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William H. Lawrence
University of Toledo

John H. Minan
University of Toledo

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The Competitive Aspects of Utility Participation in Solar Development

WILLIAM H. LAWRENCE* & JOHN H. MINAN**

The development of renewable and essentially inexhaustible sources of energy is essential to the economic growth and stability of the United States.1 As concern over the environmental impact of using fossil fuels or nuclear energy increases, and the costs of conventional energy forms steadily rise,2 the need to develop alternative energy sources is compelling.3 One such alternative with substantial promise is solar energy.4

The sun is our most abundant source of energy; each day enough sunlight

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1 B.A. 1966, J.D. 1972, University of Oregon; Associate Professor of Law, University of Toledo.
2 B.S. 1965, University of Louisville; M.B.A. 1966, University of Kentucky; J.D. 1972, University of Oregon; Associate Professor of Law, University of Toledo.
3 The authors wish to acknowledge the outstanding editorial work of David L. Nevin, Instructor in Research and Writing, University of Toledo College of Law.
4 Oil imports in 1976 averaged 7.3 million barrels per day. In February, 1977 imports amounted to 9.6 million barrels per day. The Administration projects that without timely corrective measures, U.S. demand for imported oil is likely to be in the range of 12 to 16 million barrels per day in 1985. It is questionable whether the world's oil exporting countries will be able to satisfy that level of demand at reasonable prices. But even if they can, we believe it is clearly not in this Nation's interests to import so much of our energy needs. We must lessen the demand.
5 H.R. REP. No. 95-496, Pt. 4 95th Cong., 1st Sess. 16 (1977) (hereinafter cited as HOUSE REPORT).
6 "Residential electric bills alone have gone up 72 per cent in the last five years." Sweet, Meeting the Research Needs of State Regulators, 102 PUB. UTIL FORT. Aug. 17, 1978, at 11. Between 1969 and 1975 average residential electric rates increased by 54%. Because of increased consumption as well, the average bill rose 91%. Samuelson, Battle Lines Are Being Generated for Reform of Electric Utility Rates, 8 NAT'L J. 1474 (1976).
7 In conjunction with the National Energy Conservation Policy Act, Congress made the following findings:
The Congress finds that (1) the United States faces an energy shortage arising from increasing demand for energy, particularly for oil and natural gas, and insufficient domestic supplies of oil and natural gas to satisfy that demand; (2) unless effective measures are promptly taken by the Federal Government and other users of energy to reduce the rate of growth of demand for energy, the United States will become increasingly dependent on the world oil market, increasingly vulnerable to interruptions of foreign oil supplies, and unable to provide the energy to meet further needs; and (3) all sectors of our Nation's economy must begin immediately to significantly reduce the demand for nonrenewable energy resources such as oil and natural gas by implementing and maintaining effective conservation measures for the efficient use of these and other energy sources.
9 Increased use of solar energy is a national energy goal:
For long-term economic growth, the United States will have to make increasing use of renewable and essentially inexhaustible energy sources as substitutes for declining fossil fuel resources. One of the major renewable
falls on the earth to satisfy mankind's energy needs for fifteen years.\footnote{BUSINESS WEEK, Oct. 9, 1978, at 92.}

While solar power may soon be the fastest growing part of our energy supply,\footnote{Id. at 90.} the utilization of solar equipment is presently at an early stage of development. The extent of solar use in the future will be largely determined by the relationship of the utilities to solar energy. The utilities are in the unique position to directly affect the economics of solar use, and thus determine the viability of the emerging solar industry. One should not assume that utilities will react uniformly to competition from solar systems, nor that reaction will always be adverse. The character of each utility's reaction will be determined by the number and type of solar systems operating within its energy market and by a variety of other practical, economic, and legal considerations. Utilities may be either a barrier to the development of solar technology or an active participant in its harmonious integration into our energy structure. The purpose of this article is to analyze the various types of potential competitive interaction between the utilities and the solar industry which may affect the degree of solar utilization in our society.

The article is divided into an Introduction and three Parts. Since the analysis of the interface between solar energy and the public utilities will depend largely on the type of solar system, a brief introduction to solar technology is provided. Part I of the article examines how utility pricing policies and rules will shape consumer reaction and, as a consequence, determine the economic feasibility of supplying or manufacturing solar equipment. Solar energy systems generally require an auxiliary energy source to provide backup service, which in all but unusual cases will be provided by a utility.\footnote{Thomas, Miller and Robbins, Overcoming Legal Uncertainties About Use of Solar Energy, 1978 AM. B. FOUNDATION 18.} The economic benefit of using a solar system will be reflected in a reduced utility bill. The amount of any reduction depends, however, on the price charged by the utility for the backup service. The rates for supplemental service will thus significantly determine the economic feasibility of using solar equipment.\footnote{A detailed analysis of utility pricing for solar backup service is provided in Lawrence & Minan, Solar Energy and Public Utility Rate Regulation, 26 U.C.L.A. L. REV. \hfill \text{\textemdash} (1979).}

The focus in Part II is on the competitive aspects of the utilization of a single solar system by multiple users. The utilities can be viewed as the competitors of multi-user solar systems. The owners of shared systems may attempt to enter into direct competition with a utility by obtaining "public utility" status or may choose to operate within the utility's service area without seeking this status. In either event, the solar ap-
application competes with the utility and potentially reduces some portion of its present or projected energy market. The ramifications of this situation are considered in Part II.

Part III of the article analyzes the possibility of utilities becoming directly involved in the marketing of solar equipment, and considers further the alternatives under which this type of activity might occur. Essentially three options are available: the utilities could be given a monopoly over commercialization activities; they could be prohibited from participation; or they could be allowed to compete with other solar equipment suppliers. Each of these options is analyzed. The commercialization of solar equipment by the utilities would be controversial; it may also produce a dilemma, since the need to develop viable alternative energy sources may demand the vigorous participation of the utilities to encourage solar use, while the policy of favoring competition may demand just the opposite.

INTRODUCTION

Solar energy is both direct and indirect. Direct forms create energy by the action of sunlight on solar collectors, whereas indirect forms are additional energy sources made possible by solar insolation, such as wind energy, plant biomass fuels, and ocean thermal conversions. A distinction is also made between active and passive applications. An active solar unit is primarily an engineering system that transfers collected energy by mechanical or other means from the collector to the point of use. An active solar unit usually requires an auxiliary energy source to provide power when sunlight is not available and its storage capacity is depleted. In most instances this will be provided by a public utility. A passive method is essentially architectural in nature. It utilizes solar energy through manipulation of the relationship between a structure and the outside environment. The principal focus in this article is on direct,

**Controversy also follows the involvement of energy companies in the private sector. See Braden, Corporations and Their Monopoly on the Sun, The Wash. Post, March 6, 1976, §A at 17, col. 5. The oil industry in particular has shown interest in solar energy technology and has invested heavily in it. Shell Oil Will Invest a Further $2.6 Million in Solar Energy Firm, The Wall St. J., Jan. 2, 1976, at 3, col. 3; Gapay, Oil Firms Fear Moves to Bar Their Owning Other Energy Sources, The Wall St. J., May 25, 1977, at 1, col. 6. For a good discussion of diversification of oil companies into other segments of the energy industry see Note, Horizontal Integration In the Energy Industry, 29 BAYLOR L. REV. 941 (1977).**

**Bioconversion to fuels includes the production of organic matter (biomass) and its conversion to a variety of clean fuel products and other useful clean energy forms. Sources of biomass include urban solid waste, agricultural residues, and terrestrial and marine energy crops. 1 FEDERAL ENERGY ADMINISTRATION, PROJECT INDEPENDENCE: SOLAR ENERGY (1974)(hereinafter cited as FEDERAL ENERGY ADMIN.).**

**The purpose of ocean thermal conversion is to establish the technical, economic, and geopolitical feasibility of large-scale floating power plants capable of converting ocean thermal energy into electrical energy. Id. at VI-1.**

**See generally, Minan & Lawrence, State Tax Incentives to Promote the Use of Solar Energy, 56 TEXAS L. REV. 838-40 (1978).**
active solar applications.

The technical sophistication of active solar systems covers a considerable range. The flat plate collector uses a black chrome plate or other dark surface to absorb heat which is then transferred by a liquid or air to the point of use or storage facility. Solar systems typically use tanks of water, bins of rocks, or other materials to retain heat for later use. These systems are simple devices at the bottom rung on the ladder of technical sophistication in solar hardware. Currently they can cost from as little as $1000 for a simple hot water system to as much as $15,000 for one capable of supplying up to 70 percent of the total heating and hot water needs for a typical 2000 square foot house. Although flat plate collectors are usable in some industrial processes, technical limitations on their ability to efficiently operate at temperatures above 140 °F. are likely to confine their use to hot water and space heating in residential and commercial buildings.

Instead of a flat plate collector, an evacuated tube collector can be used. This type of collector has a pair of concentric glass tubes separated by a vacuum. The blackened inside tube absorbs solar radiation and passes the heat to the central pipe which is filled with fluid. The vacuum-seal design works as an efficient insulator since it is impervious to ambient temperatures or wind. Such a system can capture twice as much energy per unit area as a flat plate system, but is also approximately twice as expensive. Because of the greater efficiency, evacuated tubes are capable of producing higher temperatures, making solar air-conditioning technologically possible.

Solar photovoltaic power systems (PEPS) use semi-conductor materials to convert sunlight directly into electricity. Since the conversion is into direct current, power inverters are required to assure compatibility with alternating current. These systems offer the potential for highly reliable power in a variety of applications ranging from small, low-power instruments in remote areas to large central power stations. Modular installation allows the creation of a facility of practically any size. At present, two problems exist with this type of application:

1\textsuperscript{1}\textsuperscript{1}Federal Energy Admin., supra note 10, at II-5 - II-6.
1\textsuperscript{2}Business Week, supra note 5, at 92.

System costs vary a great deal because families and individuals have different energy demands and because there are a wide variety of systems on the market. The average installed cost of a flatplate water heater for a house in California is about $1,700 - $2,000. Family-size pool heaters cost between $1,000 and $3,000. Active space heaters cost between $3,000 and $10,000. For all these systems, you can cut the cost in half if you do it yourself. A well done passive solar heating system can add as little as $700 to the cost of a new house.

1\textsuperscript{3}\textsuperscript{3}Business Week, supra note 5, at 92.
1\textsuperscript{4}Id.

1\textsuperscript{5}\textsuperscript{5}Federal Energy Admin., supra note 10, at VII-19.
efficiency and cost. No current photovoltaic cells have achieved an efficiency greater than 13 percent. Research reported during the summer of 1978 predicts, however, efficiencies as high as 40 percent, so the efficiency problem may be solvable. Silicon-cell arrays, which are the photovoltaic front runner, can produce electricity for about $10 per watt during peak conditions. While the cost of photovoltaic generation of electricity is not presently competitive with conventional power, it has dropped tenfold in just three years. In addition, Congress recently approved the Federal Photovoltaic Utilization Act of 1978 which should provide a major boost to the photovoltaic industry. Its purpose is to establish a photovoltaic energy commercialization program for the accelerated procurement and installation of photovoltaic solar electric systems in federal facilities. The Act appropriated $98 million for the fiscal years beginning October 1, 1978, and ending September 30, 1981. This impetus could enable solar electricity to compete with utility-produced electricity.

Solar Thermal Conversion systems (STC) initially convert sunlight to high temperature heat which is then typically used as the energy input for the generation of electricity. High temperatures are obtained by concentrating sunlight on a focal point. The power tower is an illustration of this type of technology. The power tower uses a ring of sun-tracking heliostats surrounding a tower to focus the sun's rays on a vat of fluid located on top of the tower. The heat transferred to the working fluid is then used in a thermodynamic cycle. The concentrated sunlight produces temperatures which are high enough to drive turbine-generators and produce electricity. A pilot power tower project near Barstow, California will use 2000 heliostats and be capable of generating temperatures as high as 1000° F. The Barstow power tower will cost about $12,000 per kilowatt to build. The comparable investment for a coal-fired plant is about $1700

19BUSINESS WEEK, supra note 5, at 96.
20A center for gallium arsenide research announced it had achieved efficiencies as high as 28.5%, and that company researchers think that efficiencies could one day go higher than 40%. Id. at 99.
21Deputy Energy Secretary John O'Leary indicated that the cost is now at about $12 per peak watt. 4 SOLAR ENERGY INTELL. REP. 347 (1979).
23The Secretary shall insure that such systems reflect to the maximum extent practicable the most advanced and reliable technologies and shall schedule purchases in a manner which will stimulate the early development of a permanent low-cost private photovoltaic production capability in the United States, and to stimulate the private sector market for photovoltaic power systems. Id. § 567(a).
24The Energy Department has set a 1986 goal of reducing the cost of photovoltaics to $0.50 per peak watt. BUSINESS WEEK, supra note 5, at 96.
25FEDERAL ENERGY ADMIN., supra note 10, at III-1, III-6 through III-14.
per kilowatt, including both construction costs and the present value of
costs computed over a thirty year period.\footnote{Business Week, supra note 5, at 96.} Hopefully further power tower
research will enable costs to fall considerably.

The role of solar energy as a supplemental energy source will have a
significant effect on utilities. The flat plate solar technology is likely to
be used principally by an individual capturing energy for his own use.
The competitive interface with the utility is likely to occur through the
utility rate structure for backup service. The development of an economic
STC system is not likely to change the utility's traditional role since they
will be large systems which fulfill the same function and fit into utility
operations in the same manner as do conventional systems. The principal
impact will be on lower fuel costs for the utility. Direct conversion of
sunlight into energy through PEPS could significantly affect the
utilities. Economies of scale are not present with photovoltaics; thus, the
cost of one kilowatt of capacity will be about the same for either a small
or large PEPS facility.\footnote{Federal Trade Commission, Bureau of Competition, Proceedings of the Sym-
posium on Competition in the Solar Energy Industry: The Participation of Electric
Utility Companies in the Solar Energy Industry, 2 (National Economic Research
Associates, Inc. Publication N-20078) (Hereinafter cited as Federal Trade Comm'n).}
Since transmission costs could be avoided
through the use of small facilities, neighborhood or on-site generating
stations become a likelihood. Unless the utilities invest in these small-
scale operations, their role might be reduced to the provision of back-up
power for cloudy periods or nighttime. A breakthrough in photovoltaics
which either reduces cost or improves efficiency would drastically alter
the traditional function of the utility. Therefore, significant competitive
interaction can be expected in the development of a PEPS technology.

\section*{PART I: UTILITY PRICING POLICIES}

The economic feasibility of using solar energy generally depends on the
type of system considered. Although precise determinations on the com-
petitiveness of various systems are difficult due to the large number of
variables affecting the analysis, certain generalizations are useful. In the
opinion of most analysts, solar hot water heating is presently com-
petitive on a life cycle cost basis with conventional hot water heating
systems.\footnote{Hirshberg, Public Policy for Solar Heating and Cooling, Bull. of Atomic
Scientists, Oct. 1976, at 39.} Life cycle costing considers the cost of the system over its
useful life. The competitiveness of solar space heating is more controver-
sial, the most optimistic view being that it is competitive with conven-
tional systems only in some locations.\footnote{Id.} Solar air conditioning and
photovoltaics are generally viewed as offering the promise of being com-
petitive in the future.\footnote{Id.}
The application of present utility pricing methods creates an economic barrier to the use of solar energy. The pricing of natural gas insulates the consumer from the true costs of new supplies by averaging the price of new gas supplies with the price of existing supply contracts. The same principles of average costing apply in pricing electricity since the utility costs for new fuel supplies are rolled into the price of older fuel supplies. This pricing policy insulates the consumer from the actual incremental cost of acquiring new supplies of natural gas and fuel. Solar energy is placed at an economic disadvantage in trying to penetrate the heating market since it must compete with energy forms which are priced at less than their replacement cost to society. The adoption of a pricing policy by the utilities which places less preeminence on historical costs would not only improve the competitiveness of solar energy but would also provide an incentive to conserve fossil fuels.

When these average cost pricing methods are not a complete economic barrier, the solar user faces an economic trade-off in deciding on the appropriate amount of storage capacity to be used in conjunction with the solar system. A larger storage capacity provides greater independence from the utility, but the investment cost is also greater. A larger storage capacity also means that the total capacity of the system will be used less frequently, and thus at times there will be excess capacity. Consequently, most solar users are not likely to install storage capacity capable of satisfying their needs during the worst possible weather conditions since this capability would require a disproportionately greater investment. The solar user is more likely to solve this economic trade-off by installing a reasonable amount of capacity and turning to the utility for supplemental service when that capacity is expended. The trade-off which the solar user found too costly to meet by installing sufficient capacity would appear to be solved by transferring the problem to the utility.

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38STAFF OF SOLAR IMPLEMENTATION COMM., CALIF. ENERGY RESOURCES CONSERVATION & DEVELOPMENT COMM’N, SOLAR ENERGY IN CALIFORNIA: RESIDENTIAL THERMAL APPLICATIONS V-3 (Draft Report 1978).


38"Most solar heating and cooling applications to date provide between 70 and 80 percent of the needed energy requirements, meaning the remaining 20 to 30 percent must be provided from conventional backup sources." Bos, Solar Energy: Perspective and Prospects, 38 PROCEEDINGS OF THE AMERICAN POWER CONFERENCE 449 (1976).
Economic problems can be created, though, for the utility in supplying backup service to solar users. While most utility customers require service during the entire year, the solar customers will require backup service only when the capacity of their storage system has been expended. Furthermore, the demand for backup service is likely to coincide with peak demand periods. The annual peak load or peak demand represents the maximum power requirement upon the utility, and therefore determines the plant size necessary to meet that demand. Gas distribution utilities frequently experience their annual peak load during the coldest day of the year since this is the time when the demand for heating service is likely to be the greatest. Some electric utilities also experience a winter annual peak load. The need for heating backup service, although only intermittent, will occur during extended cold and cloudy periods, which will coincide with heavy demands for heating from non-solar customers. In order to satisfy the total demand for energy during these peak periods, the utility must have adequate generating capacity. However, since the backup demand is only intermittent, the utility might be the one with an investment in excess capacity.

Demand costs are a crucial factor in ascertaining the impact of excess capacity created in providing backup service to the solar user. These costs “consist of all or most of the plant-related costs, such as return on the rate base, principal taxes, the annual depreciation accrual and certain expenses of operation and maintenance.” Put simply, they are plant capacity costs which are determined by the size of the plant. Even if a portion of the plant capacity is used only occasionally to meet peak demand, full demand costs will still be incurred by the utility since they are fixed costs unrelated to the level of output.

Intermittent solar backup service will also lead to higher unit generation costs when the demand is on-peak. Utilities satisfy their base

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Footnotes:
37 The peak load is a calculation of energy use over time. Peak loads are measured on seasonal, monthly, weekly, daily, and hourly bases.
38 Although the majority of utilities are summer peaking due to air conditioning loads, there may be a future trend back toward winter peaking in many of these utilities due to moratoriums on gas and oil hookups and price increases for those energy sources. The Aerospace Corporation, Solar Heating and Cooling of Buildings (SHACOB) Requirements Definition and Impact Analysis 2 (Interim Report 1977). The significance of the seasonal peak occurring in the summer or winter is discussed extensively in Lawrence & Minan, supra note 8.
40 The total fixed costs, other things equal, are independent of the volume of service provided. That is, their total is a function of the size of total plant and does not fluctuate in accord with variations in output from a plant of a given size. This characteristic permits utilities other than telephone companies to achieve decreasing average unit costs as total plant capacity becomes more fully used.

Id. at 151.
load requirements with their newer fossil fuel and nuclear plants. The unit costs are low, but considerable time is required to start them up and bring them on line. As demand increases, the intermediate load consisting of older, less efficient coal-fired plants are brought on line. Peak load demand is usually met with plants fired by oil and natural gas. The fuels to fire these plants is more expensive, leading to higher unit generation costs, but they can be brought on line much more quickly. Thus, peak load requirements for backup service can involve substantial demand costs and higher unit costs in the utility’s operations.

By substantially increasing the price of its backup service, a utility could prevent the solar user from relying upon it for auxiliary power and thereby drastically affect the economics of solar energy as a competitive energy source. Utility decisions on pricing are regulated, however, by state law and the decisions of state regulatory commissions. Utilities are permitted to operate as monopolies in order to achieve the economic efficiencies associated with “natural monopolies.” The advantages of this form of market structure are preserved for the public through regulation of the prices charged and the services provided by the utilities. State statutes allow public utilities to charge only reasonable rates which do not unduly discriminate or give preferential treatment.

Although regulated, a utility is nevertheless entitled to the opportunity to earn a reasonable rate of return on the properties dedicated to serve the public, in addition to recovery of its proper operating expenses, taxes, and depreciation. The regulatory imposition of a rate that is not reasonable would constitute confiscation of property in violation of the Constitution. This constitutional limitation thus creates a legitimate

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4For an explanation of the characteristics of natural monopolies see infra notes 124-141 and accompanying text.


4The revenue requirement can be stated in formula form as follows: RR = OM + D + T + (G - AD) R, where:

RR = revenue requirement
OM = operation and maintenance
D = annual depreciation
T = taxes
G = gross value of the property
AD = accrued (or sometimes observed) depreciation of the property
R = rate of return (a percentage)
(G-AD) = rate base


4The Supreme Court reiterated the constitutional principle in several of its major opinions concerning regulatory rate-making. Smyth v. Ames, 169 U.S. 466, 526 (1898) (forbidden to have rates "so unreasonably low as to deprive the carrier of its property without
claim for increased total compensation to the extent that a utility can demonstrate that increased costs are imposed in providing this service. And, as has been demonstrated, the provision of backup service during on-peak hours can result in substantial increased demand costs.

Public utility rates have traditionally been based on cost of service principles. The total expenses of the utility are first allocated to customer classifications, such as residential, commercial and industrial classes.rate schedules designed to recover all costs allocated to each class are prepared by the utility, subject to regulatory scrutiny, and are used to determine the exact charges to each customer within the class. Three cost categories are recognized in this pricing procedure. The costs of metering and billing each customer are borne equally by all customers in a class and are known as customer costs. Energy costs are the expenses incurred by an electric utility to purchase fuel for use in the generation of power. Each customer’s proportion of these costs is determined by the amount of energy the customer consumes. Demand costs are the third and last component, and they are allocated to each customer class through the use of various formulas.

Application of cost of service principles to solar backup service would result in high rates for such service. The service could be separated from existing customer classifications since it is distinguishable on the basis that medical treatment consented to by said patient would be terminated in such an event. This document would be notarized and attested to by at such compensation as the Constitution secures”); Bluefield Water Works & Improvement Co. v. Pub. Serv. Comm’n, 262 U.S. 679, 694 (1923) (“utility is protected against being compelled to serve for confiscatory rates”); McCardle v. Indianapolis Water Co., 272 U.S. 400 (1926)(schedule of rates prescribed by state commission for a water company enjoined as confiscatory).

For a discussion of rate structures and proposed reforms see Note, Lexonomics and the Electrical Utility Industry: In Search of the Optimal Rate Structure, 61 IOWA L. REV. 134 (1975).

“Customer costs “include the expenses of meter reading, billing, collecting and accounting, and the costs associated with such company property as metering equipment and service connections.” P. GARFIELD & W. LOVEJOY, supra note 39, at 154.

Gas distribution utilities refer to these costs as commodity costs.

Energy costs “include for the most part, the expenses for fuel, fuel handling, and part of power plant operating and maintenance expenses.” P. GARFIELD & W. LOVEJOY, supra note 39, at 154.

Demand costs “consist of all or most of the plant-related costs, such as return on the rate base, principal taxes, the annual depreciation accrual and certain expenses of operation and maintenance.” Id.

The Peak Responsibility Method: Allocates demand costs among customer classes in proportion to the respective class loads at the annual peak demand on the system. The underlying hypothesis of this method is that the size of plant is determined by the annual peak, which is built up by those customer classes requiring service at that time. Accordingly, the demand costs associated with that maximum annual load are allocated among the classes in proportion to their contribution to that peak demand, regardless of how long they may use the demands they create.
of such factors as the purpose to which the service is applied, the intermittent nature of the demand and the consequent effect on utility demand costs. Under the demand cost allocation formulas, a large proportion of the total demand costs would then be allocated to the backup service customer class. The allocation formulas vary in whether they emphasize class peak demands or system peaks, but backup heating service is likely to involve both. Coincidence with these peaks would result in major allocations of demand costs and correspondingly high rates for backup service. Consequently, the solar user may be required to pay for the economic burden transferred to the utilities.

The regulatory commissions might decide for policy reasons to deviate from cost of service principles in the pricing of solar backup service. This approach could be based on a decision to encourage further development of solar energy, and could be accomplished by refusing to allow the utilities to classify solar backup service as a separate customer group or by requiring special promotional rates for such services. Some states have already passed legislation which forbids increased rates for solar backup. The adoption of this policy approach, however, is tantamount to subsidization of solar users. If the increased costs imposed on utilities to provide backup service can not be charged to solar users, they will inevitably be charged to other customers.

By combining heat storage technology with time of day pricing, backup service could be economically provided by the utilities and subsidization of solar users could be avoided.


Another major method is the Non-Coincident Demand Method.

The theoretical basis of this method provides that the joint-demand costs incurred in serving a number of customer groups should be allocated in proportion to the facilities necessary to serve each customer group separately. Accordingly, this method looks to class peak demand, regardless of the time of occurrence. These steps are required: (a) the peak demands of each class, regardless of time of occurrence, are added to find the sum of the maximum class demands; and (b) the allocation of system demand costs to each class is calculated on the basis of the ratio of each class peak to the sum of the maximum demands.

Id.

The Average-and-Excess-Demand Method "allocates the cost of capacity required to meet the average load on the basis of average customer demands and apportions the cost of excess facilities necessary to meet the system peak demand on the basis of non-coincident customer peaks." Jones, supra note 43, at 889 n. 66.


"The Peak Responsibility Method "considers demand and time of use only at the time of the system peak; it does not take into account the quantity of energy consumed."

The Non-Coincident Demand Method "recognizes as important only the peak demand of each class, but not the amount or time of use. Thus, a class whose peak occurred at the time of the system peak would be allocated the same proportion of demand costs as another class of equal peak demand occurring clearly off peak." P. Garfield & W. Lovejoy, supra note 39, at 160-61.

already in use in several New England areas. A transfer fluid or ceramics are heated electrically during non-peak hours in the early morning and late evening. This stored heat is then available for use the next day. Similarly, the fluid in the storage tank of a solar system could be heated during off-peak hours on those days when the solar energy is inadequate to assure a sufficient level of stored capacity. Some utilities have already adopted special rates for service provided only during off-peak hours. Since this off-peak service is less expensive for the utility to provide, the rates for such service have been significantly lower than rates for conventional service.

The off-peak service is more economical for the utility to provide because it does not coincide with the utility's daily peak. When service demand can be diversified by spreading it out during the day rather than having it overlap during relatively short periods, the utility can use its generation facilities more efficiently. A smaller plant capacity is possible whenever the peak demands of different classes do not have to be satisfied simultaneously. Hence, a very realistic way for utilities to try to avoid higher total demand costs is to encourage daily diversity in energy demands.

Although utilities in the past have vigorously promoted their various energy forms in order to increase total sales, greater emphasis is today being placed on diversification of customer demand. This heightened interest in diversity has been prompted largely by the effects of inflation on capital construction costs, delays and frustrations in obtaining

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58 Faced with revenue deficiencies, worsening load factors, and the recognition that baseboard heating is typically over 75 percent system peak coincident, and that heat pumps use less kilowatt-hours annually yet require the same capacity as baseboard electric heating systems, [utility and regulatory commissions] see storage heating as the next logical development of electric heating as the country moves to adopt ... time-based rates. Storage heating has now gone beyond the testing phase and is being marketed in competition with direct electric heating and oil and gas heating systems. deGrasse, Electric Storage Heating after Two Years, PUB. UTIL. FORT., January 6, 1977, at 23.

59 In 1974 the Vermont Public Service Board approved an optional seventeen-hour rate for the Central Vermont Public Service Corporation. Id. at 29.

Proposals and commission action for time of day rates have occurred in a number of states. E.g., California (San Diego Gas & Electric Co. filed Jan. 20, 1978); Connecticut (Connecticut Light & Power experiment beginning October 1975); Illinois (Illinois Power Co. filed July 23, 1976, in Docket No. 760435); Kansas (Kansas Gas & Electric Co. filed Sept. 10, 1976, Docket No. 109227-U); Virginia (Virginia Electric & Power Co., Docket No. 7864675).

60 The demand charge for peak-hour usage under the Central Vermont Public Service Corporation option rate (see deGrasse, supra note 56, at 29) is more than eight and one-half times the demand charge for off-peak hours. Id. Projected ratios have been indicated at 3 to 1 or 4 to 1, or even higher if the peak-load period is narrowly defined in terms of hours. Morrisey, The Changing Structure of Utility Rates, 97 PUB. UTIL. FORT. June 17, 1976, at 17-18.

61 "It is on-peak usage which requires the incurrence of the largest part of the electric utility’s costs." Jones, supra note 43, at 496.

62 There is no mystery about the utility industry’s problems. The group is facing strong demands to expand at a time when both money costs and construction
regulatory approval for the siting of nuclear and conventional power plants, and the evolution of a national policy promoting energy conservation. Thus, utilities have increasingly directed attention to various load management techniques designed to reduce the maximum power demand on a utility. These techniques include, for example, ripple or radio control mechanisms or other types of interruptible service, energy storage devices, and load limiting devices. Time of day pricing for backup service represents a means to induce customers to use such service only during off-peak hours in order to take advantage of the lower rates. Time of day pricing would provide an effective means of securing load management controls in addition to providing the solar user with an economical rate for backup service.

The utilities are in a position to stifle solar competition through the rate charged for solar backup service. The economic trade-off which the solar user finds too costly to meet by installing sufficient capacity to satisfy demand during the worst possible weather conditions has not been solved, it has merely been transferred to the utility. Since the demand for this service will occur during peak periods, thus making it some of the most expensive offered by a utility, the cost of providing it can be prohibitive. Ideally, the rate charged by the utility for backup service should be compensatory so as to avoid subsidization of solar users by other utility customers, while not imposing an economic penalty which discourages solar use. By combining heat storage technology with time of day pricing, the seemingly conflicting interests of the utility and the solar user can be reconciled, and the stifling of solar competition through the solar backup rate avoided.

PART II: MULTI-USER SOLAR SYSTEMS

Solar systems can be used to produce energy for apartment buildings, condominiums, shopping centers, industrial parks, or any similar activity where multiple users could utilize a single system. A shared solar...
system is capable of producing substantial cost savings. No matter where it is located within the area serviced by a utility, a multi-user solar system would compete with the utility. As a result of the National Energy Conservation Policy Act, which prohibits a public utility from supplying or installing residential solar energy devices used for hot water heating or space heating or cooling, a utility will likely be more sensitive to such competition. The response of the utilities and their regulators to this competitive interaction will determine the extent of any significant barriers to the utilization of multi-user solar systems.

Most utilities are presently confronted by a steadily increasing demand for power and by the accompanying difficulty of determining the appropriate means of generating that additional power. In addition, they face a growing series of procedural difficulties in securing authorization from the various regulatory authorities to proceed with their decision to provide increased generation capacity. Even when approval is secured, vast sums are required to finance actual implementation.

To the extent shared solar systems do not significantly interfere with or adversely affect their operations, utilities may have a tolerant attitude toward them. And, of course, a utility may have a permissive attitude toward multi-user solar systems if they alleviate its capital requirements by delaying or eliminating the need to build or finance new facilities. This situation might exist, for example, with a summer peaking utility since the solar systems would tend to reduce the seasonal peak demand.

To the extent that utilities are entitled to earn a rate of return on legitimate capital investments, a permissive attitude based on reducing the capital needs of national energy conservation policy act of 1978, act of nov. 9, 1978, pub. l. no. 95-619, 92 stat. 3207 (1978). id. at § 216(a)(1); § 210(11)(h). federal trade comm'nn supra note 28, at 4. approximately one-third of the states have power plant siting statutes which regulate the location of power plant facilities. see, e.g., ohio rev. code ann. §§4906.01-99 (1977). typically, the review process provides the opportunity for public participation and includes considerations on environmental effects, compatibility with land use plans, technical feasibility, and other factors. see, e.g., conn. gen. stat. ann. §§16-50g to 2 (west cum. supp. 1978); fla. stat. ann. §§403.501-.517 (west cum. supp. 1978); n.d. cent. code §§49-22-01 to 23 (1978). see generally, best, recent state initiatives on power plant siting: a report and comment, 5 nat. resource law. 668 (1972); journey, power plant siting - a road map of the problem, 48 notre dame l. 273 (1972); stone, power siting: a challenge to the legal process, 36 alb. l. rev. 1 (1971); tarlock, tippy & francis, environmental regulation of power plant siting: existing and proposed institutions, 45 s. cal. l. rev. 502 (1972); willrich, the energy-environment conflict: siting electric power facilities, 58 va. l. rev. 257 (1972); comment, power plant and transmission line siting: improving arizona's legislative approach, 1973 law and the soc. ord. 518; note, power and the environment: a statutory approach to electric facility siting, 47 wash. l. rev. 35 (1971). these statutes are not likely to present a significant obstacle to multi-user systems. however, one should be alert to the possibility that shared systems may involve extensive land use preemption and may also cause local thermal pollution and disrupt atmospheric circulation patterns. see j. holdren & p. herrera, energy: a crisis in power 115 (1971). lawrence & minan, supra note 8.
by their use will be affected by whether the "idled" capacity can be as economically deployed by the utility elsewhere through load management or other techniques. As long as the excess capacity can be effectively used to meet other loads or demands, the multi-user solar system is likely to be viewed as complementary to utility operations and not competitive.

A negative attitude may exist toward multi-user solar systems when the utility is left with excess capacity which can not be as economically deployed or when capacity must be expanded to meet solar backup demand. The utility may be required to increase capacity because, for example, the multi-user's need for backup service coincides with seasonal peak demand periods. Under either of these circumstances the utility faces decreased revenues without any corresponding cost benefit. Predictably, the utility will want to continue earning a return on the undepreciated portion of its investment in the "idled" or expanded facilities. The economic burden occasioned by either of these situations may be borne by the utility's non-solar customers, but this result would have to be achieved through a rate increase necessitating a change in the rate structure. Allocating the burden to the non-solar user would effectively subsidize the solar user at the expense of the non-solar user. A public utility commission or other regulatory agency may be reluctant to permit this form of subsidization out of a sense of equity or for other reasons. Moreover, the utility may be hesitant in seeking to use the rate structure to accomplish this purpose because of increasing customer hostility to rate increases. Thus, placing the added economic burden on non-solar utility customers may not be feasible.

As discussed in Part I, the rate structure for providing backup service to the solar user may be the mechanism for allocating the economic burden associated with the "idled" or expanded facilities. Since multi-user systems may receive backup service from the utility the same principles apply. Arguably, a utility may not be as reluctant to use the rate structure for placing the burden on the solar user class since it created the economic disadvantage. Statutory limitations may, however, limit the utility in doing this. Therefore, less politically sensitive or legally objectionable alternatives may be sought by a utility. One such alternative may involve the regulatory process.

A public utility operates in a natural monopoly market, and is generally spared from competition by government protection. Regulation has been the principal response to natural monopoly conditions. For the

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69 Supra notes 36 through 63 and accompanying text.
60 OKLA. STAT. ANN. tit. 17, § 156 (West Cum. Supp. 1977-78), specifically provides: "No public utility shall increase rates charged or enforce a surcharge on the basis of the use or installation of a solar energy device by a consumer."
71 The debate has raged long and hard over the merits of utility regulation. See Posner, Natural Monopoly and Its Regulation, 21 STAN. L. REV. 548 (1969); Comanor, Should Natural Monopolies be Regulated? 22 STAN. L. REV. 510 (1970); Swidler, Comments on the Case for Deregulation, 22 STAN. L. REV. 519 (1970); Shepherd, Regulation
most part, it is a state agency process conducted through a public utility commission (PUC) or similar regulatory entity. PUC jurisdiction and authority over shared solar systems will depend on the interpretation of state statutes and will vary between states.72

A utility may be required to obtain one or more franchises from the state or local governmental bodies located within the area it desires to serve.73 Typically, franchises grant the utility the right to provide its services for profit on an exclusive or nearly exclusive basis within a designated area.74 The terms of the franchise protect the utility from competitive encroachment.

Territorial protection by franchise has been superseded in practical importance, however, by the requirement that a certificate of public convenience and necessity be obtained from the PUC prior to the construction and operation of any new generation or transmission capacity.75 As a practical matter, the monopoly status of a public utility is established and maintained by the refusal of a PUC to authorize competition in a utility service area. This practical effect holds true regardless of the exact provisions of the certificates issued. Even though many states do not issue certificates that confer monopoly rights upon the certificate holders, a PUC may still refuse to authorize competition by the multi-user system unless the public convenience and necessity requires it.76 The certificate proceeding is an administrative matter for a PUC and certification is the foundation of the regulated monopoly principle under which most public utilities are protected and allowed to operate.

When the existing service is inadequate or when a new type of service is required, a PUC may permit competition. Ordinarily, while certificate proceedings inquire into the ability of an applicant to provide efficient and adequate service, they also determine the public need for the proposed service. The proceedings involve determinations as to the financial, engineering, and economic feasibility of the proposed project. They also examine whether another utility is already providing adequate service, and whether sufficient potential customers exist to make the enterprise a viable one.77 When the certificate application is based on deficiencies in existing service, many PUCs allow the incumbent utility a


76Id. at 29.
period of grace within which to effectuate reforms, unless it appears that any such effort would be futile. As a general rule, most PUCs prefer the incumbent utility over the new entrant when the applicant proposes obtaining a certificate to serve a need not presently being satisfied by an existing utility.

Whether the state certification process is an obstacle to the operation of multi-user solar systems principally depends on whether the solar activity is subject to PUC jurisdiction. Public utility status would entail the duty to obtain a certificate of public convenience and necessity before operating. Since additional regulatory burdens also accompany public utility status, the owners of a multi-user solar system are likely to want to avoid it. Public utilities hostile to the development of multi-user solar systems, on the other hand, are likely to favor subjecting them to PUC jurisdiction and regulation.

The form of energy supplied by the multi-user solar system may be controlling in determining PUC jurisdiction. Shared solar systems may be used to generate electricity, chemical energy, or thermal energy which may be in the form of steam or hot water. Some states do not grant jurisdiction over the production and sale of steam to the public utility commission. Generally, thermal energy is not regulated because the statutes fail to mention it. While electric utilities are uniformly regulated by public utility commissions, regulation of utilities supplying heating or cooling is not nearly as pervasive. Therefore, under existing state statutes multi-user electric solar systems are more likely to be subject to PUC jurisdiction than are multi-user heating or cooling systems.

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See, e.g., UTAH CODE ANN. § 54-4-25(l) (Supp. 1971) which provides: “No ... electric corporation ... shall henceforth establish, or begin construction or operation of a plant or system, without having first obtained from the commission a certificate that present or future public convenience and necessity does or will require such construction.”

If a shared solar system is found to be a public utility, it must file reports and accounts, serve all customers who demand service within a given area, submit its rate schedules to the PUC for approval, continue providing service until given permission to discontinue, provide safe and adequate service, and comply with limitations on the issuance of securities.

Dean & Miller, supra note 72, at 348.

See, e.g., FLA. STAT. ANN. § 366.02 (1968). But see, PA. STAT. ANN. tit. 66 § 1102(17)(a) and (b) (1959): “A public utility is defined as: ... persons or corporations owning or operating facilities for (a) Producing, generating, transmitting, distributing ... natural or artificial gas, electricity, or steam ... to or for public compensation.”


Dean & Miller, supra note 72, at 346.
In many states the term “public utility” is construed to require that the entity hold itself out as ready and willing to serve an indefinite public. The concept of dedication to the public use is normally controlling, and is usually evidenced by some act which is reasonably interpreted and relied on by the public as an indication of a willingness to provide service on equal terms to all who might apply. In addition to this requirement, a state may also require a sale before the activity obtains public utility status. In other states, activities not involving a service to the public have nevertheless been found to be so impregnated with the public interest that regulation as a public utility was warranted. An activity not involving a dedication to the public use may be judicially declared to be so affected with a public interest that PUC jurisdiction is justified. Public utility status also may depend on either the number of persons serviced or the amount of power produced. One state provides, for example, “no person shall be deemed to be a public utility if it presently produces or furnishes service to less than 25 persons.”

Varying legislative and judicial responses exist, however, when a lessor supplies utility service to a lessee. For example, a Utah shopping center

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Priest, supra note 85, at 24.


WECS, supra note 73, at 112.

MINN. STAT. ANN. § 216 B.02(4) (West Supp. 1977). See also ALASKA STAT. § 42.05.701(5)(A) (1962).

See, e.g., Sun Prairie v. PSC/Wisconsin, 37 Wisc.2d 96, 154 N.W.2d 360 (1967) (landlord furnishing power to tenants is not a public utility. “Public” is construed to mean more
owner was not allowed to generate and distribute electrical power to its tenants, who were all retail business outlets in the shopping center, without being regulated as a utility. The generating facilities were located on contiguous private property owned by the shopping center, and the service was to be supplied only to its tenants. The Tenth Circuit held that the shopping center had no right to sell electricity since it lacked the necessary certificate of public convenience and necessity. In contrast, some states specifically exempt lessors from utility regulation. A Minnesota statute, for example, provides that no entity shall be deemed to be a public utility if it furnishes services only to tenants in buildings owned, leased, or operated by it. Furthermore, some PUCs have rejected jurisdiction when the cost of the service is included in the rent on the basis that the service is not affected with a public interest. However, metering and charging each lessee for the electrical service, as distinguished from including it in the rent, may result in PUC jurisdiction.

Public utilities have been traditionally required to provide a certain quality of service to their customers. If the multi-user solar system falls within PUC jurisdiction, the discontinuous nature of the power it provides may give an independent justification for denial of certification. If, however, the multi-user system effectively provides continuous service through the use of storage capabilities or a conventional backup source, the discontinuous nature of the solar power itself may not be determinative.

Recent federal legislation has removed some of the present discretion from the state regulatory authorities. The Public Utility Regulatory Policies Act of 1978 permits the Federal Energy Regulatory Commission to prescribe rules relating to the exemption of "qualifying cogeneration facilities" from state laws and regulation respecting electric utility regulation. The term cogeneration facility is defined as a "facility which than the relation between landlord and tenant or the nearness of location of neighbors); Dreselbrook Assoc. v. Penn P.U.C., 418 Pa. 430, 212 A.2d 237 (1965) (service for tenants of apartment village is not service to the public so supplier is not a public utility); General Split Corp. v. P & V Atlas Indus. Center, Inc., 44 P.U.R.3d 334 (1962) (landlord serving and submetering only his tenants is not a public utility); State v. Public Serv. Comm. of Mo., 178 S.W.2d 788 (1944) (those selling electricity to themselves and tenants in their building are not a public utility); Jones v. Sweetland Co., 162 N.E. 45 (1928) (realty company furnishing electricity to tenants but not selling to public utility).

"Cottonwood Mall Shopping Cent., Inc. v. Utah Power and Light Co., 440 F.2d 36 (10th Cir. 1971).
"See, e.g., MINN. STAT. ANN. § 216 B.02(4) (West Supp. 1977).
"See, e.g., Turner, supra note 77, at 705-06.
"Act of Nov. 8, 1978, Pub. L. No. 95-617, 92 Stat. 3117 (1978) at § 210(e) provides:
(c) Exemptions. (1) Not later than 1 year after the date of enactment of this
produces (i) electric energy, and (ii) steam or forms of useful energy (such as heat) which are used for industrial, commercial, heating, or cooling purposes. A facility owned by a person not primarily engaged in the generation or sale of electric power and determined by the Federal Energy Regulatory Commission to meet certain requirements respecting minimum size, fuel use, and fuel efficiency, is defined as a qualifying cogeneration facility. In most instances the promulgation of rules by the Commission should exempt multi-user solar systems from PUC jurisdiction.

The Public Utility Regulatory Policies Act represents an effort to adopt a comprehensive set of national policies, and by doing so changes the states' role in determining energy policy. Given the disparity between states as to the type of activity having public utility status, the establishment of a unified scheme for the amount of power which can be produced without being subject to state regulation is desirable and should facilitate the utilization of shared solar systems. Furthermore, multi-user activities which are limited in scope and do not evidence an intent to serve all comers may not be subject to PUC jurisdiction in some states. Desires on the part of public utilities to resist the development of multi-user solar systems through the regulatory certification process are thus unlikely to be realized. This assessment does not mean, however, that a utility has lost the potential to limit or control multi-user competition within its service area.

The owners of multi-user solar systems may wish to interconnect with the local utility for supplemental power, and this desire may provide a utility with an alternative mechanism for exercising some control over their operation. Although a utility is under a general duty to supply all act and from time to time thereafter, the Commission shall, after consultation with representatives of State regulatory authorities, electric utilities, owners of cogeneration facilities and owners of small power production facilities, and after public notice and a reasonable opportunity for interested persons (including State and Federal agencies) to submit oral as well as written data, views, and arguments, prescribe rules under which qualifying cogeneration facilities and qualifying small power production facilities are exempted in whole or part from the Federal Power Act, from the Public Utility Holding Company Act, from State laws and regulations respecting the rates, or respecting the financial or organizational regulation, of electric utilities, or from any combination of the foregoing, if the Commission determines such exemption is necessary to encourage cogeneration and small power production.

(2) No qualifying small power production facility which has a power production capacity which, together with any other facilities located at the same site (as determined by the Commission), exceeds 30 megawatts may be exempted under rules under paragraph (1) from any provision of law or regulation referred to in paragraph (1), except that any qualifying small power production facility which produces electric energy solely by the use of biomass as a primary energy source, may be exempted by the Commission under such rules from the Public Utility Holding Company Act and from State laws and regulations referred to in such paragraph (1).

98Id. § 201.
99Id.
those within its service area, this general principle is subject to a number of exceptions. If a customer sells the service to others,\textsuperscript{101} or violates utility rules or regulations, or permits those who are not customers of the utility to use its service, the utility's duty to provide service may be negated.\textsuperscript{102} In order to prevent service contracts or utility regulations from being used to impose unreasonably restrictive terms and conditions on the owners of multi-user systems, uniform state or federal laws anticipating this problem are desirable.\textsuperscript{103}

Allowing a utility to control the standards under which the interconnection can be made is another problem area since such standards may effectively limit competitive entry. This problem was recognized, for example, in \textit{Radiant Burners, Inc. v. Peoples Gas Light and Coke Co.}\textsuperscript{104} Radiant Burners manufactured a new and arguably improved gas burner but was refused the seal of approval of the American Gas Association. This action by the Association practically destroyed the market for the burner since gas distributors refused to connect their facilities to furnaces lacking the seal of approval. Multi-user systems could face similar difficulties. Any procedure for setting standards that contemplates a controlling or substantial voice for a utility has the potential for competitive abuse.\textsuperscript{105} But advantages also accompany allowing limited utility


\textsuperscript{102}See Note, \textit{The Duty of a Public Utility to Render Adequate Service: Its Scope and Enforcement}, 62 COLUM. L. REV. 312 (1962). See also, Toledo Edison Co. Rules and Regulations Regarding Customers' Wiring and Installations, filed pursuant to Order No. 71-148-Y of the P.U.C. of Ohio, dated January 31, 1973, § (1) which provides: "The Company shall have the right to refuse to connect any wiring or installation which does not fully meet these requirements, regulations and rules, also the right to disconnect the wiring or installation of any customer violating any such requirements, regulations or rules . . . ."

\textsuperscript{103}Congress took a preliminary step in this direction with the adoption of the following:

Upon application of any . . . qualifying cogenerator, or qualifying small power producer, the Commission may issue an order requiring—

(A) the physical connection of any cogeneration facility, any small power production facility, or the transmission facilities of any electric utility, with the facilities of such applicant,

(B) such action as may be necessary to make effective any physical connection described in subparagraph (A), which physical connection is ineffective for any reason, such as inadequate size, poor maintenance, or physical unreliability,

(C) such sale or exchange of electric energy or other coordination, as may be necessary to carry out the purposes of any order under subparagraph (A) or (B), or

(D) such increase in transmission capacity as may be necessary to carry out the purposes of any order under subparagraph (A) or (B)." 92 Stat. 311, § 202.

\textsuperscript{104}364 U.S. 656 (1961).

participation in standard setting. A utility has a specialized technological expertise which can be brought to bear on the complexities accompanying both the operation of the multi-user system and its interconnection with existing utilities. In addition, utility personnel are familiar with the specific heating and cooling requirements of customers within their service area. The harmonious integration of shared systems into utility operations is more likely if the utility is involved to some extent in standard setting. Further, the utility may have an incentive to insure that multi-user systems perform efficiently and reliably in order to minimize unplanned additions to peak demand. In sum, utilities will need to have a comprehensive understanding of multi-user systems in order to plan for adequate service, since both the type of installation and its reliability can have important effects on the utility’s costs and capacity requirements. However, serious consideration must be given to the potential competitive dangers which would result from the control of shared solar systems by rules and regulations formulated by utility policy.

Depending on state law, multi-user solar systems may be subject to PUC jurisdiction and utility certification. The requirement that the owners of a multi-user system obtain a certificate of public convenience and necessity before construction or operation may pose an obstacle to the use of such systems. The Federal Energy Regulatory Commission has been granted authority by the National Utility Regulatory Policies Act of 1978 to promulgate rules exempting qualifying cogeneration facilities, which in most instances would include multi-user systems, from state laws and regulations respecting electric utility regulation. The exercise of this authority is likely to minimize the importance of state certification procedures as an impediment to the use of shared solar systems. However, the rule-making process will afford to the public, which includes the states and utilities, the opportunity to comment on the proposed rules and thus perhaps influence their final promulgation. State law will control, of course, until such rules are actually promulgated. Non-exempted, large scale multi-user systems would still be subject to state control and certification.

PART III: COMMERCIALIZATION OF DECENTRALIZED SOLAR EQUIPMENT

Some public utilities have already begun marketing solar equipment, and some others have evidenced strong interest in being permitted to do so. Factors which may not be readily apparent explain why the utilities

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108 In California several utilities, including San Diego Gas and Electric, Southern California Gas, Southern California Edison, and the City of Santa Clara’s municipal electric utility, have indicated an interest in solar marketing. STAFF OF SOLAR IMPLEMENTA-
are interested in such market entry. Natural gas utilities envision solar energy as a means to conserve dwindling supplies of natural gas by relying on solar energy to satisfy a portion of customer demand.\textsuperscript{109} Electric utilities\textsuperscript{110} are more likely to focus on decentralized use of solar energy for load management purposes. Widespread adoption of solar systems with adequate storage capacities could significantly diversify utility customer demand, smoothing out a utility's load curve to enable more efficient use of plant facilities. Time of day pricing as it affects the operation of solar energy systems is not the exclusive means to achieve load management control.\textsuperscript{111} However, to the extent that such systems are cost beneficial compared with other control techniques and effective in diversifying demand, the utilities are likely to be interested in greater solar utilization.\textsuperscript{112}

Recent legislation deals specifically with utility involvement in the commercialization of solar equipment. The National Energy Conservation Policy Act\textsuperscript{113} includes a provision which prohibits utilities from supplying, installing or financing solar energy equipment or other energy conservation devices.\textsuperscript{114} Definition, exemption and waiver provisions operate, however, to make the prohibition less than absolute or complete. Section 216(a)(1) provides that no public utility may "supply or install a residential energy conservation measure," which is defined to include, among other things, "devices to utilize solar energy or windpower for any residential energy conservation purpose, including heating of water, [and] space heating or cooling."\textsuperscript{115} The term "residential building" is defined as "any building used for residential occupancy which . . . contains at least one, but no more than four, dwelling units . . .".\textsuperscript{116} Thus, utility participation is not prohibited either for industrial and commercial applications, or for residential buildings exceeding four units.

The Act also includes exemption provisions which could have relevance to utility involvement in the commercialization of solar energy. The pro-

\textsuperscript{109}OFFICE OF TECHNOLOGY ASSESSMENT, APPLICATION OF SOLAR TECHNOLOGY TO TODAY'S ENERGY NEEDS 150 (1978).
\textsuperscript{110}The Southern California Gas Co. has initiated a Solar Assisted Gas Energy (SAGE) program. A test installation in El Toro, California supplies hot water for 32 apartments and a laundry room. The SAGE system is estimated to save about 1,200 cubic feet of natural gas daily. SAGE Fact Sheet included in J. WILLIAMS, supra note 107.
\textsuperscript{111}Nearly 100 electric utilities have developed projects in solar heating and cooling. ELECTRIC POWER RESEARCH INSTITUTE, SURVEY OF ELECTRIC UTILITY SOLAR PROJECTS, ER 321-SR (1977).
\textsuperscript{112}See the references to time activated switches and ripple or radio controls in Miller & Gerber, supra note 63.
\textsuperscript{113}In 1975 capital costs to control a kilowatt of load on peak were $80 and $100 compared with $100 to $300 per kilowatt for additional peaking capacity. Gilbert & deGrasse, PROSPECTS FOR ELECTRIC UTILITY LOAD MANAGEMENT, PUB. UTIL. FORT. AUG. 28, 1975, at 19.
\textsuperscript{115}Id. at §216(2).
\textsuperscript{116}Id. at §210 (11)(H).
hibitions on supply, installation, and financing will not apply to any solar equipment which the Secretary of Energy determines were being installed on the date of enactment of the Act,117 nor to any supply activities “which the Secretary determines were broadly advertised or for which substantial preparations were completed on or before the date of enactment” of the Act.118 Considerable discretion has been delegated to the Secretary of Energy to ascertain those activities falling under the rubric of “substantial preparations.” Utilities which have engaged in extensive data accumulation and assessment with a view toward entering the field arguably should be included. Additional discretionary authority is delegated to the Secretary of Energy to grant temporary exemptions for a period not to exceed three years.119 A general exemption covers devices associated with load management techniques, but limits the exemption to techniques applicable to the type of energy sold by the utility.120 Its application to solar equipment, therefore, would only relate to photovoltaic systems supplied or financed by electric utilities.

The Act contains another extremely significant waiver provision. The Secretary of Energy, upon a petition of a public utility supported by the Governor, is authorized to waive in whole or in part the prohibitions on the utility supplying, installing, and financing solar devices, though certain standards must be met.121 The Secretary must be satisfied that in engaging in the otherwise prohibited activities “fair and reasonable prices and rates of interest would be charged” and the Secretary must find, “after consultation with the Federal Trade Commission, that such activities would not be inconsistent with the prevention of unfair methods of competition and the prevention of unfair or deceptive acts or practices.”122

The net effect of Section 216 is not so much to absolutely prohibit the supply, installation, and financing of solar equipment and other conservation measures by interested utilities, as to extend federal regulation to the pricing and competitive impact of utility activities in this area. In essence, the Secretary of Energy has been delegated the authority to determine on a case by case basis the extent to which utilities will be allowed to participate in the commercialization of solar energy equipment and other energy conservation devices. Congress has closed the field to

117Id. at §216 (d)(1).
118Id. at §216(d)(2).
119Id. at §216(2).
120Id. at §216(b).
121Id. at §216(e).
122Id. These provisions in the federal law are similar in effect to a recently enacted statute in California. The state law requires that before a utility or its subsidiary could begin a solar manufacturing or marketing program, the Public Utilities Commission would have to find that the proposed program does not restrict competition or growth in solar development. The law exempts affiliates of utilities. Public Utilities - Solar Energy Development, Chapter 1102, 1978 Cal. Legis. Serv. 3689 (West) (to be codified as CAL. PUB. UTIL. CODE § 2775.5).
public utilities until federal officials have had the opportunity to scrutinize and approve a utility's proposed involvement. Although the Act is not written in terms of licensing or certification, a form of prior approval is nonetheless made a condition to entry.

Although the National Energy Conservation Policy Act has a significant impact on utility involvement in the commercialization of solar equipment, it has by no means completely foreclosed its participation. The current regulatory restriction might be removed if the policy makers determined, for example, that solar energy was not being sufficiently adopted by our society. Thus, consideration of all of the policy options concerning utility marketing of solar equipment, including granting utilities monopoly status, is still relevant. The existing legislation is based upon policy considerations favoring competition over monopoly. As the following discussion demonstrates, this preference is valid since monopoly control by utilities cannot be justified under any of the traditional regulatory rationales.

The Act has also made more timely the consideration of the other two policy options: A complete, absolute ban on utility involvement and the allowance of competitive utility participation. The Act, in addition to delegating authority, identifies some broad policy considerations. The Secretary of Energy and his advisors must now further refine these policies in order to respond to petitions which may be forthcoming from utilities. This task will hopefully be undertaken with a careful consideration of each of these options and of the consequences accompanying them. The following analysis deals with the major factors which should affect the Secretary's decisions.

Extending the Monopoly Franchise of Public Utilities

Various rationales have been developed to support the legal restriction of free entry into businesses. When applied to the extent of allowing entry by only one firm, monopoly conditions exist. This section analyzes the four major criteria for limiting entry: Natural monopoly conditions, limited physical resources, cream-skimming, and destructive competition.

Natural Monopoly Conditions

The primary rationale for government support of monopoly status is the principle of natural monopoly. The principle is based on the realizat-
tion that monopolies represent the most efficient form of market organization for industries having certain economic and physical characteristics. Although most of the public utilities in this country\(^{125}\) originated under conditions of competition, their evolution led to price wars, deteriorated service, and eventual consolidations.\(^{126}\) This historic trend of failure of the competitive forces in these industries eventually resulted in state regulation, which protects the public by setting prices and providing for required levels of services. The regulatory legislation also creates monopoly positions for utilities thereby allowing them to realize the most efficient means of production.\(^{127}\)

An industry is subject to the law of increasing returns when unit costs tend to decline as output is increased.\(^{128}\) The existence of this economic characteristic over the entire extent of the market is the essential prerequisite of natural monopoly.\(^{129}\) Related and additional characteristics, including economies of scale, direct connections of supplier and customer, and diversified demand characteristics are related elements in the makeup of natural monopoly. As demonstrated below, since these characteristics are absent, no justification exists for giving the utilities an exclusive franchise based on natural monopoly conditions for the commercialization of solar equipment.

Declining unit costs resulting from increases in output essentially follow from the extensive fixed or capital costs which some industries must incur.\(^{130}\) As production increases, the fixed plant costs are allocated among a greater number of units, thereby decreasing the costs for each

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\(^{125}\)See Pace, Relevant Markets and the Nature of Competition in the Electric Utility Industry, 16 ANTITRUST BULL. 725 (1971) for a discussion of the proposition that “to the extent that the characterization of electric utilities as natural monopolists is no longer accurate, it follows also that traditional market definitions are no longer appropriate.” Id. at 727. The article explores “how one may define meaningfully for the electric utility industry those market forces are or could be at play.” Id.

\(^{126}\)Competition “favored the public for a time with low rates, but invariably at the expense of a deteriorated service. Financial exhaustion of one or more of the companies eventually brought about a complete consolidation, or an agreement as to rates or territory.” 2 A. KAHN, supra note 124, at 118, citing BEHLING, COMPETITION AND MONOPOLY IN PUBLIC UTILITY INDUSTRIES 20 (1938). For an excellent discussion of the development of both public utilities and the regulatory controls over them see W. JONES, CASES AND MATERIALS ON REGULATED INDUSTRIES 1-69 (2d ed. 1976).

\(^{127}\)E.g., Idaho Power & Light Co. v. Blomquist, 26 Idaho 222, 141 P. 1083 (1914)(upheld restrictions on entry of electric utilities since several suppliers would create inefficiency and the financial stability of existing companies necessitated a restriction on competition).

\(^{128}\)Before the turn of the century Henry Carter Adams distinguished such industries from those subject to laws of constant returns and those subject to the law of increasing returns. See H.C. ADAMS, RELATION OF THE STATE TO INDUSTRIAL ACTION (1887).

\(^{129}\)“The critical and— if properly defined— all-embracing characteristic of natural monopoly is an inherent tendency to decreasing unit costs over the entire extent of the market.” 2 A. KAHN, supra note 124, at 119. “An industry where the single-firm average cost curve declines over the entire range of demand is called a ‘natural monopoly’ industry.” D. BOIES & P. VERKUIL, PUBLIC CONTROL OF BUSINESS 27 (1977). Natural monopoly is an industry where “the long-run unit cost function declines continuously out to a scale of output which saturates potential market demand.” F. SCHERER, INDUSTRIAL MARKET STRUCTURE AND ECONOMIC PERFORMANCE 520 (1970).

\(^{130}\)2 A. KAHN, supra note 124, at 119.
SOLAR DEVELOPMENT

the utility is likely to exist, if at all, only in the short run. The likelihood of a permissive attitude accompanying a reduction in demand occasioned unit of production. While all plants are subject to such economic principles within their production capacity limits, high fixed costs alone do not lead to natural monopoly conditions. Decreasing unit costs over the entire range of demand are attainable only when an industry can realize significant economies of scale. Such economies result when a larger plant or production unit can produce at less cost than several smaller plants or units. Under these conditions, a single supplier becomes the most efficient producer.

If the utilities market solar equipment they will clearly have to raise and invest significant sums of money either to manufacture the equipment themselves or to procure it elsewhere. Declining unit costs in the manufacture and marketing of solar panels will be limited to those which can be realized from production utilizing greater manufacturing plant capacity or from discounts related to volume purchases. Neither the manufacturing nor the marketing has technological advantages related to size of output so as to give rise to economies of scale, nor do the existing utilities have any inherent advantages in this regard over other suppliers. Although electric utilities realize economies of scale in the generation and transmission of electricity, as do gas utilities in distributing natural gas, those economies of scale are not applicable to their commercialization of solar equipment. Sales and leases of solar products are like the retailing of other home heating and cooling equipment, and such retailing business is not subject to economies of scale.

Marketing solar energy systems lacks another characteristic common to natural monopolies. The public utility natural monopoly markets have "lines" which connect the supplier with the consumer. The significant

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131 P. GARFIELD & W. LOVEJOY, PUBLIC UTILITY ECONOMICS 17 (1964).
132 A. KAHN, supra note 124, at 121 & n. 20.
133 Id. at 121.
134 "Finally, economies of scale tend toward monopoly only if costs are still declining when market demand is exhausted. If costs of operation level off at some point short of that at which market demand is satisfied, an industry can accommodate multiple firms of optimal scale." W. JONES, supra note 126, at 51.
135 "The dominant reason for the failure of competition to survive in the utility industry is the fact that utilities operate at or near lowest average cost, in supplying a particular market, when free from the competition of other sellers of the same service." P. GARFIELD & W. LOVEJOY, supra note 131, at 16.
136 A business enterprise that is relatively large can realize economies from buying in large quantities. The overhead cost of purchasing are [sic] subject to decreasing average charges as the size and volume of purchases increase. Further, large buyers receive economies of quantity and volume discount given by the seller filling large orders." Id. at 18.
138 W. JONES, supra note 126, at 61-62. Examples of these lines are the underground pipes in natural gas and water utilities, transmission wires for electricity, and rails for railroads.
investment in these lines\textsuperscript{139} is the basis of the natural monopoly\textsuperscript{140} since their duplication by a competitor creates more capacity than is required and thereby unit costs are raised.\textsuperscript{141} Physical lines of connection do not have to be constructed before a sale or lease of solar equipment can be made.

The fixed lines between the supplier and customer result in the creation of a geographical market which can serve customers only in that area. The fixed costs of investment in these permanent connections can thus be recovered only in the market in which they are constructed. On the other hand, the supplier of solar equipment, like the manufacturer or retailer of electrical or gas appliances, is not bound by such market constraints, since these services can be more easily shifted to other markets.

The relationship of diversity of demand to possible economies of scale is yet another aspect of the natural monopoly concept which is inapplicable to solar equipment supply activities. When a single firm has an entire service market the prospects of diversity are enhanced.\textsuperscript{142} In serving all of the market, the types of customer demands and the times at which they occur are more likely to vary. The monopolist can thus serve the entire market more efficiently, since the off-peak services are determined against a single market peak.\textsuperscript{143} Solar equipment sales, however, are unrelated to such concepts of diversity. The seller is not under the obligation to meet the customer’s demand instantaneously. The customer demand is also singular, not recurring, and is thus not affected by concepts such as time of demand.

Limited Physical Resources

Even in the absence of natural monopoly characteristics, limits on entry can be justified in some industries on the basis of a need to allocate limited physical resources.\textsuperscript{144} The television and radio broadcasting bands provide an excellent example. Since transmissions on the same frequency within the same geographic area will cause intolerable interference, a system of licensing is used to allocate the limited number of

\textsuperscript{139}Fixed costs “often exceed one-half the total company cost of service in the electric and other utility industries.” P. Garfield & W. Lovejoy, supra note 131, at 151. The electric power industry is “the largest in the United States in terms of capital assets, sixty percent larger than its nearest rival.” Special Committee on Electric Power and the Environment, Association of the Bar of the City of New York, Electricity and the Environment 23 (1972). Only about one-half of the capital costs are attributable to generating facilities, thereby demonstrating that a significant portion of a utility’s capital costs are devoted to transmission and distribution facilities. P. Joskow, Applying Economic Principles to Public Utility Rate Structures: The Case of Electricity, in Studies in Electric Utility Regulation 17 (C. Cicchetti and J. Jurewitz eds. 1975).

\textsuperscript{140}“While the local distribution and long distance transmission of electricity have natural monopoly characteristics, the generation of electricity has characteristics more analogous to manufacturing—i.e., economies of scale up to a point, with multiple producers feasible beyond that point if there is a sufficiently broad market for the product.” W. Jones, supra note 126, at 52.

\textsuperscript{141}Cf. 2 A. Kahn, supra note 124, at 121 & n. 21.

\textsuperscript{142}Id. at 122.

\textsuperscript{143}P. Garfield & W. Lovejoy, supra note 131, at 18.

\textsuperscript{144}T. Morgan, Economic Regulation of Business, 57 (1976).
frequencies to broadcasters. Since the demand for licenses exceeds their supply the licensing regulation restricts entry into the broadcasting field.\footnote{146} If entry is restricted to a single firm, as for example in the licensing of hydro-electric plant development along a particular location on a river,\footnote{146} the successful entrant acquires a monopolistic position supported by regulation with regard to the affected physical resource.\footnote{147}

By contrast, the required resources for the development of commercialized solar energy are abundant. For all practical purposes the supply of sunshine is without limit; indeed this availability makes decentralized exploitation feasible. Nor are the natural resources necessary to manufacture solar equipment unique or in short supply.\footnote{148} In short, solar resources are not limited, so this second rationale will not support any restriction on the number of entrants to the field, let alone justify the creation of a monopoly position.\footnote{149}

Prevention of Cream-Skimming

The prevention of cream-skimming as a basis for restricting free entry into a field has at least two distinct facets. One is the concern that new entrants in a field will deal only in the most lucrative sectors of the market avoiding the less attractive sections.\footnote{150} This possibility is particularly significant with public utilities since they operate under an obligation to serve all of their market, despite losses on some service.\footnote{151}

\begin{footnotes}
\item[144] U.S.C. \$ 301 (1976).
\item[145] U.S.C. §§797(e), 817 (1976).
\item[146] Even if the rationale of limited supply of physical resources were applicable to decentralized solar energy exploitation, the existing utilities would not be an inevitable choice to occupy the preferred position. As in the case of broadcasting license allocation by the Federal Communications Commission, criteria for the selection of licensees would have to be established. See e.g., Policy Statement on Comparative Broadcast Hearings, 1 F.C.C. 2d 393 (1965).
\item[147] "'Both solar heating and thermal electric systems use large quantities of steel, concrete, aluminum, copper, plastic and glass." Baron, Solar Energy—Will It Conserve Nonrenewable Resources? 102 PUB. UTIL. FORT. September 28, 1978, at 32.
\item[148] Even though the resources required to construct solar systems are not rare, they still are nonrenewable. This latter characteristic leads to some important conservation considerations.
\item[149] If solar energy applications are to be successful, the energy consumed for fabrication, construction, and operation of these plants must be less than the energy recovered by these solar systems over their operating life. If the cumulative consumption of nonrenewable resources of natural gas, oil, coal, and uranium to build and operate solar energy plants is significantly large compared to the recovered energy, then we have not achieved the conservation objective for solar energy. In addition, the magnitude of consumption of nonrenewable resources is a measure of the economic and environmental acceptability of solar energy. If more energy is consumed in the construction of these plants than is recovered by the solar systems, there is no purpose in developing the technology unless designs are forthcoming which are less energy intensive.
\item[150] Id.
\item[151] Id. at 8, 221-22. See also Harriss, Taxation of Public Utilities: Considerations for the Long Run, 43 TAXES 660, 665-66 (1965).
\end{footnotes}
This affirmative obligation might leave them unable to meet their total service obligations if their most profitable markets were skimmed away by competitors operating free of such obligations. Therefore, free entry in public utility markets is generally limited. This aspect of the cream-skimming rationale does not justify granting the utilities an exclusive franchise in marketing solar equipment because they are not under any obligation to serve the entire market.

The second aspect of the cream-skimming rationale is based on promotional considerations. Sometimes the market potential of an industry must be developed before anyone will be in a position to tap it. The enterprising firm which undertakes promotion may find its competitors reaping the benefits of its promotional efforts. The realization that rival firms may later invade the market without undertaking any of the promotional costs may lead to an unwillingness to undertake such development. Limitations on entry are sometimes raised in order to encourage initial developers to engage in needed promotions. Such protection from competition, however, has generally been provided only in high risk transportation ventures.

Promotional activities are clearly needed to develop the market potential of the solar equipment industry. People must be informed of recent advances in solar technology. They must also be convinced of solar system capability, reliability, and cost effectiveness before they will "go solar." However, the number of solar manufacturers and marketing firms is quite large. This present involvement indicates a willingness to enter the field and undertake the necessary promotional activities without regulatory support limiting entry of other competitors.

Prevention of Destructive Competition

The presence or potential for economic competition which leads to a deterioration of service quality is yet another rationale for limitation on free entry to a market. This rationale constituted at least part of the justification for allowing monopolies for the electric and natural gas utilities. The era of competition during the early development of these industries was marked by intensive price wars which in many instances so reduced the revenues of the involved companies that they were unable to provide adequate service. This failure of the competitive approach, together with the natural monopoly conditions that came to prevail with

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102 A. KAHN, supra note 124, at 233-35.
103 See id. at 8-10, 233-35.
104 "The growing public interest in solar heating is evidenced by the installation of thousands of systems installed in the U.S. in the past two years, with an estimated 500 companies offering components and systems on a commercial basis." Baron, supra note 148, at 31, citing A National Plan for Energy Research, Development, and Demonstration, ERDA 77-1, June 1977 at 25-27.
105 A. KAHN, supra note 124, at 173-78.
106 D. BOIES & P. VERKUIL, supra note 129, at 29.
technological innovations affecting the economies of scale, spurred the legal recognition of monopoly positions in these industries.187

Unrestrained competition in the marketing of decentralized solar systems does have a strong potential to adversely affect the quality of the product sold, as distinguished from the deterioration of service quality. Intensive price competition is likely to lower the selling price of the equipment, and along with it the profit margin of suppliers and retailers. As that profit margin narrows, the temptation increases to cut costs by skimping on safety and reliability features. The detection of such deficiencies will be difficult for the consumer due to unfamiliarity with solar technology. Solar equipment is also a relatively durable product, generally designed for use over a period of many years. The adverse effects on performance may not become apparent until the product has been used for several of those years. By then, irresponsible sellers may have become insolvent or have disappeared.

Unrestrained competition might lead to deteriorations of product quality in the solar equipment business. Yet the problem does not appear to require direct restraints on entry or the granting of a monopoly position, since well-conceived quality control standards and financial responsibility legislation could achieve the same objectives.188 Even though public utilities are permanently established institutions subject to close scrutiny by regulatory commissions, and therefore likely to stand behind their solar products, such advantages at best favor allowing them to enter the market, but not to secure a monopoly position therein. Thus, none of the criteria for limiting entry can justify extending the monopoly position of public utilities to include the marketing of solar equipment.

Prohibiting Entry by Public Utilities

While extending the monopoly position of public utilities is at one end of the spectrum of possible reactions to solar development, the absolute prohibition of utility participation appears at the other extreme. The National Energy Conservation Policy Act has implemented this option, subject to waiver powers granted to the Secretary of Energy.189 The argument justifying the ban on public utilities from the commercialization of solar products essentially takes two forms. One is the fear that utilities will retard the development of solar technology; the other is the concern that utility involvement will constitute unfair competition.

187"Public utility rate regulation came about as a means to control monopoly power which had been allowed to exist at the pleasure of the Government in order to prevent 'destructive competition' among utilities." Oldham, Rate Base Determination and Profits to Affiliates, 39 Colo. L. Rev. 509 (1967).
188See 2 A. Kahn, supra note 124, at 177-78.
189Supra notes 118 through 123 and accompany text.
Possible Limitations on Technological Development

A utility's involvement in the marketing of solar equipment could retard the development of solar technology in a number of ways. If solar power were regarded as a competitive energy form which could cause declining revenues, a utility might attempt to stifle or limit its use. This hindrance could be accomplished, for example, by acquiring patent rights or through public expressions of skepticism and doubt about solar energy. However, even if utilities assumed the opposite approach and attempted to advance the development of the solar resource, the growth of technology could still be restrained. The utilities are likely to direct their efforts toward solar technologies which interrelate with their traditional services. Using an intensive research and development program the utilities might quickly assume a paramount position which could diminish or even foreclose the chances for alternative forms of development of solar technology.

On the other hand, the policymakers should recognize that a complete ban on the public utilities will exclude an entity which has a proven record in technological development. For example, the utilities have made significant reductions in the amount of coal used in the generation of power. The development of larger, more economical generating equipment also has resulted in considerable economies of scale. Although the devastating effects of inflation levels in recent years have reversed the trend of decreasing costs in electric utility economics, im-

162 [T]he consumption of coal to produce steam for electric generation has steadily decreased on a per-kilowatt-hour basis as a result of increasing technological efficiency. While an average of about 6.7 pounds of coal was required per kilowatt-hour generated in 1902, modern plants require less than one pound. In 1960 the national average was 0.88 pound per kilowatt-hour. P. GARFIELD & W. LOVEJOY, supra note 131, at 149.
163 In 1930, the average size of all steam-electric units was 20 megawatts. By 1955, when larger units began to come on-line in significant numbers, the average unit size had jumped to 35 megawatts and the largest unit had increased to 300 megawatts. Subsequent years showed a continuous progression of larger units until 1974, when four 1,300-megawatt units were in operation and a 1,500 megawatt unit was projected to come on-line in 1983. Even if future units do not increase greatly in size, the average unit size will continue to expand as older and smaller units are retired. While unit size increased, plant size also grew. In 1972, the largest steam-electric plant in the United States was the seven-unit Sammis plant of Ohio Edison with 2,889 megawatts of capacity. In 1948, the largest plant had a capacity of 881 megawatts and there was only one other plant with a capacity of over 500 megawatts. D. SCOTT, FINANCING THE GROWTH OF ELECTRIC UTILITIES 27-28 (1976) (footnotes omitted).
proved technology is still very important. This same type of technological innovation is imperative for advancement of the state of the art of solar energy exploitation. The involvement of electric utilities in the field could provide important technological impetus.

Whether the potential for retarding technological development is a persuasive justification for prohibiting utility entry depends largely upon whether solar energy will be perceived by the utilities as a threat. The potential threat of solar energy is easy to perceive, especially with long-term projections. Extensive use of this alternative energy source can signify decreasing revenues for the utilities. Future economic feasibility of photovoltaic systems which convert solar energy directly into electricity raises the specter of considerable independence from public utilities. The desire for self-preservation might motivate utilities to seek means to stall such developments, but such a reaction is by no means inevitable. Some utilities have already perceived solar energy as valuable rather than as a threat. Solar energy could provide utilities with an effective means of conserving dwindling conventional fuel sources and, in connection with load management techniques, in more efficiently utilizing existing utility plant capacity.

Relatively recent changes in the economic environment in which utilities must now operate, although by no means conclusive, suggest reasons why some utilities might favor an integration of solar energy into their operations. For a number of years the average unit cost for electricity declined at an impressive rate. During the 1970's, however, those declining rates were reversed. Many of the factors which had favored utility marketing changed concurrently during the late sixties and early seventies. Inflation increased capital construction costs.

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164 During prior years, when price increases were relatively low, improved technology and economies of scale more than offset the burden of inflation and yielded a decreasing cost industry. Recently, however, this utopian set of factors has been replaced by a level of inflation against which the utilities have not been able to compensate.

165 While in 1931 the average residential consumer used 583 kilowatt-hours at an average rate of 5.78 cents per kilowatt-hour, the average consumption in 1960 was 3,827 kilowatt-hours and the average rate was 2.47 cents per kilowatt-hour." P. GARFIELD & W. LOVEJOY, supra note 131, at 150.

166 Electric rates have declined through time despite a sharply rising general price level and increasing costs in the economy as a whole. For example, as of January 1, 1960, the weighted average bill for 500 kilowatts of residential service per month was $10.62, whereas the same service had cost $13.87 in 1935. This comparison is all the more impressive in light of the doubling of the general price level during this period.

167 Inflation has had a severe impact upon capital costs of electric utilities. Projections for nuclear plants to come on-line in the early 1980s estimate costs at over $700 per kilowatt. Cost estimates for coal-fired plants for commercial operation in the same period are over $600 per kilowatt. This compares with a 1967 Atomic Energy Commission projection for 1972 operation of $134 and
Capital spending by electric utilities rose from three billion dollars in 1948 to over twenty billion dollars in 1974.\textsuperscript{168} Fuel costs escalated rapidly. The cost of fuel oil rose approximately 400 percent, and the cost of gas more than 175 percent between 1972 and 1977.\textsuperscript{169} Environmental regulations have required utilities to invest considerable sums of money. In 1974 electric utilities spent approximately 1.3 billion dollars on pollution controls compared to 4.0 billion dollars for all manufacturing industries.\textsuperscript{170} Because regulatory lag delayed the implementation of rate increases, revenues have not always kept pace with increasing costs.

Widespread customer adoption of solar systems, together with time of day pricing of backup service to encourage greater diversity, could provide a means for some utilities to begin avoiding the full impact of these cost escalators. With better daily diversity the utility could use existing plant capacity more efficiently and thus eliminate the need to construct the additional capacity which would be required if this demand were to remain on-peak. Eliminating the need to expand would enable the utility to avoid the effects of inflation tied to such new construction, including investment in costly pollution control equipment.\textsuperscript{171} Since solar energy would provide some of the customer demand, total energy requirements on the utility would be less and utility fuel costs would be reduced accordingly. These considerations could lead some utilities to actively promote and develop technology for solar systems.

Unfair Competition

The potential for unfair competition is probably the more urgent concern advanced in support of complete prohibition of public utility involvement in supplying solar systems. The National Energy Conservation Policy Act indicates it was foremost in the minds of the draftsmen of this legislation. Section 213 (b)(1) provides that the Secretary of Energy is not to approve any residential energy conservation plan for regulated

$100 per kilowatt, respectively. It should be noted that the 1967 estimate was in constant prices, while the more recent projection included a factor for cost escalation.\textsuperscript{169}

\textit{Id.} at 96.

\textsuperscript{168}Id. at 96.

\textsuperscript{169}"After remaining relatively constant in price throughout the 1960's, fossil-fuel costs began a rise in 1970 that gained momentum with each passing year. Cost increases over the decade 1964-74 amounted to 190 percent for coal, 89 percent for gas, and 488 percent for oil." \textit{Id.} at 48. "Overall, the distribution of total electric revenues required to pay for fuel increased from 19.8 percent in 1970, to 24.3 percent in 1973, to 34.8 percent in 1974." \textit{Id.}

\textsuperscript{170}Id. at 47.

\textsuperscript{171}The U.S. electric utility industry alone anticipates a need for $650 billion over the next fifteen years to meet new energy demands. To meet that need, the electric utilities will have to raise $400 billion in the capital market—four and one-half times the amount raised over the past fifteen years.

\textit{Sweet, Meeting the Research Needs of State Regulators, 102 PUB. UTIL. FOR.T., August 17, 1978, at 11.}
utilities submitted by a participating state unless "such plan contains adequate measures for preventing unfair, deceptive, or anti-competitive acts or practices" in implementing utility programs in the state. Similar language is utilized in Section 216(e) of the Act dealing with standards for waiving the prohibition of utility activity in providing and financing energy conservation measures.

With the utilities' substantial investment in conventional generating equipment, the concern is that they will be interested in restricting the competitive energy source and not in promoting it. Public utilities might effectively use their superior financial strength and the flow of their monopoly profits to drive smaller rivals out of business. On the other hand, unfair competition, like the stifling of technological development, can also occur under conditions in which the utilities actively seek to utilize rather than suppress the solar resource. Business advantages from existing utility contacts with customers might accrue to utilities which would make it too difficult for other entities to compete.

Appliance sales and promotional inducements by electric and gas utilities provide some historical support for the concern over unfair competition with utility involvement. In the past, utilities were actively involved in the sale of large domestic appliances such as ranges and hot water heaters since these sales increased the demand for electric and natural gas service. The advantages of increased demand for utility services were so great that some utilities even sold appliances at a loss.


Each state is authorized to submit a proposed residential energy conservation plan to the Secretary of Energy for his approval. §212(c)(1)(A). Each plan must comply with the rules and standards to be promulgated by the Secretary. §212(a). The statute also identifies specific standards which must be included in these rules. §212(b). No proposed residential energy conservation plan can be approved unless specific provisions are included. §§213 and 214. If a state does not propose a plan within the specified time limitations, the Secretary is authorized to promulgate one for it. §219(a).

The Secretary may . . . waive in whole or in part the prohibitions . . . if . . . the Secretary finds, after consultation with the Federal Trade Commission, that such activities would not be inconsistent with the prevention of unfair methods of competition and the prevention of unfair or deceptive acts or practices." §216(e).

Home demonstrations proved highly successful and were facilitated by the utilities' access to marketing information such as names, address and financial ratings of customers. Monthly billing systems accommodated deferred payment plans offered with minimal interest charges. Monthly visits by customers to power company offices to pay their bills provided an additional opportunity to promote the use of appliances. Indeed, power company showrooms grew into medium and large-sized stores and often occupied most of the main floor of the conveniently located offices.

C. THOMPSON & W. SMITH, PUBLIC UTILITY ECONOMICS 510 (1941).

A 1937 survey of 140 electric utilities showed that 129 of them sold appliances to residential users. These sales represented more than one-third of the total dollar volume of appliance sales. 111 ELECTRICAL WORLD, March 11, 1939, at 697.

Utilities also used a number of promotional practices designed to induce builders of multi-unit structures and developments to use one energy source exclusively and to encourage individuals to shift from one source of energy to another. These practices included "cash payments, free underground trenching, free appliances, free advertising, free installation of appliances, low-cost financing, and guaranteed rates." The utilities considered these inducements to be necessary in order to effectively compete in markets which had been predominantly served by other utilities or by fuel oil companies. These types of activities resulted in claims by appliance retailers and other companies in affected markets that the utility involvement constituted unfair competition.

The anti-competitive consequences of past promotional inducements are not as likely to apply to the utility marketing of solar equipment. The close scrutiny in the late sixties of utility promotional activities resulted in states prohibiting utilities from engaging in many of these types of activities. Some of the remaining incentives, however, can be used by the utilities to encourage solar energy utilization. The California Public Utilities Commission, for example, has adopted a policy of granting the maximum allowable line extension credits for housing.

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178 Id.
179 Competition among suppliers of various forms of energy has intensified greatly during the last 5 to 10 years. Prior to this each of the principal energy sources—electricity, natural gas, and fuel oil—operated largely in separate markets. Electricity enjoyed a natural monopoly with respect to energy needed for basic needs such as lighting, most household appliances, etc. Natural gas, in areas favored with a pipeline connection to the producing areas, served principally space and water heating needs. Fuel oil predominated as a source of heating energy in areas remote from natural gas pipelines or so remote from natural gas producing areas as to reduce the cost advantage frequently enjoyed by natural gas....

One of the most intense areas of competition is in water and space heating. The electric utilities, because of the high cost of electricity vis-a-vis natural gas and fuel oil, have had to overcome consumer resistance to electric space and water heat. According to data submitted to the committee by the National Oil Jobbers Council, the electric utilities had almost none of the home heating market in 1947, and in 1957 accounted for only 4 percent of the heating installed in new construction. In contrast, gas had 15 percent of the home heating market in 1947 and 34 percent in 1957, and fuel oil had 85 percent of that market in 1947 and 62 percent in 1957.

180 Id.
181 Hearings were held in 1968 by a subcommittee of the Select Committee on Small Business on the subject of "Promotional Practices by Public Utilities and Their Impact Upon Small Business" as "a result of the various complaints received from numerous small businessmen engaged in diverse fields of endeavor as the wholesaling of heating and cooling equipment, consulting engineers, oil jobbers, and appliance wholesalers and retailers." Promotional Practices Report, supra note 176, at 1. Their investigation led the members of the subcommittee "to question both the usefulness and propriety of these promotional allowances." Id. at 94.
182 See e.g., Staff of Solar Implementation Comm., supra note 33, at IV-27.
developments using solar devices.\(^\text{183}\)

The anti-competitive influences associated with past utility appliance sales activities are possible, although for different reasons, with sales of solar equipment, but they are also unlikely due to state regulatory responses. Solar systems, unlike major appliances, will decrease total consumer demand for utility gas and electric service, not increase it. Still the forceful economic factors of inflation, escalating fuel costs, and pollution control expenses have modified the objectives of utilities.\(^\text{184}\) Rather than seeking to increase demand, which will necessitate further expansion of plant capacity, most utilities are currently more interested in diversifying demand in order to avoid expansion,\(^\text{185}\) which is partly evidenced by the number of utilities that have abandoned the appliance sales business.\(^\text{186}\) Assuming that time of day pricing proves an effective means of securing load management controls over the operation of solar systems,\(^\text{187}\) the utilities might be tempted to underprice solar equipment in order to promote greater service demand diversification. However, the arguments supporting refusals of state regulatory commissions to allow the inclusion of losses incurred on promotional sales of appliances as legitimate operating expenses in calculating utility rates would be equally applicable to such pricing of solar equipment.\(^\text{188}\)

The most serious facet of the concern over possible unfair competition stems from the unique position occupied by the utilities. The utilities have direct contact with nearly every American home, and these contacts

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\(^{183}\)Id.

\(^{184}\)See supra notes 165-70 and accompanying text.

\(^{185}\)The electric utility industry is tremendously capital intensive. Companies engaged in the production of electric power must spend nearly $4.50 for assets to produce a dollar of revenue, compared with all manufacturing industries which spend only $0.60 per dollar of revenue. It is this large amount of fixed expenses which has guided financial policies of the industry. D. Scott, supra note 163, at 95.

\(^{186}\)By 1962 fewer than one-third of the 200 largest electric utilities still sold appliances, and most of those operated through cooperative programs with local dealers. 95 ELEC. MERCHANTS WEEKLY, January 21, 1963 at 91. Between 1966 and 1971 the number of power companies selling appliances further declined another 25%. 107 ELEC. MERCHANTS WEEKLY, April 28, 1975 at 3.

\(^{187}\)See supra note 56-63 and accompanying text.

\(^{188}\)In times past, many utilities, especially electric and gas firms, have operated appliance businesses or services, sometimes attracting sales by underselling independent competitors. Sales of utility services associated with the appliances might thus be increased, and appliance sales losses could be charged as operating expenses of the parent utility company. . . . Commissions now rule, with only a few exceptions, that nonutility expenses and revenues must be carefully segregated and that nonutility operations of a utility firm must stand or fall on their own. M. Farris & R. Sampson, supra note 74, at 96. See e.g., Rochester Gas & Elec. Corp., 43 P.U.R. 3d 210, 225-27 (N.Y.P.S.C. 1962); Lowell Gas Co. v. Dept. of Pub. Util. 324 Mass. 80, 84 N.E.2d 811, 822. "[T]he primary purpose of the company in engaging in the sale of appliances is to utilize the most effective and least expensive way of building additional gas load and maintaining the present load of the company." Peoples Gas Light & Coke Co., 99 P.U.R.N.S. 361, 379 (Ill. Com. Comm’n 1953) (allowing as a legitimate sales promotion expense the losses incurred in connection with the sales of gas appliances).
would give them a significant advantage in the competitive commercialization of solar equipment. Direct solicitations, for example, would be possible at small incremental costs in the billing correspondence or through service calls. This advantage would be difficult for private firms to overcome.\footnote{189}

The National Energy Conservation Policy Act, however, requires the establishment of even further contacts between utilities and residential customers. Utilities are required to inform their residential customers of suggested conservation measures (including solar devices), expected energy cost savings associated with each measure, and lists of suppliers and financers of such measures.\footnote{190} The Act also makes the utility a project manager by requiring it to offer to inspect residential buildings, estimate purchase and installation costs of conservation measures and anticipated savings, and arrange for installation and financing.\footnote{191} Due to

\footnote{189}{Other views have been expressed:

It will be extremely difficult for any organization to monopolize the solar industry because of the inherent diversity of approaches; there will probably always be intense competition between different designs. Probably the most serious danger to competitiveness in the solar industry is the Federal Government itself. The potential for competition between different organizations and different engineering concepts could be distorted if Federal funding is unwisely allocated.

1 OFFICE OF TECHNOLOGY ASSESSMENT, APPLICATION OF SOLAR TECHNOLOGY TO TODAY'S ENERGY NEEDS 100 (1978).

\footnote{190}{Each utility program shall include procedures designed to inform, no later than January 1, 1980, or the date six months after the approval of the applicable plan under section 212, if later, and each two years thereafter before January 1, 1985, each of its residential customers who owns or occupies a residential building, of—

(1) the suggested measures for the category of buildings which includes such residential building;

(2) the savings in energy costs that are likely to result from installation of the suggested measures in typical residential buildings in such category;

(3) the availability of the arrangements described in subsection (b) and the lists referred to in section 213(a)(2) and (3); and

(4) suggestions of energy conservation techniques, including suggestions developed by the Secretary, such as adjustments in energy use patterns and modifications of household activities which can be employed by the residential customer to save energy and which do not require the installation of energy conservation measures (including the savings in energy costs that are likely to result from the adoption of such suggestions).

\footnote{191}{Each utility program shall include—

(1) procedures whereby the public utility, no later than January 1, 1980, or the date six months after the approval of the applicable plan under section 212, if later, will, for each residential customer who owns or occupies a residential building, offer to—

(A) inspect the residential building (either directly or through one or more inspectors under contract) to determine and inform the residential customer of the estimated cost of purchasing and installing the suggested measures and the savings in energy costs that are likely to result from the installation of such measures (a}
the extensive nature of these contacts, together with the obvious potential for conflicts of interest, Congress may have stacked the deck against involvement by the utilities in the actual commercialization activities. The potential for unfair competition has been greatly increased through these requirements of expanded utility contacts with potential solar customers.

If the increased contacts between utilities and their customers so heighten the prospects of unfair competition that the Secretary of Energy is unable to grant any waivers to utility prohibition, the new Act will give rise to some startling consequences. Utilities earnestly desiring to enter the business will be shut out, whereas the position of utilities that wish to retard the competitive viability of solar energy will be improved. Cast into the role of energy advisor to homeowners, the utility that perceives a threat from solar energy is in the position to sow doubts about solar energy. While the more obvious abuses can surely be prevented by regulation, the more subtle abuses may not be. Since the utilities' informational and advisory services must extend to all forms of energy conservation measures, and not just solar equipment, a utility program could de-emphasize solar energy simply through enthusiastic support for other measures. Carefully worded statements made during residents' appraisals would be particularly difficult to regulate.

The reason for the decision to make the utilities responsible to disseminate information, inspect and appraise homes, and arrange for installation and financing seems quite apparent. All utility rate payers will pay for the costs of disseminating the required information, since the Act requires these costs to be treated as current operating costs. It leaves to the discretion of each state's regulatory body the authority to determine whether to treat the remaining costs (home inspection, appraisal, arranging financing, and installation) as current operating costs or charge them directly to the customer for whom the service is performed.

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report of which inspection shall be kept on file for not less than 5 years which shall be available to any subsequent owner without charge, except that a utility shall be required to make only one inspection of a residence unless a new owner requests a subsequent inspection;

(B) arrange to have the suggested measures installed (except for furnace efficiency modifications with respect to which the inspection prohibition of section 213(b)(2)(B) applies, unless the customer requests in writing arrangements for such modifications in writing); and

(C) arrange for a lender to make a loan to such residential customer to finance the purchase and installation costs of suggested measures; . . .

§215(b).

§216(e). See supra notes 121-23 and accompanying text.

§215c(1)(B).

§215c(1)(C).
The program is simply taxation by regulation. Costs will be shared by many and benefits directly available for only a few. All utility customers will have subsidized the promotion of solar energy, with benefits redounding to the solar equipment industry, and to the affluent who can meet the high initial capital costs of a conversion to solar energy. The poor and lower middle classes will encounter greater difficulty in securing the financing, and thus often remain dependent on conventional energy sources from the utilities, which are themselves caught in an escalating fuel cost spiral.

Concern for the possible retardation of solar technology development and for unfair competition is real and legitimate. Yet utility involvement might be an impetus to technological advancement and improve rather than harm competition. The issue can be best resolved by a careful analysis of the manner of participation proposed by each utility, of the market characteristics that will be affected by the proposed entry, and by close monitoring of utility activities which are approved. In this respect Congress has shown wisdom in adopting those provisions of the National Energy Conservation Policy Act which allow utility entry only on an individual company basis after acquiring regulatory approval. Unfortunately, the other statutory provisions which expand utility contacts with their customers may serve to preclude regulatory authorization of entry in those cases in which utility involvement appears to be beneficial.

Allowing Public Utilities to Compete

The dangers of utility participation have been analyzed above in conjunction with the option of prohibiting utility entry. The discussion in this section focuses on the advantages of competitive involvement of public utilities, and on whether regulatory controls should accompany that involvement. Many of the factors relevant to the analysis of the first two options are equally applicable to the analysis of allowing the utilities to compete.

Benefits of Utility Involvement

Public utility involvement might reduce the significance of the economic barrier associated with using a solar system. The high initial cost of solar equipment presents a barrier which utilities can help to over-
come by leases or sales and accompanying financing arrangements.\textsuperscript{198} Of course, utility involvement in the sale and leasing of solar equipment offers no special financing advantage unless the utilities extend their involvement further than private companies will. The utilities are certainly accustomed to capital intensive investments.\textsuperscript{199} Regulation, however, while not removing all the risk from such business decisions, also affords a hedge on the degree of risk involved, since the utilities are entitled to the opportunity to earn a fair rate of return on capital properly invested. Bad debts are part of operating expenses,\textsuperscript{200} and their inclusion in rate calculations serves to spread such losses to all customers. Subsequent discussion indicates, however, the unlikelihood that investment expenses for the sale and leasing of solar equipment will be included in a utility's rate base.\textsuperscript{201} Thus the willingness of utilities to extend more attractive financing arrangements than private companies must be predicated on some other factor, such as significant beneficial load management controls.

While increased utility access to the capital market could be a significant advantage leading to extended involvement by the utilities,\textsuperscript{202} they would again likely require solid security as well as major advantages, such as positive load management benefits, as a prerequisite to financing decentralized solar equipment on a long-term basis. Public utilities have historically enjoyed a very strong credit position evidenced by superior bond ratings and low interest rates.\textsuperscript{203} Their access, however, while still superior to that of many businesses, has slipped significantly in recent


\textsuperscript{199} The capital intensive nature of the electric utilities is the most significant cost characteristic of the industry. The electric power companies not only require more capital per year than any other industry, but they also need more money invested in capital per dollar of revenue than any other manufacturing industry in the United States. Even the railroads and communications companies require only two-thirds the amount of assets per dollar of revenue as the electric utilities.


\textsuperscript{200} Some commissions on some occasions have disallowed uncollectibles, but the general practice is to recognize that any large business will have some uncollectible accounts and that this is a normal cost of doing business. Frequently, though, commissions impose or suggest operating procedures by which uncollectibles can be minimized, or they establish percentage standards beyond which uncollectible amounts may be considered as stemming from the faults or inefficiencies of the firm.

M. FARRIS & R. SAMPSON, supra note 74, at 99.

\textsuperscript{201}Infra notes 218-19 and 226 and accompanying text.

\textsuperscript{202} See 1 OFFICE OF TECHNOLOGY ASSESSMENT, supra note 189, at 148-49; Dean & Miller, supra note 72, at 354.

\textsuperscript{203} High-grade utility bonds carried relatively low interest rates of 4.0 percent to 4.5 percent, and the common stocks of utility and communications companies were highly favored by investors, regularly trading at from 1.5 to over two times book value." La Blanc & Luftig, What are the New Market Prospects for Raising Utility Capital? 97 PUB. UTIL. FORT., February 26, 1976, at 26. See also Fredman & Sharma, The Performance of Electric and Natural Gas Utility Equities, 102 PUB. UTIL. FORT., October 12, 1978, at 22.
years.\textsuperscript{204}

The initial high cost to the consumer of owning a solar system can be avoided if the utility owns the solar system and charges the customer for all the energy used without distinguishing the source or without imposing a specific charge for the solar equipment.\textsuperscript{205} Electricity and natural gas prices are based on average cost.\textsuperscript{206} The lower cost of older energy supplies is averaged with the higher cost of newer energy supplies, and thus the price does not reflect current replacement cost.\textsuperscript{207} This method of pricing creates an artificial economic barrier since solar systems would be more competitive economically if incremental cost were considered. Since utilities are continually required to obtain new energy supplies at increasing costs, the utility would compare the cost for using solar energy systems with the incremental cost of new supplies of traditional energy forms. Solar energy would be economically viable whenever able to compete with these incremental costs to the utility.

Another economic advantage could be realized from the utilities’ existing customer service and billing network since they could be used to cover solar equipment business at a lower cost than would be possible if provided by an independent company.\textsuperscript{208} The major costs of computer programming, paper and envelopes, addressing personnel and equipment, and postage are already incurred by the utilities in billing for their existing services. On-site inspections and maintenance services are already performed by both natural gas and electric utility crews, and the utilities are likely to have the capability of extending their training to

\textsuperscript{204}Beginning in 1965 the utilities’ position began deteriorating. Interest rates on the utility bonds increased to exceed ten percent by 1975 and common stocks began to sell for considerably less than book value. Utilities increased their long-term debt which, together with the rising interest rates, led to declining coverage ratios and lower bond ratings. LaBlanc & Luftig, supra note 203, at 26-29, 33. See also Rakes, Trends Affecting Power Company Securities, 102 PUB. UTIL. FORT., August 31, 1978, at 31-32.

The overall rate of return on the electric utilities from 1965 to 1972, just prior to the oil embargo, was an unsatisfactory 1.7 per cent. Considering the high rates of inflation, the real rate of return to investors was substantially in the negative area. Even though electric utility share prices advanced by nearly 40 per cent from their lows in mid-1974 to their mid-1976 levels, these equities were still selling about 10 per cent below book value in early 1977. Fredman & Sharma, supra note 203, at 25. The recovery in the return on common equity in the electric utilities was due to the large rate increases allowed from 1974 through 1977. \textit{Id.} at 27.

\"The gas utility equities, although not outstanding performers, exhibited somewhat better performance generally than the electric over the 1965-76 period.\" \textit{Id.} The gas utilities were not affected directly by the Arab oil embargo. \textit{Id.} \"The electric utility industry is, of course, much larger, more basic, more capital intensive, and thus more affected by changes in interest rates than is the gas industry.\" \textit{Id.} at 25.

\textsuperscript{205}In contrast to selling or leasing solar equipment to individual consumers, some utilities might prefer to retain complete ownership rights in the installed solar equipment. The consumer would then be charged on a monthly basis for the total energy used, irrespective of whether the energy was solar generated.

\textsuperscript{206}Supra notes 32-33 and accompanying text.

\textsuperscript{207}1 OFFICE OF TECHNOLOGY ASSESSMENT, supra note 189, at 5, 23, 148.

\textsuperscript{208}\textit{Id.} at 149; Dean & Miller, \textit{supra} note 72, at 354.
Utility marketing of solar equipment could substantially increase consumer confidence in solar energy. It would demonstrate to the general public that some traditional energy suppliers are now convinced of solar energy's practicality. The record of utilities for providing reliable service would be reassuring to many consumers, and thus they would be in a position to strongly influence public opinion. Utilities, like any large permanently established business enterprise, would undoubtedly warrant the products they sell or lease.

Finally, the utilities are in a unique position to significantly affect the competitive viability of the solar resource. As the traditional utility markets are penetrated by the solar alternatives, utility revenues are likely to decrease. If the utilities view solar energy as economically threatening, they are likely to resist its widespread adoption. If on the other hand, they can participate in revenue-producing solar activities, the utilities are more likely to actively seek a harmonious integration between solar energy and conventional energy forms.

Controls on Utility Involvement

Assuming utilities have both the opportunity and desire to compete in the commercialization of solar equipment, the question remains whether their involvement should be regulated. Two levels of regulation should be distinguished: One encompasses the entire solar equipment industry; the other focuses only on utility activities in the field.

Some of the rationales for limiting entry to the field are similarly inapplicable for public regulation of a business. Three of those rationales, specifically the existence of natural monopoly conditions, the limited availability of physical resources, and cream-skimming, are not present in solar commercialization and are therefore as equally unavailing to support any form of regulation as they were to favor limiting entry. Although the rationale of preventing destructive competition is equally inadequate in limiting market entry, it does justify the promulgation of solar equipment quality standards and financial responsibility requirements for suppliers.

The legal test of the propriety of subjecting an industry to regulation is very broad. The Supreme Court in 1877 first articulated that regulation is proper when a business is "affected with a public interest ...." In 1934 the Court stated that "affected with the public interest" is the equivalent of "subject to the exercise of the police power," and this

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299 See 1 Office of Technology Assessment, supra note 189, at 23.
301 See supra notes 124-54 and accompanying text.
302 Supra notes 155-58 and accompanying text.
303 Munn v. Illinois, 94 U.S. 113, 126 (1877).
standard is still applicable today. The Court summarized its position: “The phrase ‘affected with the public interest’ can, in the nature of things, mean no more than that an industry, for adequate reason, is subject to control for the public good.”

Given the general lack of consumer knowledge about solar systems, their relation to the provision of essential heating and cooling services, and the potential for unreliable or unsafe units, regulation based on the public interest can be imposed on the entire solar equipment industry.

Less certain, however, is whether existing utility regulation should be extended to cover a utility’s marketing activities. Such utility regulation would apply only to utilities and not to manufacturers or suppliers in the private sector. In other industries such extensions have been made when necessary to protect an existing regulatory scheme. A good example is the regulation of cable television companies. Competition from the cable companies sufficiently threatened licensed broadcasters to cause the Federal Communications Commission to assert jurisdiction over the entire cable television industry.

An extension of regulation would be a near certainty if the utility retained all of the property rights in the installed solar system. Under such an arrangement the utilities would market solar energy rather than solar equipment. Capital investment in equipment and processes to produce energy, and the distribution and sale of that energy, would remain the utilities’ primary functions. Regulation of quality of service and pricing would still be necessary.

The utilities might be inclined to prefer such ownership arrangements since utility regulation would inevitably follow. The benefit to the utility would be the inclusion of its solar equipment investment in its rate base. The rate of return allowed by the regulatory commission would thus apply equally to this investment as to the expenditures for conventional capital assets, and bad debt expenses resulting from customer accounts would be allowable as an operating expense. The regulatory process would thus provide security in the form of a guaranteed realistic oppor-

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118 Id. at 536.
119 D. Boies & P. Verkuil, supra note 129, at 76.
120 In 1965 the Federal Communications Commission issued its First Report and Order on Community Antenna Television System Regulation, 38 F.C.C 683, modified, 1 F.C.C.2d 524 (1965). Although that report was restricted to those systems served by microwave relays, the conclusions were more relevant to all CATV systems. For example, the FCC found that “the likelihood or probability of adverse impact [by CATV] upon potential and existing service has become too substantial to be dismissed.” (1 F.C.C.2d at 713-14.) The FCC found that CATV created “substantial competition” for local licensees (1 F.C.C.2d at 707) which, while it cannot be measured precisely, has a “substantial negative effect upon station audience and revenues....” (1 F.C.C.2d at 710-711).
121 Boies & Verkuil, supra note 129, at 91. In the Second Report and Order on CATV System Regulation, 2 F.C.C.2d 725 (1968) the FCC asserted jurisdiction over all cable television systems. The jurisdiction was challenged and upheld in United States v. Southwestern Cable Co., 392 U.S. 157 (1968).
122 Supra note 205.
tunity to earn an established rate of return on its invested capital. Such a benefit could be particularly attractive to the utilities during the early stages of solar technology application.

Extension of the regulatory process, while affording some benefits to both consumers and the public, also poses a significant danger. Regulation does protect the public interest. In return for monopoly positions in their service areas and the security associated with rate regulation, the utilities are obligated to provide safe and adequate service under maximum rate restrictions. The regulatory scheme, however, creates a strong inducement for the utility to overcapitalize. The rate of return established by a regulatory commission is applied only to the utility's rate base, which is calculated as the gross valuation of the utility property less the accrued depreciation. Operation and maintenance expenses incurred in utility operations are recoverable, but the rate of return does not apply to them. Because the extent of any profit which can be realized is thus limited by the size of the rate base and the amount of the allowed rate of return, a strong inducement exists for the utilities to make investments in capital assets and thereby expand their rate bases. This inducement has been named after Averch, Johnson, and Wellisz and is known as the "A-J-W effect."

Utility ownership of solar systems could give rise to the A-J-W effect. The desire to inflate the rate base might lead the utilities to overinvest by installing systems having greater capacity than is consistent with total cost efficiency. To the extent that utilities must compete with private solar firms this tendency would be balanced by the recognition that the utility might eventually price itself out of the market. The A-J-W effect

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220 See supra notes 42-44 and accompanying text.
221 Supra note 45.
223 Kahn argues that the likelihood of this distortion is greatly diminished by regulatory lag.

Observe that the A-J-W tendency prevails only to the extent that regulation approaches instantaneous effectiveness in holding realized rates of return to a single, legally prescribed level. Only in these circumstances could regulated companies, without fear of loss, undertake investments the marginal product of which fell short of their cost of capital: only if the rate of return that they were previously earning was already at the legal minimum and only if, after these investments were made, rates could instantaneously be raised on the inelastic portions of the business to hold the return to that minimum would there be no losses to offset the benefit of the expanded rate base. Only if, to look at it from the opposite direction, all reductions in cost were instantaneously accompanied by equivalent rate reductions, so as instantaneously to take those cost-savings away from them, could regulated companies afford to have no compunctions about adopting excessively capital-intensive, hence cost-inflating methods of production.

2 A. KAHN, supra note 124, at 56.
could nevertheless still lead to distortions. Since the public utilities could not earn any profit on expenses incurred in the maintenance of their decentralized solar systems, they would have a clear incentive to invest in the higher cost systems requiring less maintenance.

In addition to overcapitalizing, a utility owning solar equipment could be influenced by the A-J-W effect to reach out for additional business, even though the rates on it are unremunerative. If the new business yields less net revenues than the allowed rate of return, utilities may be able to have the rates on other services raised to bring their total revenues up to the allowed level. Low rates on the new business are likely when the demand is sensitive to price and competition exists since such rates will attract new business which can then be used to augment the rate base. Utilities owning solar systems might underprice the solar component of their services in order to more effectively compete against private suppliers and then recoup the lost portion of revenues by raising rates for conventional services where demand is less sensitive to price and the utility enjoys a monopoly position.

Regardless of the extension of utility regulation, the A-J-W effect is not likely to occur if the utility sells or leases the solar equipment. Although regulation is an essential prerequisite for the A-J-W effect, not all regulation is sufficient to give rise to its tendencies. The A-J-W effect applies only to the expenses allowed in the rate base, which under most regulation have been limited to capital investments undertaken to supply utility energy services. Utility costs in programs such as appliance sales have not been included. The utilities' expenses in acquiring solar equipment for sales and leasing is therefore not likely to be included in the rate base.

The sales and leasing forms of utility involvement present their own potential problems. Internal or cross-subsidization is possible whether the solar commercialization activities are carried out by the regulated utility or a nonregulated subsidiary. Under either form of business organization, joint expenses will be incurred which must be allocated between the traditional utility service and the solar activities. Examples of such common expenses include advertising, service calls, and shared office costs. If an excessive portion of these expenses are allocated to utility activities covered by the rate schedules, a utility would be unfairly using its monopoly position in those traditional service activities to sub-

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24 Id. at 49.
25 Id. at 54.
26 Re Intermountain Gas Co., 67 P.U.R.3d 511 (1967); supra note 188.
27 The problem posed here is the fair allocation of joint costs which would be shared in providing conventional utility service and solar equipment. See D. Boies & P. Verkuil, supra note 129, at 113-14. It should not be confused with the common problem of regulating transactions entered into between affiliated enterprises wherein one affiliate purchases goods or supplies from the other. See id. at 181-94; W. Jones, supra note 126, at 178-90.
sidize its solar energy business.\textsuperscript{228} This potential problem is by no means unique to utility involvement in solar energy, however.\textsuperscript{229} Accounting requirements and controls over transactions with affiliates, although considered inadequate by some, already exist and can surely be applied to sales and leasing of solar equipment if utility participation is otherwise desirable.

Although marketing of solar equipment by utilities would provide a number of benefits in furtherance of the development of solar energy, concern centers on how to best control utility involvement. If the utility owned outright all of the property rights in an installed system, existing regulation would almost inevitably be extended to cover the solar operations. Extension of the regulatory process raises the potential danger of overcapitalization by a utility. On the other hand, marketing solar equipment through separate non-regulated operations may lead to the problem of internal or cross-subsidization.

\textbf{CONCLUSION}

The technological development of solar energy exploitation is substantially more advanced than the legal analysis of the subject. Yet the pace of its adoption and development depends to a large extent on the resolution of certain legal problems. The exact role that solar energy will play in contributing to the satisfaction of future energy needs will be materially affected by the nature and the adequacy of the legal responses which are selected for the purpose of developing and encouraging its use.

The nature of the interface between solar energy and the public utilities will be significant in determining the competitive viability of solar power as an alternative energy resource. With vested interests tied strongly to conventional energy sources, some utilities might view solar use as a competitive threat and thus choose to hinder its development. Other utilities, however, will just as predictably desire to become directly involved with the utilization of solar technology. This utility role raises concern over the ability of solar firms to successfully compete. Consequently, regulators and policy-makers will not be dealing with a uniform attitude on the part of the utilities or the general public. Furthermore, the levels of competitive interaction of utility participation in solar development are varied and include pricing for solar backup service, the utilization of multi-user solar systems, and utility involvement in the


marketing of solar equipment. Simple, singular policies are, therefore, not likely to be successful.

One basic principle is available to guide the direction of our national policy and legal response. Alternative energy sources must be developed and harmoniously integrated into our existing energy structure. Existing and projected shortages make the need for additional energy evident. The needs and interests of energy consumers, utilities, businesses, and the nation dictate that each be considered in formulating an energy policy in which new energy resources play a significant role. The new federal energy legislation, particularly the National Energy Conservation Policy Act, represent a step in the right direction, but a great deal of work remains to be done.