially bituminous coal. Mineral sources of energy provide the main domestic fuel.

There was no response from Pennsylvania to the questionnaire. There is also no known solar legislation. It appears that solar energy plays an insignificant role in the state's energy policy.

New Jersey. The climate of New Jersey is moderate, with marked differences between the northwest and southeast. New Jersey must import its domestic sources of energy. Nuclear energy is an important source of electricity.

New Jersey recognizes solar easements (Chapter 152, Laws of 1978). The respondent stated that the state also can restrict covenants unfavorable to solar systems. Future solar access bills are seen, as the state's policy toward solar is progressive and becoming more so due to the increase in cost of fossil fuels. Sales and property tax incentives exist and many new homes are beginning to adopt passive solar designs.

Maryland. The climate of Maryland is continental in the west and humid subtropical in the east. Maryland has deposits of coal in the west but nuclear energy use is significant.

Maryland recognizes solar easements (Chapter 934, Laws of 1977) but the respondent felt solar energy plays a minor role in the state. A new state law, which became effective on January 1, 1981, does prohibit restrictive covenants which hinder solar energy devices. The law may be challenged in court.

Maryland does not allow local governments to enact zoning ordinances protecting solar access. Lack of funds was cited as the reason why solar energy development is not being pushed further in the state.

Delaware. Delaware is on the Atlantic Coastal Plain east of Maryland. The climate of the state is moderate. The state must import all of its domestic energy fuel.

There was no response from Delaware to the questionnaire. There are no land use laws concerning solar access in this state. There is a law providing an income tax credit for solar hot water systems.

South Atlantic

Virginia. This state has a mild and pleasant climate. The state has deposits of bituminous coal which it uses for residential energy use. Although coal and fuel oil are still the major sources of electricity, nuclear power is important also.

The state recognizes solar easements (Chapter 323, Laws of 1978). The respondent noted that state enabling legislation allows local governments to consider solar access in their land use regulations. State policy is favorable to solar energy development.

West Virginia. This state is landlocked and mountainous. The climate is humid continental except for marine modification in the lower panhandle. West Virginia has large deposits of bituminous coal. It also has deposits of natural gas and crude petroleum. Hydroelectric power generates the most electricity in this state.

West Virginia has no solar legislation. The respondent said that solar energy plays a very minor role in the state's energy policy.

The respondent also noted that three bills concerning solar tax credits and solar easements were introduced to the 1980 state legislature. No action was taken on them. Any future bills, in his opinion, will require a considerable effort to get passed. Legislative attitude seems to consider solar energy "insignificant" for West Virginia.

The respondent went on to say that the large abundance of coal in the state overshadows any attempts to promote alternative energy sources or ideas. As long as coal "looms" so large on the horizon, or until the public demands it, solar energy will be of little consequence.

North Carolina. This state has a sub-tropical climate in the southeast and a medium continental climate in the mountain regions. The climate is tempered by the Gulf Stream and the mountains. Imported mineral energy sources are relied upon for domestic use.

North Carolina representatives did not respond to the questionnaire. The state does have tax incentives but no solar access legislation.

South Carolina. The climate of South Carolina is humid sub-tropical. The state must import its mineral sources of energy. Nuclear energy produces almost as much electricity as mineral sources of fuel in this state.

There was no response from South Carolina to the questionnaire. There is no solar energy legislation for the state.

Georgia. Maritime tropical air masses dominate this state's climate in the summer. Continental polar air masses dominate in the winter. Georgia must import most of its sources of residential heating fuel.

The respondent felt that solar energy plays a large role in his state's energy policy. Future state bills are foreseen to protect solar access. Solar easements are recognized and subject to the same requirements as other easements (Act 1446, 1978).

Southeast Ocean

Florida. Florida occupies a peninsula between the Atlantic Ocean and the Gulf of Mexico. The climate is tropical in the south and subtropical in the north. The state has tremendous potential for solar energy development. The state has small amounts of natural gas and petroleum.

Florida has a law that recognizes solar easements (Chapter 309, Laws of 1978). The easement does not have to be appurtenant to the land. The respondent sees no future state bills protecting solar access. He felt that not enough was being done to provide for solar energy use in the state. Although the state's attitude toward solar energy is positive the legislature was described as conservative in nature and reluctant to allow local governments more authority to promote solar energy use.

South Central

Mississippi. The climate of this state is semi-tropical with no extreme temperatures. The state has deposits of crude petroleum and natural gas.

The respondent stated that solar energy plays a minor role in the state's energy policy. There is no active promotion of solar. No future state bills are foreseen for several years. Every solar bill

has died in the legislature due to lack of interest.

The state energy office believes in solar energy development and feels passive and hot water heating are feasible now. Solar cooling is looked forward to. But the state legislature has shown extremely little interest in alternative energy, except for gasohol.

Louisiana. The climate of this state is subtropical and affected by continental weather patterns. The state has large deposits of mineral fuels. Natural gas, liquified petroleum gases, and crude petroleum are important. The state is an energy exporter.

Louisiana has no solar land use laws. It does have tax incentives and building standards for solar energy devices. The respondent noted that solar energy plays a minor role in the state's present energy policy. Local governments do have the power to create solar access laws on their own.

East South Central

Alabama. Alabama has long, hot summers and mild winters. The state has large deposits of natural gas, bituminous coal, and crude petroleum.

The respondent felt that solar energy would play an important role in the state but not at the present time. Future state bills protecting solar access are foreseen but not by legislative initiative. The private sector will have to influence the legislature.

Tennessee. The climate of Tennessee is humid continental in the north and humid sub-tropical in the south. The state has large

deposits of bituminous coal. Mineral energy sources serve most state domestic needs with hydroelectric power providing a large amount of electrical power.

The state recognizes solar easements and prescribes their contents. Local governments are also empowered to protect solar access through zoning regulations (Chapter 259, Laws of 1979). The legislature favors solar energy development.

Kentucky. Kentucky's climate is moderate. The state has large deposits of fossil fuels which are used for domestic heating.

The state has no specific laws dealing with solar access. But state laws do permit planning boards the power to protect solar access. Subdivision regulations, easements, and nuisance laws can all be used for solar access protection. The state legislature meets every two years so no solar legislation is expected until 1982.

East North Central

Ohio. The climate of this state is temperate but variable with the weather subject to much precipitation. The state has deposits of mineral fuels which serve most of its domestic needs.

The state recognizes solar easements and subjects them to the same requirement as other easements (Amended Substitute House Bill 154, 1979). The respondent noted that local governments are able to enact solar zoning ordinances on their own authority. The respondent felt that the state legislature reluctantly favors solar energy development.

Indiana. The climate of Indiana is temperate with four distinct

seasons. The state has significant supplies of coal which serve most of its domestic energy needs.

This state allows its local subdivisions a large degree of power in land use questions. Thus, solar access laws can be created on the local level without state approval. The respondent stated that no state laws were expected in the near future.

Michigan. The state has well defined seasons tempered by the Great Lakes. Michigan has native sources of crude petroleum and natural gas but nuclear energy is also important. Mineral sources of energy are imported.

The respondent felt that solar energy played a minor role in the state's energy policy. There are no solar laws pertaining to land use for the state. Tax incentives and building standards for solar energy systems do exist.

Illinois. Illinois has a temperate climate with cold, snowy winters, and hot summers. Mineral fuels, or coal, natural gas, and petroleum are important in this state. Nuclear power is important in electricity production.

Illinois has passed no laws dealing with solar access. The respondent did not feel that solar energy plays a role in the state's present energy policy. The state does allow its local subdivisions considerable power in dealing with land use questions and this is probably why no specific state legislation has been passed. The respondent said that local governments in Illinois do not need state approval to pass solar regulations.

North Central

Wisconsin. This state has a long, cold winter and a short, warm summer tempered by the Great Lakes. The state has no significant deposits of mineral energy sources. Electricity is generated by imported mineral sources and nuclear energy.

Wisconsin does not have a state solar access law. Local governments can create their own zoning and subdivision regulations for solar access. The state does provide tax incentives and grants and loans for solar development. There is an active solar demonstration project in the state.

Minnesota. The northern part of this state is located in the moist Great Lakes storm belt region. The western side of the state lies near the semi-arid Great Plains. Minnesota must import a large amount of its mineral energy sources. Nuclear energy is the source of almost half of the state's electricity.

Minnesota passed a law in 1978 that allows solar zoning ordinances and easements. The easements are enforceable in civil actions (Chapter 786, Laws of 1978). The respondent stated that covenants that limit the use of solar energy devices are restricted. Nuisance laws can also be used to protect solar access. A solar rights law is being considered by the state legislature which favors solar energy development. The state recognizes its energy problems and wishes to develop alternative energy sources.

Midwest

Iowa. Iowa has a humid, continental climate. The state has no

natural mineral energy sources. Fuel, oil, coal, and natural gas has to be imported.

Iowa is another state with no specific state solar access legislation but because of strong local governmental powers none is considered necessary. The local governments can create their own solar access legislation. The respondent said that the state legislature is divided over making certain solar access provisions mandatory or voluntary.

West North Central

North Dakota. This state has a continental climate. The state has sources of petroleum, natural gas, and natural gas liquids. Mineral sources of energy is used for domestic use.

North Dakota recognizes solar easements (Chapter 425, Laws of 1977). Local governments can also consider solar access in their comprehensive plans. The respondent noted that North Dakota is on the great plains where trees and other forms of vegetation are not a problem for solar energy systems. The executive branch of the state favors solar.

South Dakota. The climate of this state is characterized by extremes of temperature, constant winds, low precipitation and humidity. The state has a large source of crude oil. Hydroelectric power is the major source of electricity.

The respondent said that easements and subdivision regulations can be used on the local level to protect solar access. There is no specific state solar legislation.

Nebraska. The climate of Nebraska is continental and semi-arid. Natural gas and petroleum are found in this state. Nuclear power is the major source of electricity. Nebraska is an energy importer.

There was no response from Nebraska to the questionnaire. The state does have a solar access law. It recognizes solar easements and allows local governments to include solar access considerations in their comprehensive plans and zoning ordinances. A variance from an existing zoning ordinance is permitted for solar access purposes (Legislative Bill 353, 1979).

Kansas. The climate of Kansas is temperate but continental, with great extremes between summer and winter. The state has reserves of petroleum and natural gas which make the state self sufficient in energy.

A questionnaire was not returned from Kansas. The state does recognize solar easements (Chapter 277, Laws of 1977).

Missouri. The climate of this state is continental and subject to cold Canadian air, moist warm Gulf air, and drier air from the southwest. Most of the mineral sources of energy used in Missouri are imported. Hydroelectric power is also important.

Missouri passed a law which declares that the right to use solar energy is a property right. But it cannot be acquired by eminent domain. Solar easements are also recognized by this law (Chapter 442.021 of the Missouri Code). The legislature favors solar energy development.

West South Central

Oklahoma. The climate of Oklahoma is temperate. The state has large deposits of mineral fuels which more than meet its energy needs.

The state has no solar access laws. The respondent said that solar energy played a minor role in the state's energy policies. Future solar laws would be enacted when the public calls for them. Until then no legislation is expected.

Arkansas. This state has long, hot summers and mild winters. The state has small reserves of natural gas and crude petroleum.

There is no specific legislation dealing with solar access yet in this state but the respondent felt there would be. He noted that the law of prior appropriation and nuisance laws may possibly be used for solar access protection.

Mountain

Montana. Montana is a Rocky Mountain state which has a cold, continental climate with low humidity. Although Montana has large resources of mineral fuels, most electricity is generated by hydro-electric power.

Montana seems to be highly supportive of solar energy development. The state recognizes solar easements (Chapter 524, Laws of 1979). The respondent indicated that the state also had a law which prevented restrictive covenants from interfering with solar collector construction. Future solar access bills are expected in the near future.

Wyoming. This state is similar in climate to Montana. Semi-desert conditions exist throughout the state with true desert in the Big Horn and Great Divide basins. Wyoming is rich in petroleum, coal, uranium, and natural gas. The state is self-sufficient in energy and exports a great deal of it to other states.

Since Wyoming is not worried about domestic energy problems, alternative energies, like solar, play minor roles in the state's energy policy. There are no state solar laws in this state but local governments can enact zoning ordinances and subdivision regulations for solar access. The respondent said that nuisance laws may also be used but no test cases have been heard yet.

The respondent indicated that the Energy Conservation Office is pushing for solar legislation in the 1981 state legislature. The state legislature is divided between those who want to push conventional fuel production and those which stress renewable fuels.

Utah. This state has an arid climate with low-relative humidity. Utah has deposits of crude oil, coal, uranium, and natural gas. Mineral sources of energy are important for domestic use with hydroelectric energy providing a significant amount of electricity.

Utah recognizes solar easements as a property interest. Easements must be in writing and will be appurtenant to the land unless terminated upon stated conditions. Enforcement can be by injunction or other civil action (Chapter 82, Laws of 1979). The respondent noted that solar played a minor role in the state's energy policy. Local governments can enact their own solar laws. But the state government will probably give local governments specific authority to protect

solar access. The state legislature is more concerned with non-renewable energy sources such as oil shale and tar sands as alternative energy sources.

Nevada. This mountain state has a semi-arid climate. It has large deposits of gold and copper but no major energy resources. Mineral sources are used for domestic heating.

The respondent indicated that solar energy plays a large role in the state's energy policy. Nevada has a law that formally recognizes solar easements. The easement is appurtenant to the land but can be terminated upon expiration or release (Chapter 314, Laws of 1979). It was noted that local governments have the power to pass zoning and subdivision regulations for solar access protection. Water rights law is recognized in Nevada and this law may be used to protect solar systems. The respondent foresees future enabling legislation which would specifically direct local governments to include solar easements and consideration of orientation and set back requirements in all land use planning.

West Central

Colorado. This state has a climate with low relative humidity and abundant sunshine. There are wide daily and seasonal temperature changes. Alpine conditions exist in the high mountains. Colorado has large resources of uranium, coal, natural gas, and petroleum.

Colorado has passed important solar access legislation. Solar easements are recognized (Chapter 326, Laws of 1975). Colorado also prohibits restrictive covenants, based on aesthetic considerations, from interfering with solar energy devices (Chapter 358, Laws of 1979).

Another law allows local governments to use planning and zoning to protect solar access. Special exceptions to zoning ordinances can be made to protect solar access and subdivision regulations may be changed (Chapter 306, Laws of 1979). Local nuisance laws can be used to protect solar collectors in this state.

The respondent felt that no new legislation is anticipated. Shading bills were tried but failed to pass. He said the state would likely encourage local governments to deal with solar access according to their locales. This would vary with density and other factors. State policy is very favorable towards solar energy.

South West

Arizona. Arizona is clear and dry in the southern regions and northern plateau. The high central areas of the state have heavy winter snows. This state has no large supplies of natural energy minerals. The climate is ideal for solar energy development.

There was no response from Arizona to the questionnaire but this state does have significant solar legislation. Aside from tax incentives and standards for new construction favorable to solar development, the state also provides authority for local governments to regulate solar access (Chapter 94, Laws of 1979).

New Mexico. This state has a dry climate. It ranks first in the United States in uranium production. Natural gas and petroleum are also found in the state. Hydroelectric power generates the most electricity. The state has no nuclear power plants.

New Mexico did not respond to the questionnaire. This state

was the first to declare the right to use solar energy as a property right of landowners. This law is based on the law of prior appropriation (Chapter 169, Laws of 1977). The state is experiencing difficulties with this law.

Texas. Because of its great size the climate of this state is varied. Arid areas are found in the west. Texas has huge sources of petroleum, natural gas, and natural gas liquids. Texas is a large energy exporter.

The respondent felt that solar energy plays a minor role in his state's energy policy. Oil and gas overshadows all other energy sources. Texas offers several tax incentives for solar energy development. The cities have local power to pass solar legislation. Legislation to be considered in 1981 contains provisions for solar access, subdivision planning, and removal of anti-solar covenants. Texas is slowly beginning to promote solar energy use.

North West

Idaho. This state has a Pacific climate in the west and a continental climate in the southeast. Altitude is an important factor on climate in this state. Idaho generates a large amount of hydroelectric power from large dams.

Solar easements are recognized in Idaho (Chapter 294, Laws of 1978). The respondent felt that solar energy plays a large role in the state's present energy policy. Although there is only one solar access law, future bills are expected. Local governments are not expressly authorized by the state to provide for solar access nor are they

prohibited. The governor has given renewable energy sources priority for energy development.

Washington. Washington has a mild climate dominated by the Pacific Ocean and protected by the Rockies. The state has small deposits of coal. Hydroelectric power produces the greatest amount of electricity in this state.

Washington permits local governments to use comprehensive plans and zoning ordinances to protect solar access. The state also recognizes easements, covenants and other restrictions created to protect solar access to sunlight. Some remedies for interference with solar easements are authorized (Chapter 170E-1, Laws of 1979).

The respondent from Washington noted that solar energy plays a minor role in his state. While enabling legislation exists, local agencies must write their own access codes. This can create a variety of codes which are suited for each locality.

Oregon. The coastal areas of this state are humid and mild. The interior has a dry continental climate with extreme temperatures. Hydroelectric power provides a great amount of the energy used in the state.

Oregon has a strong solar land use law. It enables local governments to regulate solar access in comprehensive plans, zoning ordinances, and subdivision regulations. Solar easements are recognized and private restrictions prohibiting the use of solar energy are void and unenforceable (Chapter 671, Laws of 1979). The state legislature is favorable toward solar energy development.

West

California. This state has moderate temperatures and rainfall along the coast and extremes in the interior. California has significant sources of crude petroleum, natural gas, and natural gas liquids.

California leads the nation in solar access legislation. One law states that anyone who owns, occupies, or controls real estate is prohibited from allowing vegetation or trees from casting a shadow on a solar collector between 9:30 A.M. and 2:30 P.M. Trees casting a shadow prior to collector installation are excluded (Chapter 1366, Laws of 1978). The second land use law voids any property restrictions which can prohibit the installation of a solar energy system. Solar easements are recognized, too. City and county governments may not prohibit or restrict solar energy systems except to ensure the public health. New subdivision maps must be designed to accommodate passive solar energy systems. Also, city and county governments are permitted to require the dedication of solar easements before a land use map is approved (Chapter 1154, Laws of 1978).

Alaska and Hawaii

Alaska. Alaska is in the north west corner of North America, bordered on the east by Canada. The southeast, southwest, and central areas are moist and mild. The far north is very dry. Summer days and winter nights are extended throughout the year. Alaska has large mountains, plateaus, and Artic regions. The state has large deposits of crude petroleum and natural gas.

There was no response from Alaska to the questionnaire. There

is no solar access legislation for the state. The state does have solar tax incentives, grants, and loans.

Hawaii. The Hawaiian Islands lie in the North Pacific, 2,397 miles southwest from San Francisco. The climate is temperate. Most residential energy sources are imported.

State and local bodies have considered solar access legislation but no bills have been passed. The respondent said the state is investigating and supporting many solar technologies such as wind systems, solar water heating, ocean thermal energy conversion, and passive building designs. Funding for these programs is limited. It was mentioned that the legislature was in support of solar energy but was inhibited by the feeling that enormous sums of money are needed to support and implement such a policy. Land is at a premium in Hawaii and this may make the cost of easements prohibitive.

VITA

Gerald Joseph Yuknavage was born in Kingston, Pennsylvania on May 9, 1950. He moved to New Jersey the following year, finally settling in Linden. He attended St. Elizabeth's elementary school in that city and was graduated from Roselle Catholic High School in June 1968. The following September he entered Union College in New Jersey. In 1970 he transferred to The George Washington University in Washington, D. C., and received a Bachelor of Arts degree in History in May 1972.

After working for the Great Eastern Linen Company and Dun & Bradstreet, he entered the Graduate School of Planning at The University of Tennessee, Knoxville, in September 1974. He received the Master of Science in Planning degree in March 1981.