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SOLAR HEATING AND COOLING: STATE AND MUNICIPAL LEGAL IMPEDIMENTS AND INCENTIVES*

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INTRODUCTION

While research and development activities to exploit solar energy for heating and cooling[1] will undoubtedly find their support levels tied to the developing Federal energy policy,[2] the various state laws and local ordinances and codes are likely to provide both impedi-

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1. For the purposes of this paper, solar energy utilization is confined to the heating and cooling of individual residences, apartments, and commercial buildings by the ultimate consumers. The assumption has been made that there are no insurmountable technical barriers.

2. The President's National Energy Plan now before Congress contains proposed legislation which would provide for "a tax credit . . . 40 percent of the first $1,000 and 25 percent of the next $6,400 (for a maximum of $2,000) paid for installation of qualifying solar equipment . . . for expenditures between April 20, 1977 and December 31, 1984 . . ." In urging the States to support the widespread utilization of solar energy, the plan points out that "a number of [States] have already amended their property tax laws to exempt solar installations from assessments. It is desirable that the other states do so as well. The States are also encouraged to enact legislation to protect access to the sun. . . . Under the proposed utility reform program, State public utility commissions would develop guidelines to prevent utilities from discriminating against users of solar energy . . ." Executive Office of the President, THE NATIONAL ENERGY PLAN: CHAPTER VII:–NONCONVENTIONAL SOURCES AND ENERGY RESEARCH 75, 76 (April 29, 1977). [*See* note 37, *infra*, and accompanying text.]

On August 5, 1977, the House of Representatives passed its version of the National Energy Plan, with somewhat different tax credits: 30 percent of the first $1,500 and 20 percent of the next $8,500 (for a maximum credit of $1,150), for the principal resident of the claimant, usable by owners, renters and owners of co-ops and condominiums. The credit covers existing and new housing for expenditures from April 20, 1977 through December 31, 1984. Wall Street Journal August 8, 1977, at 4, col. 4. The Senate is expected to act before the end of 1977.

ments to and incentives for the use of solar end-products by consumers.

It will be useful for solar researchers, producers of solar energy devices, and legal scholars to acquaint themselves with the particular problems that arise in connection with the translation of solar designs into practice and that are related to the *acceptance* of solar energy: everything from the aesthetics of design[3] through the economics of individual solar systems to the regulations or restrictions that serve either as barriers against or encouragement for the widespread use of solar energy. This paper will describe state and municipally originated impediments and incentives, and changes that might provide flexibility will be suggested. The discussion will examine access to sunlight (right to light, easements, zoning, land use planning), marketing and financing (grants and loans, tax credits), design and construction (aesthetics, building codes, material standards, performance specifications, labor laws, and union regulations) operating problems (utilities, insurance), and institutional attitudes.[4]

ACCESS TO SUNLIGHT

Every solar energy system depends on access to sunlight in order

3. *E.g.*, a designer proposing a home utilizing the latest features of energy-conscious design recently wished to use an earth berm rising in front of the south wall of the home to permit the installation of a less expensive solar heating and cooling unit than otherwise because of the insulating properties of the earth. The architectural review board of the subdivision, in an East Texas city, first rejected the idea on the grounds that "a wall is a wall, not a mound of earth, and a home should not be buried in the ground." The home owner instructed that an alternative system should be used, somewhat more expensive and less energy-efficient. Just after the foundation was poured, the review board gave its consent, too late to change back to the original system. The designer reflected that if he had visited the board in person, instead of submitting blue prints and specifications, they might have approved the original design without delay (private communication, George E. Way, Research Associate, The Energy Institute, University of Houston, July 1977).

4. The following are general references:

A readable and concise account of legal issues, concentrating on access to sunlight, legal and policy matters, regulation of building materials and design, financing and marketing arrangements, public utilities' roles, land use planning, etc., can be found in Thomas, *Legal Aspects of Solar Energy Development,* PROCEEDINGS, AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE, Annual Meeting, February 21, 1976 (Am. Bar Fdn., 1976), [hereinafter cited as Thomas].

The American Bar Foundation has also published an interim report on its project, "Legal Issues Related to the Utilization of Solar Energy," as PROCEEDINGS OF THE WORKSHOP ON SOLAR ENERGY AND THE LAW (Am. Bar Fdn., 1975). This pamphlet contains short papers by authors working in the field, as follows:

Thomas, *Access to Sunlight,* 7
Robbins, *Fiscal Impediments and Inducements,* 11
Rivkin, *Restrictions on Building Design and Materials,* 12
Robbins, *Zoning,* 15
Costonis, *Transferable Development Rights,* 19
Haar, *Innovative Land Use Laws,* 21

to operate.[5] If the owner of land adjoining the collector constructs a building or plants a tall tree that shades the collector, no energy is captured. Even if no such obstruction currently exists, the possibility that it might arise in the future may deter investment in solar energy devices. This is probably more significant in urban areas where large numbers of homeowners occupy a relatively small land area, particularly as fossil fuel prices rise and as the relative economics of retrofitting existing homes for solar energy inspire more demand.[6]

The allocation of sunlight encompasses two main questions. What rights does the owner or user of a solar collector have to the continued use of the sun's rays that may cross the property of another before reaching his collection unit? And who will make allocations, and on what legal principles will the allocations be made?[7]

[Hereinafter cited as WORKSHOP, preceded by the name of the individual author.] The project has also issued an 85-page compendium of model solar energy laws for state and local governments focusing on eight prime issues:

(1) improving access to insulation,
(2) optimizing the location of solar collectors,
(3) improving the public economics of solar systems,
(4) improving the operation and design of systems through cooperation with public utilities,
(5) removing potential construction and maintenance problems,
(6) improving the financing arrangements for solar energy systems,
(7) increasing the number of available solar energy systems, and
(8) allocating rights to solar energy.

Model Solar Energy Laws, (Am. Bar Fdn. 1975).

Two surveys performed for the Federal Energy Administration under contract combine technical, administrative and legal considerations, and focus on incentives as well as impediments:

The Effectiveness of Solar Energy Incentives at the State and Local Level: An Overview for the Federal Energy Administration. Booz-Allen & Hamilton, Inc. (1975) [hereinafter cited as Booz-Allen].

Solar Energy Utilization in Florida, report to the Florida Energy Committee. Booz-Allen & Hamilton, Inc. (1975) [hereinafter cited as Booz-Allen Florida].

The National Conference of State Legislatures periodically surveys various aspects of state activity in energy. *See* Jones, *Analysis of State Solar Energy Policy Options,* Energy Policy Project, National Conference of State Legislatures (1976) [hereinafter cited as Jones].

A status report of state solar legislation, arranged by topic, is given in *Summary of State Solar Legislation* 1974-1976, Energy Report to the States, Energy Policy Project, National Conference of State Legislatures (January 17, 1977) [hereinafter cited as NCSL Summary].

The most recent report on barriers to the spread of solar heating and cooling is a result of a project sponsored by the Division of Solar Energy of the Energy Research and Development Administration, a full review of the literature in the field. Legal Barriers to Solar Heating and Cooling of Buildings, Environmental Law Institute (March 1977) [hereinafter cited as Legal Barriers]. This project also produced a case study in which the state of Colorado was utilized to study legal and other issues, published as Hillhouse, Solar Energy and Land Use in Colorado: Legal, Institutional and Policy Perspectives. Environmental Law Institute (April 1976) [hereinafter cited as Hillhouse].

5. *See generally* Eisenstadt and Utton, Solar Rights and their Effect on Solar Heating and Cooling, 16 NAT. RES. J. 363 (1976) [hereinafter cited as Eisenstadt and Utton].

6. Hillhouse, *supra* note 4, at 36.

7. White, *The Allocation of Sunlight: Solar Rights and the Prior Appropriation Doctrine,* 47 U. COLO. L. REV. 421 (1976).

The decisions could be made judicially, or federal, state and/or local statutes could be involved. From a constitutional point of view, it is likely that Congress will have to settle the problem as to which of the above institutions will be responsible. To this date, the matter has not been settled in the courts.[8]

Ancient Lights Doctrine. The ancestral common law principle, the doctrine of ancient lights, is still in effect in a modified form in England and some other parts of the English-speaking world. The doctrine establishes that uninterrupted use of light and air through a window for 20 years prevents an adjoining landowner from blocking access, thus granting a prescriptive easement by possession.[9]

The Law in the United States. At first the doctrine of ancient lights was upheld in the United States but was rejected repeatedly beginning in New York in 1838.[10] Its most recent rejection of note was the case in the late 1950's involving the Eden Roc Hotel, a resort hotel on the ocean in Miami Beach, Florida. The neighboring Fountainebleau had begun construction of a building addition that would, when completed, shadow the swimming pool of the Eden Roc after two o'clock in the afternoon in the winter. The appeals court in Florida held that "ancient lights" had been unanimously repudiated in the United States but that "if public policy demands that a landowner in the Miami Beach area refrain . . ." from encroaching on another's sunlight, "an amendment of (the city's) comprehensive planning and zoning ordinance, applicable to the public as a whole, is the means by which such purpose should be achieved."[11]

Under this case the owner of a solar energy system seeking judicial relief from shading of his collector caused by construction or plantings on adjoining land would appear to have little chance of success.

Easements. Easements for access to light and air are available in most states and are a partial answer to the problem.[12] The holder of an easement for unobstructed light owns the right to the light coming across an adjacent piece of land. Such easements can be created for any length of time by covenant, grant, or reservation.[13] Thus, the owner of a solar collector could guarantee his access to sunlight by obtaining an easement from his neighbor. However, an easement provides insufficient protection and incentive for solar

8. *Legal Barriers, supra* note 4, at 4.
9. Eisenstadt and Utton, *supra* note 5, at 366 & 67.
10. *Id.*, at 367.
11. Fountainebleau Hotel Corp. v. Forty-Five Twenty-Five, Inc. 114 S.2d 357, at 360 (Fla. 1959).
12. Eisenstadt and Utton, *supra* note 5, at 368 & 69.
13. Hillhouse, *supra* note 4, at 33.

energy users, because of the possibly prohibitive cost of acquiring the rights and the requirement for prospective solar energy users to negotiate with their neighbors. A more equitable method of allocation requiring action at the community rather than the individual level is zoning.[14]

Zoning. Eisenstadt and Utton have commented that: "it would appear that the public policy in favor of solar heating and cooling systems is at least as strong as that for unshaded resort hotels, and that zoning ordinances should be available for the former as for the latter."[15] A new concept like solar energy, whose use can only increase in the future, creates a series of problems for federal, state, and local governments. Such problems probably fall hardest on local governments whose zoning restraints, because imposed on the use of privately owned land, must be equitably designed. A solar zoning plan should recognize the following kinds of protection:

(1) Directional orientation of street to take advantage of sunlight;
(2) Directional orientation of slanted roofs to provide workable surfaces for solar collector retrofits;
(3) Requirements for setting structures back from property lines to limit shadows on neighboring property; and
(4) Control of building heights and density to minimize interference with neighborhood access to light.[16]

Thomas has pointed out that zoning is the "sand" of property law, not the "rock," and that people should not rely upon it to remain stable over the long run.[17] Normally it requires only three readings by a local legislative body to change any zoning ordinance—sometimes drastically.[18]

Robbins has reasoned that "the most controversial and difficult issue was often the variance process, whereby various exceptions are made to the zoning laws depending upon circumstances."[19] These circumstances often benefit one party to the detriment of another. In fact, in order to insure that local government does not punish its enemies and reward its friends the constitutional safeguards concerning zoning are continually before the courts.

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14. *Id.*, at 34.
15. Eisenstadt and Utton, *supra* note 5, at 368.
16. Booz-Allen, *supra* note 4, at VII-10.
17. Thomas, *supra* note 4, at 7.
18. Note, though, that Houston, Texas is the only major city in the United States without zoning ordinances, yet has a growing reputation for excellent planning. While some are skeptical, there are those who find that the market mechanism is not materially different in result from zoning ordinances, and has a lower economic and social cost.
19. Robbins, WORKSHOP, *supra* note 4, at 16.

Until recently, zoning was thought to be within the exclusive control of local government; as national concern grows over energy use and abuse, local planning will come under the surveillance of state and federal bodies.

Ninety percent of government decisions about land use are made at the local level by officials who are familiar with the circumstances. If solar energy is to gain national prominence, much of the progress will be due to work by local government. Fiats from Washington will not have the desired political influence unless there exists a group of competent individuals at the local level.[20] With zoning, one can control the actual and potential use of land and the size, placement, and design of the collector.

Typical zoning systems applied to solar heating and cooling provide for allocation of rights to unobstructed airspace for users of solar energy, accompanied by an administrative procedure for alleviating undue hardships. These schemes are usually limited to areas populated by low-density, single-family dwellings to avoid the obviously undesirable (and probably illegal) result of restricting construction of new high-rise buildings for the benefit of heating or cooling existing buildings. Some proposals automatically distribute rights to existing property owners, while others attempt to create an incentive for use of solar energy through a "first in time, first in right" system. A critical element is the provision for variances, since granting one property owner the right to unobstructed airspace may mean an unjust taking of property from another without compensation.[21]

In Colorado a study made by aerial photography determined that the vast majority of rooftops in residential zones were free from shade most of the day, but serious shading existed in other areas.[22] It is recommended that advance planning (supported with strong legislation to provide for new developments) would minimize costs in the future.[23]

Eminent Domain. If solar zoning is not considered a permissible exercise of police powers, it may be questioned whether the local government could condemn necessary airspace and sell or lease it to solar energy users. Theoretically, this approach would allow a local government to encourage solar energy development by condemning property for small solar electric systems. The use of eminent domain

20. *Id.*, at 15.
21. Hillhouse, *supra* note 4, at 34.
22. *Id.*, at 35.
23. Robbins, WORKSHOP, *supra* note 4, at 34.

powers could be expensive, and might not contribute to rational land use planning if arbitrariness occurred.

Legally, the basic question about eminent domain is whether authority is being exercised for public benefit. Since eminent domain could be utilized for the benefit of individual property owners, it might be argued that the power is being employed for private benefit. The Supreme Court has approved eminent domain for urban renewal even though private landowners have been primarily benefitted. "Assuming similar general benefits to the public at large can be shown to accrue from the use of solar energy, a solar energy related condemnation program should also be upheld."[24]

Other Measures. Newer procedures in land use planning have been devised and serve to protect property characteristics that favor the use of solar energy. These include comprehensive land use plans, land donation, transferable development rights, official mapping of solar districts, and planned unit development.[25]

Comprehensive land use plans, particularly for large-scale residential developments, shopping centers, and industrial parks, would permit advance planning and integration of solar devices. Land donation can be required by developers for a park or similar municipal purpose. This system can be extended to solar energy location donations.[26]

Density bonuses could be provided to those who use solar devices, allowing somewhat more income from a given amount of land, since the solar units would lessen the impact of the development on the environment of the whole community.[27]

The transferable development rights involve the trading of a right available in one location, where there is a higher use for the property or airspace, for another where the development is welcome. This involves the valuation of the development rights of both pieces of property, the computation of the future value of the properties (under different conditions that are assumed to be coming about in the future), reduction of both properties to a present value, and the exchange of one for another or for money.

It is possible that rational land use will be brought about by the creation of a "land tribunal," such as those in England, where private controls such as covenants, easements, and restrictions are placed under a body that is not traditionally judicial. The tribunal could be

24. Hillhouse, *supra* note 4, at 36.
25. Thomas, WORKSHOP, *supra* note 4, at 7.
26. Robbins, WORKSHOP, *supra* note 4, at 18.
27. *Id.*, at 18, 19.

composed of appraisers, economists, businessmen, and lawyers and be given statutory responsibility to take into account land use planning considerations for the entire community when they consider whether a particular agreement serves the purpose for which it was created. This suggestion, made by Charles Haar, seems a viable way to move in the solar energy field.[28]

FINANCING AND MARKETING

The private sector functions that provide both the most difficult barriers to overcome and the possibilities of the greatest incentives to speedy spread of solar heating and cooling technology are financing and marketing. The areas will be discussed together as follows: financial institutions, tax barriers and incentives, distribution of solar energy systems, and warranties.

Lending Institutions. Historically one of the most important impediments to or incentives for marketing of technological improvements is financing. Lending institutions have in the past favored lending to those organizations that have had experience in a field. Since solar technology is new, it will have to show that it can compete realistically with other energy sources, or that other sources will eventually lose position because they are not economical.[29]

In their comprehensive report, Booz-Allen point out that "lending institutions will require information on:

> (1) reliability of solar systems in general as well as ratings of specific manufacturers and products;
> (2) explicit and documented information on potential cost savings of solar technologies;
> (3) experience in solar home resale values, and
> (4) viability of retrofitting solar systems for residential and commercial buildings."[30]

Because of their newness, solar-equipped homes may seem to be "gadgety" to bankers or other lending institutions. Banks may undervalue such property for mortgage investment purposes; therefore, houses may not be sold and commercial buildings go unmarketed because their heating and cooling systems seem inadequate. Unreasonable backup systems may be required, making costs excessive.

Loans may be unavailable at current rates, and sales prices may therefore be unpredictable, thus deterring investors. These impedi-

28. Haar, WORKSHOP, *supra* note 4, at 24, 25.
29. Jones, *supra* note 4, at 4.
30. Booz-Allen, *supra* note 4, at VIII-9.

ments are not removable by simple legislation; it will require a concerted effort to change attitudes and create a nondiscriminatory financing law that will insure reasonable terms for solar heated and cooled structures.[31]

A recent study of lending institutions using intensive interviews has produced results different from past reports: lenders are concerned with "whether or not solar devices will perform as claimed, whether they are worth the costs, and whether they will have acceptable resale values—but may not be as concerned over the 'novelty' of this development as has been suggested."[32]

General Financial Incentives. Financial incentives can be devised to reduce consumer resistance, expand capital available for manufacturing, and reduce risks to financial institutions.[33] A series of programs has been proposed to the Federal Energy Administration (now part of the Department of Energy):

(1) Low-cost loan programs for consumers with easy terms, which reduce first costs at the time of solar system purchase, rather than at the end of the year as tax incentives do.[34]
(2) Low-cost loans to manufacturers can subsidize product costs thereby stimulating sales and reducing the financing burden of new equipment.[35]

From the standpoint of the State agencies engaged in promoting solar heating and cooling, there are advantages in employing the incentives to manufacturers instead of consumers: they ease the problem of communication, since manufacturers are fewer in number than consumers, and the burden of communicating with the ultimate consumer is shifted to the manufacturer. The type and rate of investment expenditures by manufacturers can be influenced in the direction the state believes is most productive.

On the other hand, no product sales result from loans to manufacturers, and resources could be expended without any solar market development occurring at all; loans to consumers, however, are directly correlated with sales and stimulate marketplace "pull" rather than "manufacturing" push.[36]

Tax Incentives. The President's National Energy Plan has pro-

31. Robbins, WORKSHOP, *supra* note 4, at 12, 13.
32. D. Barrett, P. Epstein, and C. Haar, *Financing the Solar Home,* Regional and Urban Planning Implementation, Inc. 84 (1976).
33. Booz-Allen, *supra* note 4, at V-1.
34. *Id.*, at V-2.
35. *Id.*, at V-4.
36. *Id.*, at V-5.

posed a federal tax incentive.[37] States are urged to do likewise.[38] Seventeen states have already enacted property tax incentive laws, and others are following.[39]

A range of possible incentive mechanisms exists, which can be directed either at individuals or corporations for different tax results. Each mechanism provides its own special ways of extending market incentives. Tax laws vary widely regionally, and each local approach requires specific study and debate.[40]

Four general tax channels are involved:

(1) sales taxes or use taxes which purchasers pay on materials used in solar devices;
(2) property assessments;
(3) income taxes; and
(4) depreciation rates (they may all be impediments as well as incentives).[41]

Sales Taxes. There must be a clear description of the solar devices to be sold, and what constitutes the benefit, if sales taxes are to be forgiven. If accomplished, sales tax exemption would be a one-time stimulation, generally under five percent of the total system price.[42] If materials constituted half or more of the cost of installation, several percent of the installation's cost of solar units could be saved if sales and use taxes were waived.[43] The removal of sales taxes could give an important psychological lift to manufacturers and potential users of solar devices. This has a recent precedent in the measures taken to encourage the use of pollution control equipment.

If sales taxes are removed, however, there would be an impact on state and local governments because of the decrease in revenues. For example, if solar units replaced furnaces, there would be no sales tax income from either. On the other hand, there might be lessened expenditures for fuel extraction, transportation, and conversion and improvement in local air pollution.

There is model legislation for air and water pollution equipment exemption in Kentucky and other states. Proposed legislation needs to define what constitutes a solar collector and to determine the cost benefit resulting from the additional energy.[44]

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37. *See supra* note 2.
38. *Id.*
39. NCSL Summary, *supra* note 4, at 1.
40. Booz-Allen, *supra* note 4, at IV-1.
41. Robbins, WORKSHOP, *supra* note 4, at 11.
42. Booz-Allen, *supra* note 4, at IV-7.
43. Robbins, WORKSHOP, *supra* note 4, at 11.
44. *Id.*, at 11-12.

Property Taxes. In order to determine what property tax relief should properly be given for the installation of solar heating and/or cooling units, advantages, disadvantages, and cost-benefit ratios must be carefully considered. The tax advantage should reflect actual public interest in solar energy, without becoming a windfall. For example, it may be determined that a solar installation will actually raise the value of a home, and this might suggest a tax increase. Such action could deter the installation of solar devices, which are not in the same class as the addition of a bedroom. Solar devices are expensive, but have more substantial benefits for the community, for example, saving nonrenewable resources by reduced pollution from fossil fuels.

To apply property tax rebates to solar devices, several steps need to be taken:

(1) A clear description of what the benefit is to be and what constitutes a solar device.
(2) Tax assessors must be trained to understand the cost and value of the devices.

Losses in local taxes due to exemptions and the loss of property taxes on conventional systems must be considered. The contribution of the solar device needs analysis. Where a collector forms part of a protective roof, only those elements serving solar heating and cooling functions could be entitled to preferential treatment.[45]

Corporate Income Tax. Income taxes on businesses can have a major impact, since the tax code is oriented toward the business costs of present fossil fuels, with relatively low capital investment when long-term, life cycle costs are considered. Solar costs will be heavily loaded at the outset.[46] Through incentive packages the Federal Government and the States could seriously influence the course of corporate actions. One type of tax would allow manufacturers to deduct a fixed amount or a percentage of income from the sale of solar systems.

Another incentive would be an investment tax credit to encourage investment in larger and more efficient plants. Credits for research and development expenditures should encourage more development of systems prior to marketing. Accelerated depreciation will increase the return on new investment in plant and equipment during the early years of operation.

Decisions about where to direct the incentives, to the builder, manufacturer of components, distributor, or contractor will depend

45. *Id.*, at 12.
46. *Id.*, at 12.

on the structure of industry in the state and the local taxing system.[47] Other considerations, including the system of reporting required by the Securities and Exchange Commission, accounting methods, and other regulatory systems, will require review so that solar devices are reflected fairly on balance sheets, etc.[48]

Personal Income Taxes. Some thought has been given to allowing personal income tax deductions for the purchase of solar units, but in most states income tax rates are generally not high enough for a significant saving even if the full value is allowed. Because of the progressive tax structure, savings would be greater for high income tax payers than low income tax payers.[49]

Depreciation Rates. The depreciation rate applicable to solar devices for individuals and businesses could greatly affect solar installation. The actual life of collectors, the repair cycle, and risk factors need to be known in order to calculate actual depreciation and the possible applicable rates to be applied by federal and state tax bodies.[50]

In order for tax incentives to have an impact, significant amounts of money must be committed; on the other hand, two positive factors are present: removal of disincentives and barriers to the installation, and provision of wide publicity for solar technology, even if the cost barrier is not significantly affected. If the incentives are provided to the consumer rather than the industry, the incentives should have the greatest impact.[51]

Grants and Loans. In addition to indirect incentives via tax adjustments, there are several rounds of federal agency grants and loans that have distributed partial or full subsidies to home owners, developers, and owners of commercial buildings (particularly the states themselves, and owners of federal government agency buildings). HUD completed in the summer of 1977, the second round of grants, $6.6 million for hot water units in 10,000 homes, in programs run by state agencies under HUD rules. An additional $10 million has been given to produce solar heating or cooling in 4,000 homes and apartments, under ERDA and HUD auspices.[52] Other agencies, including

47. Booz-Allen, *supra* note 4, at IV-9, 10. Two states, Kansas and Massachusetts, have passed laws providing for corporate income tax breaks.

48. Booz-Allen, *supra* note 4, at IV-8.

49. *Id.*, at 8. Kansas, HB 2969, 1976, and New Mexico, SB 1, 1976, provides credits of 25 percent or $1,000, whichever is less; Idaho, HB 68, 1976, provides an income tax credit of 40 percent the first year, then a 20 percent credit each succeeding year for three years thereafter. In any one year, the deduction is not to exceed $5,000.

50. Robbins, WORKSHOP, *supra* note 4, at 12.

51. Booz-Allen, *supra* note 4, at I-3, 4.

52. *Business Week,* May 23, 1977, p. 30, col. 1, 2 Solar Engineering, April 1977, #4, p. 5.

NASA, are installing on government-owned property in various states equipment that will be operationally utilized, but will be evaluated throughout its useful life.[53]

Warranties as Barriers. Solar heating and cooling is likely to have hazards of its own in installation and operation, even though it may be safer than an ordinary hot water heater. Barriers to use may be raised by the cost of insuring against those hazards.

Broken glass, glare, leakage of chemicals used to store heat, or malfunctioning may be some of the problems.[54] Remedies for these problems may be expensive. Insurance may cost more, and it may be necessary for the government to develop performance standards for the units—not only in connection with construction but in order to provide marketing incentives to stimulate sales.[55] State laws and judicial rulings will have most influence here.

DESIGN AND CONSTRUCTION

Design and Aesthetics. However efficient and nondepletive solar energy may be, one major problem can be summed up in the elusive word "taste." Public acceptance of the external appearance of the solar roof collector, wall, or backyard or frontyard solar collecting frame will probably play a major part in the rate of development in the next few years. There have already been cases where solar installations have been discouraged by neighbors who did not like the view or perhaps the glare. Civic club and homeowners' association covenants, irritation and pressure from individuals who must face the solar-roofed house, regulations, resolutions, and ordinances from local subdivision appearance control, and zoning boards intent upon preserving the homogeneity of the neighborhood can soon discourage the timid builder and his architect—even when some energy savings lie in the future.[56]

If life cycle savings seem too uncertain, if there are no immediate monetary incentives in the form of a tax reduction or the ability to pay out the solar energy unit cost at a lower-than-normal rate of interest, if there seems to be uncertainty in the parts supply or securing maintenance and repairs, if the banker is not a ready lender,

53. The University of Houston at Clear Lake City, Texas, will install an 18,000 square foot solar collecting unit to heat, provide hot water, and 75 tons of air conditioning for a 35,000 square foot building. This project will be funded, installed, operated and evaluated throughout its useful life by NASA's Marshall Space Flight Center, Alabama. Data will be obtained to aid in the development of commercially feasible solar units of this size. *Houston Post*, August 19, 1977, Sec. A, at 15, col. 4.

54. Legal Barriers, *supra* note 4, at 172.

55. *Id.* at 178.

56. *See supra* note 3.

and there is a surrounding climate including otherwise knowledgeable and authoritative people who claim that there is plenty of fossil fuels for future heating, air conditioning, and electric power generation, then the average American will look with curiosity at the solar energy product folders—but will buy something more traditional, more like what his neighbors have, something more expensive in the long run.

Fortunately, a number of things can be done. In its FEA survey, Booz-Allen made the following recommendations:

> Indirect actions can probably be effective in creating a climate of general solar energy conceptual and aesthetic acceptability.
>
> Specific programs should include:
>
> Adoption of solar equipment on public buildings
>
> Solar energy features in local newspapers, including pictures of solar homes, and
>
> Encouragement of display of solar equipment in home shows.
>
> Incentive and information programs can be designed to encourage manufacturers to develop aesthetic technologies
>
> Aesthetic considerations are less important on commercial buildings
>
> Encouragement of commercial installations can provide a climate of solar acceptability, and
>
> It is possible that if the major implementation of solar energy is for low-cost housing projects, the technology could develop an image as a substandard substitute for electricity. This could create additional acceptability barriers to further diffusion.[57]

Building Codes. There is a multiplicity of building codes over the United States, and little or nothing is being done to bring about standard building regulations for the entire nation. This, in itself, inhibits technological innovation, for there are fifty possible bodies of state law and several thousand city ordinances that can be brought to bear on any "new" concept that might otherwise receive national attention and distribution for sales and use.[58]

Standards and Building Codes. Standards generally refer to criteria for rating or approving equipment. *Codes* refer to a more formal set of regulations for controlling the specifications and quality of buildings. Codes can be viewed as a formal, legal, collection of stan-

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57. Booz-Allen, *supra* note 4, at VII-8, 9.

58. Rivkin, WORKSHOP, *supra* note 4, at 2. For a full-scale investigation into the possibility of utilizing judicial decision-making as a means of removing impediments to building code changes, in a general context, *see* Rivkin, *Courting Change: Using Litigation to Reform Local Building Codes,* 26 RUTGERS L. REV. 774 (1972). *See also* Legal Barriers, *supra* note 4, at 49, for a critical examination of codes as serious potential barriers to solar technology spread.

dards adopted by a locale. Since solar equipment-related standards and codes are different facets of the same issue, they are here discussed together.[59]

Regulation of Building Materials and Design. Two well-established procedures exist for devising building codes. The first is to set prescriptive standards that designate specific building materials and how they are to be used, such as specifications for the type and installation of electrical wiring. The other method is to establish performance criteria that are descriptions of what the materials or designs must do or objectives they must attain. Keyed to function rather than design, they are greatly preferred by architects and engineers as they allow flexibility and reduce unnecessary financial burdens.[60]

Monetary Costs. The patchwork of current building codes and the somewhat unique requirements of the solar industry make it difficult to estimate the dollar investment necessary to develop standards. Four of the five proposals on the creating of standards that were introduced into state legislatures in 1975 died in finance committee. None of the authorizations requested more than $100,000, which is probably closer to the low end of the likely cost of a standards development effort. Separate or independent state efforts to produce codes are likely to be expensive and cost-ineffective; given current state and municipal finances even small expenditures are a burden.[61] It would almost certainly be best if a uniform national system of standards and codes could be developed along with a program to consider the specialized characteristics of local markets:

> [R]eview commissions should encourage and facilitate comment from a statewide geographic representation of architects, builders, developers, consumer advocates, trade unions and guilds, and the general public. These reviews should be made known to the parties responsible for national standards development while the standards are in the draft stages, and when consensus national standards are in final form, the state and local agencies should act immediately to incorporate the standards into existing building codes.[62]

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59. Booz-Allen, *supra* note 4, at VII-1.

60. Thomas, *supra* note 4, at 4.

61. Booz-Allen, *supra* note 4, at VII-3, 4.

62. Booz-Allen, *supra* note 4, at VII-7. The Federal Energy Administration commissioned a study by Arthur D. Little, Inc., of the energy and economic impact which would be brought about by a construction code designed to promote energy conservation in buildings. This code, a voluntary standard, was produced by the American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) in 1975. The standard was designated ASHRAE 90-75. The Arthur D. Little, Inc., report contains a description of the implications of the adoption of this standard, and is well worth reading: *Energy Conservation in New Building Design:* An Impact Assessment of ASHRAE 90-75. Report prepared for the Office of Building Programs, Energy Conservation and Environment Division, Federal Energy Administration. Conservation paper No. 43B (1976).

Proposals and Enactments of Standards and Codes. Several efforts, led by the federal government and involving standards groups and trade associations, are currently in progress to develop solar equipment criteria, testing procedures, and approved specifications. These efforts are being pursued under the Solar Heating and Cooling Demonstration Act of 1974 and may take as much as five years to develop.[63]

State legislative efforts are less advanced than federal: five states—New York, Florida, Vermont, Connecticut and California—have introduced legislation that involves standards development. In general, these proposals have not met with success. The State experiences are as follows:

New York, Florida, and Vermont considered legislation with virtually identical language. The New York and Vermont bills requested $50,000 from the state legislature; the Florida bills left the amount unspecified. The three states have referred the bills to committees where no action has been taken since 1975.[64]

Under separate legislation, Florida now requires that the hot water systems in all new buildings have plumbing that will accept solar system retrofits. That is, however, a nominal requirement, as plumbing need not be led to the roof, and it will not appreciably reduce the costs of future solar retrofit installation.[65]

The Connecticut proposal provides for a legislative committee to review and propose solar equipment codes. It is inactive in Connecticut's ways and means committee and has not been reconsidered to this date.[66]

The California proposal is more comprehensive than that of the other states. It authorizes the California Energy Resources Conservation and Development Commission, which began in January 1975, to develop standards and codes for construction, safety, materials, and installation. It also requires that these standards and codes be reviewed and implemented by the State Department of Housing and Community Development. This bill also authorizes cities and counties to require that new buildings subject to the state housing law be constructed in a manner permitting installation of solar heating and cooling devices.[67]

Special attention was paid to a study of energy utilization in Flor-

63. Booz-Allen, *supra* note 4, at VII-4, 5.
64. Booz-Allen, *supra* note 4, at VII-6.
65. Booz-Allen, *supra* note 4, at IV-18.
66. Booz-Allen, *supra* note 4, at VII-6.
67. *Id.*

ida; no serious barriers were found to be present in housing and building codes.[68] The study authors recommended inclusion in the state-wide building code now under development of specific guidelines to insure that solar system installations meet minimum standards of quality and that the consumers' interests are protected. It was recommended that the code should be written in a way which does not restrict the development and marketing of innovative solar system designs in the future.[69]

In Houston, Texas, a recent building code provides that "design, construction, use, location, and maintenance of all direct solar systems . . ." be regulated. All active solar systems require a building permit, and the following kinds of disciplines: "A plumber for solar water heating and/or swimming pool; electrician, if the solar energy is to be converted into electrical energy; air conditioning mechanic if other."[70]

Labor Regulations. A barrier, which until very recently has caused difficulty and expense in construction, lies in organized labor's resistance to unknown work situations, where the work cuts across several job classifications.[71] Since solar energy installers have not yet become part of a total scheme of marketing, installation, and training, there will be continuing change of job specifications, work orders, etc. Small contractors may be unable to implement the worksite changes that may be the most efficient manner to make solar energy installations work properly, yet those contractors may be those most willing to try innovative ideas to market their houses.

Recently Robbins noted:

> We all know that labor unions often carve construction operations into small pieces to protect the skills of individual union members. There is no question that substantial questions will arise in the characterization of solar device with respect to structures. If it is mounted on the roof, it may be a part of the roofing. If it is mounted in the yard, it is an independent structure . . .
>
> An interim agreement has been reached by the United Association of Journeymen and Apprentice of the Plumbing and Pipe Fitting Industry of the U.S. and Canada, and the Sheet Metal Workers' International Association providing that:
>
> '(1) Solar collectors or panels with tubing and or piping for liquid flow as well as all supports for same and any rigging will be

68. Booz-Allen Florida, *supra* note 4, at IV-18.

69. *Id.* at IV-19.

70. CITY OF HOUSTON, BUILDING CODE, Chapter 88, Regulating Direct Solar Energy Applications, amended 9 November 1976.

71. Legal Barriers, *supra* note 4, at 154.

handled and erected by a composite crew equal in numbers of members of the respective unions.
(2) Sheet metal workers will handle installations of solar collectors where liquid is not used as a collector medium.
(3) All pipe work in connection with an installation will be performed by members of the Pipe Fitters Association.
(4) Duct work will be performed by members of the Sheet Metal Workers' Association . . .'[72]

The City of Houston's amended building code specifies that: plumbers install water heating and or swimming pool heating units, that electricians install the units, if they convert solar energy into electricity, and that air conditioning specialists install all other installations. Permits will be issued to individuals who are constructing units to be owned by them, except for units that convert solar energy directly into electricity.[73]

OPERATING IMPEDIMENTS AND INCENTIVES

Two problems appear to have most influence on the cost of operating solar units; these are utility regulation and structure and insurance coverage.

Utility Structure and Regulation. One of the most difficult barriers to overcome is the invisible barrier produced by those who see the widespread use of new sources of energy as a threat to their vested interests, economic pursuits, and jobs.[74] The electric utilities will represent an important barrier, because they fear that too much solar energy will be a threat.[75]

The appropriate solution is to gain utility participation in the solar heating and cooling market (as well as in the even more threatening central generation of electrical power by direct solar-thermal means).[76] Utility ownership and leaseback of solar systems has been suggested as one option.[77] (This activity has been going on in California for some years.) In this mode, solar system cost could be incorporated in the monthly utility bill; the use of gas vs. electricity generated by solar energy by direct solar heating could be optimized for the season of the year and for other economic factors.

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72. 4 SOLAR ENGINEERING 17 (April 1977).
73. CITY OF HOUSTON, BUILDING CODE, *supra* note 70.
74. For a comprehensive discussion of the barrier imposed by the public utility plight in the face of national gas shortages and rising costs of generating stations, *see* Legal Barriers *supra* note 4, at 86.
75. Booz-Allen Florida, *supra* note 4, at Appendix A(52).
76. Jones, *supra* note 4, at IV-2, 3.
77. *Id.*

Areas of Conflict. An energy source that displaces electricity sales reduces the utility's energy market share, as does conservation activity; these measures would act to reduce net sales and thereby reduce net profits. If the rate of energy consumption is different at different parts of the day and night, where the utility had prepared to meet a different peak, profits could be lost.

The effect of solar heating and cooling systems may have the most impact on load factors from hour to hour rather than on total amount of sales of energy. For example, a solar thermal system that reduces total energy consumption by a customer but does not affect the amount of electricity the customer demands at the time of system peak demand could have the effect of requiring the utility to maintain generating capacity to serve the customer's peak demand without allowing the utility to recover its total cost because the off-peak sales would be lost.

The utility would have to maintain generating capacity to serve the customer's peak demand period, but the utility would not be compensated for off-peak sales lost to the solar competitor.[78]

We have not yet found a way to store electricity as electricity efficiently for later consumption, and we have taken the position that every utility customer has a right to electric energy on demand. This has forced the utilities to keep available the capacity for meeting the peak. When in an emergency it cannot do so, we castigate it.[79]

Public Utility Impediments. If users adopt solar systems in addition to electric utilities, the supplier of electricity must have energy available on demand, but the price that the user will pay may be higher for both sources than it would have been for electricity alone (provided fossil fuel costs did not rise).

Electricity is now priced under an average cost method; if solar energy were to be used during the peak periods, then both the utilities and the customers might benefit. But if solar energy use reduces off-peak use of electricity, then peak period requirements for energy may not be changed, and the peak period costs would be spread over fewer kilowatt hours of electricity, and price would go up as utility company load factors were worsened.[80]

Public Utility Incentives. If the utilities were to adopt a method of peak load pricing, solar units would reduce the customer's pay-

78. Jones, *supra* note 4, at IV-3.

79. *Cf.* the blackout in New York City, July 13, 1977 and the public's attitude toward the Consolidated Edison Company, TIME, July 18, 1977.

80. Jones, *supra* note 4, at IV-6.

ments for expensive electricity, and they could pay reduced prices when they used off-peak electricity, increasing the economic desirability of solar devices. Experiments with such rate structures are now beginning.[81]

The impediments discussed above could be turned into incentives by the following means:

(1) Rate structures should not be biased against small users.
(2) Communal solar facilities should be encouraged and regulatory commission rules should be changed when there are unreasonable impediments to them. Newly created regulatory commissions that are designed to handle solar energy should be given eminent domain power.
(3) Hostility or retaliation on the part of present utilities should be limited by those governing the rate structure.
(4) Just because private solar devices might compete with utility capital investments, they should not be prohibited.
(5) Public utility companies should be encouraged to experiment with means of adding solar devices on line, or promotion of the use of solar energy by individuals.
(6) If necessary, federal jurisdiction should be involved.[82]

Social policy issues still remain, such as: "[S]hould utilities be encouraged to use and sell solar energy? Should a house or shopping center with a solar collector be considered a power producer for tax purposes? Should solar energy cooperatives be formed under present or new utility regulations? If neighgors get together to install a solar conversion system to distribute energy only among themselves, would they be subject to regulation as a public utility? . . ."[83]

If utilities were to be encouraged to own and lease solar electric or other systems to consumers with the solar system paid for in a monthly utility bill, utilities could derive substantial economic benefits from controlling the utilization patterns of solar systems.[84] Another type of program would add the cost of insulation to utility bills to be paid back at a relatively low rate of interest.[85]

Processes of Change. In order to accomplish the changes to a utility system involving solar energy, public utility commission charters would need to be changed through legislative initiatives. One approach might be to revise charters to include responsibility for conservation of energy resources through pricing policies, fuel substi-

81. Robbins, WORKSHOP, *supra* note 4, at 13.
82. *Id.*
83. Thomas, *supra* note 4, at 6.
84. Booz-Allen, *supra* note 4, at I-6.
85. Hillhouse, *supra* note 4, at 16.

tution, and stimulation of new technologies. States might provide utility managements with information concerning solar energy feasibility in geographic areas in order to facilitate industry assessment of approaches to participation in solar system markets. Active participation on the part of utilities in solar energy markets could be beneficial both to the solar industry and to end users, but not at a net cost to utilities. Mechanisms need to be developed to ensure they do not inadvertently introduce unexpected economic disincentives elsewhere, or for consumers not using solar systems.[86]

The National Conference of State Legislatures has reported that "the appropriate solution to the conflict between solar energy and electric utilities is the establishment of a valid relationship between electric energy price and electric energy cost . . ." This would substantially improve the economic attractiveness of solar thermal development, including space cooling, and "would create strong incentives for solar energy utilizers to acquire systems designed for optimum patterns of utilization from both the utility . . ."[87] and public policy viewpoints.

Insurance. Another impediment to acceptance of solar heating and cooling may be the high cost of or unavailability of insurance. Solar devices may have special vulnerability to damage caused by falling trees and branches, ice, hail, wind, and vandalism. Robbins points out that:

> [W]ithout reasonable insurance rates, the risk may be beyond the ability of individual owners to assume. Especially critical here are the very large expanses of glass or plastic. . . . Basic insurance policies need to be analyzed to see what coverage is currently available for collectors. Another possibility is a federal insurance program alalogous to . . . flood insurance. . . . New structures might damage property of others, thus creating a combination of insurance and tort liability problems. . . .[88]

All of the above problems could be alleviated by proper design and the provision of liability insurance.

ATTITUDES

Certain incentives—such as outright grants and subsidies—would probably be met with skepticism, since they carry with them high administrative costs, the potential for abuse by corruption, and con-

86. Booz-Allen, *supra* note 4, at VI-19, 20.
87. Jones, *supra* note 4, at I-3.
88. Robbins, WORKSHOP, *supra* note 4, at 13; Legal Barriers, *supra* note 4, at 172.

ceivably could be cut out of future governmental plans more easily than they can be included in present ones. There is a feeling that subsidies tend to allow the unscrupulous and the inefficient to flourish without having to come up to market standards.

The federal government has begun to demonstrate a positive attitude for the first time. The President's National Energy Plan provides for up to $100 million for the installation of solar equipment in federal buildings. A public education initiative is proposed in the form of a joint federal-state program of development of standards, certification, and training of equipment installers and information gathering and dissemination.[89]

Four states have appropriated funds for demonstration of solar heating and cooling systems on state-owned or financed buildings.

Colorado: The north campus of the Community College of Denver had the largest solar energy hearing and cooling installation in the world when it was completed at the end of 1976; state funds of $736,000 were expended for the system.

Iowa: The state capitol complex in Des Moines has a solar heating demonstration system for which $200,000 was appropriated.

Nevada: The desert research institute of the University of Nevada received $370,000 in state funds for a solar heated and cooled solar energy research facility.

New Mexico: A solar heated and cooled office and laboratory constructed with $1,500,000 of state funds to be shared by New Mexico State University and the State Department of Agriculture has been completed at Las Cruces. A residential building is also the beneficiary of a $75,000 grant for a demonstration solar heating and cooling plant.[90]

Some cities have moved a considerable distance along the way to a concerted program. Los Angeles, California, has mobilized the Los Angeles Building and Construction Trades Council (AFL-CIO) and the Task Force on Alternative Energy Sources of City Commission Presidents, which joined the Mayor of the City in forming a Solar City Committee. The city is planning to heat swimming pools at schools and municipal parks, and it is possible that a $6.6 million grant will be received from the U.S. Department of Commerce Economic Development Administration to convert swimming pool heating from natural gas to solar power. The city's Department of Water and Power, cooperating with the Southern California Edison Company, a private utility firm, proposes to build a solar generating plant

89. NATIONAL ENERGY PLAN, *supra* note 2, at 75.
90. Binns, TURNING TOWARD THE SUN 31 (1975).

in the Southern California desert, to generate enough electricity for 2,500 homes. Southern California Edison also plans a program involving the installation of 1,400 electric-assisted solar hot water heaters in new homes. The hope is that solar energy would give Los Angeles a clean energy supply and a new segment of technical expertise and facilities.[91] Phoenix, Arizona, and Davis, California, are also prominent in the use of solar technology.[92]

Solar energy possibilities are even featured by those who advocate a slowing of growth. Recently, Commoner devoted a full chapter to solar energy possibilities. Nothing in the chapter is new, but ten or even five years ago such a subject would have been thought too speculative for inclusion.[93]

With the acceptance of solar energy by popular "tastemakers," removal of barriers by local governing bodies, and incentives from governments at all levels, solar heating and cooling can be fully utilized.

SUMMARY

The progress of heating and cooling buildings by means of energy from the sun will be highly dependent upon the economic and legal actions taken by states to supplement federal energy policy, which is only now beginning to be formulated in concrete terms. At the present time, state and local ordinances contain many impediments to advancement, but the situation is changing; seventeen states have passed enabling legislation to exempt solar installations from property tax assessments. Areas in which barriers can be additionally lowered and incentives increased include the following:

Access to Sunlight. As a result of judicial lawmaking in the United States, it is reasonable to conclude that zoning and land use planning, including the use of transferable development rights (with perhaps some resort to easements) will be the methods of choice for achieving equitable access to solar energy. These activities are really the province of state and local legislative bodies. The courts do not seem to have speedy remedies for access problems. The U.S. Congress may have to pass an overall statute that will make the responsibilities clear.

Marketing and Financing. The major actions that will provide an incentive for the market system to operate quickly include federally

91. News Release, City of Los Angeles, Wednesday, June 9, 1976, p. 1.

92. Letter from Thomas P. Graves, Director, Energy Staff, National League of Cities, United States Conference of Mayors (June 15, 1977).

93. B. COMMONER, *The Poverty of Power* 121 (1976).

funded, state-operated programs of grants and loans, which are beginning to accelerate, property tax relief by the states to encourage the purchase of units, capital investment credits for both manufacturers and users, sales and income tax incentives. All of these require federal, state, and local legislation, which is just beginning.

Design and Construction. The aesthetic barriers need to be overcome by a great deal of education of the general public and exposure to innovative designs. Building codes in over three thousand jurisdictions need attention, and materials and operating standards need development. This activity is in its infancy, but there are a number of progressive cities that are models for others to copy, including Los Angeles and Davis, California, and Phoenix, Arizona. Building standards and housing codes should be written so as to insure quality solar installations but to avoid restricting innovative systems concepts. The jurisdictional problems that labor unions have in determining who is responsible for solar heating and cooling unit installations need to be settled at the local level, perhaps by local ordinances.

Operating of Solar Heating and Cooling. Because of the intermittent nature of the solar supply, utilities will have to be linked into the system in ways that have not yet been settled, since there are regulations that interfere with utility desire to participate in the solar area: regulations that prohibit utility companies from selling equipment, problems of competition between utility company geographic monopolies, and the need for incentives to individuals and organizations to compete with utility companies on individual or community based units. State-wide public utility commission regulation, legislation, and local ordinances are needed.

Attitudes of Institutions. The attitudes of state and local governing bodies, of executive and legislative groups in the states, and of the judiciary need to be attuned to the important trends of the future. These are intangibles that will operate either as barriers to or incentives for the utilization of solar heating and cooling to its fullest extent in the next twenty years. Much will depend on the persistence of the federal executive branch, which must exert leadership. The expression of national energy policy in the President's National Energy Plan and its first review in the House of Representatives bodes well.