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I. INTRODUCTION

Recent events like long lines at gasoline pumps,[1] nuclear accidents,[2] and escalating energy costs[3] have dramatized this nation's need to develop renewable energy sources. In enacting the National Energy Act in November 1978,[4] Congress recognized the potential contribution that solar energy could make toward meeting the nation's energy needs and made its development a national goal.[5] After the Act's passage, President Carter sent to Congress a

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1. Automobile lines several blocks long and waiting periods of three hours or more were commonplace during the summer of 1979. Although gasoline demand had increased by 3% over the previous year, oil companies in 1979 allotted their stations from 5% to 20% less gasoline per month than they had allotted in the same month in 1978. TIME, May 21, 1979, at 14; *id.*, July 2, 1979, at 14, 17-21.

2. The worst accident occurred on March 29, 1979.

> For six riveting days, the nation—and the world—watched a gas bubble build up in a nuclear reactor at Three Mile Island near Harrisburg, Pa., and threaten to cause a hydrogen gas explosion that would spew radiation into the atmosphere. When the bubble finally disappeared and the danger subsided, deep relief was mingled with grave concern about the nuclear future.

TIME, Apr. 16, 1979, at 22.

3. The refiner acquisition cost of domestic crude oil rose from the 1976 average of $8.84 per barrel to $22.60 for the first half of the year average in 1980. The cost of imported oil rose from $13.48 in 1976 to $33.26 in 1980. [Nov. 6, 1980] EN. USERS REP. (BNA) 25.

4. The National Energy Act was signed into law on November 9, 1978. 14 WEEKLY COMP. OF PRES. DOC. 1978 (1978). It contains five significantly different statutes: the Public Utility Regulatory Policies Act of 1978, Pub. L. No. 95-617, 92 Stat. 3117; the Energy Tax Act of 1978, Pub. L. No. 95-618, 92 Stat. 3174; the National Energy Conservation Policy Act of 1978, Pub. L. No. 95-619, 92 Stat. 3206; the Powerplant and Industrial Fuel Use Act of 1978, Pub. L. No. 95-620, 92 Stat. 3289; and the Natural Gas Policy Act of 1978, Pub. L. No. 95-621, 92 Stat. 3352.

5. The National Energy Act thus has three principal themes: energy conservation, conversion to coal, and incentives to production. The Act also establishes six goals to be achieved by 1985:

plan designed to meet twenty percent of the energy needs of the United States with solar energy by the year 2000.[6] Before the expectations for solar energy can be realized, however, a number of complex legal problems must be resolved. Ways must be found to overcome the fundamental legal barriers that presently exist to the rapid expansion of solar energy use. The "solar future" is not just a challenge to investors, engineers, and energy planners; it also demands the unequivocal attention of the legal community.

Fortunately, considerable legal interest in solar energy has developed over the past four years. A good deal of legislation and legal research has been directed toward improving the economic and technological feasibility of solar usage. Because the high initial cost of solar equipment is a significant barrier to greater solar use,[7] the federal government[8] and more than half the states[9] have en-

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1. To reduce the average growth rato of energy consumption to 2 percent per annum.
2. To reduce the oil imports level to less than 6 million barrels a day.
3. To achieve a 10 percent reduction in gasoline consumption from the 1977 level.
4. To retrofit for energy conservation purposes 90 percent of the residential and commercial buildings in the United States.
5. To increase coal production by at least 400 million tons annually over 1976 levels.
6. To use solar energy in more than 2½ million homes.

HOUSE AD HOC COMM. ON ENERGY, NATIONAL ENERGY ACT, H.R. REP. No. 543, 95th Cong., 1st Sess. 9 (1977).

6. The plan includes provisions for the creation of a Solar Bank to finance more than 100,000 installations of solar units the first year, a 20% tax credit for passive solar applications, a 5% investment tax credit to supplement the existing 10% investment tax credit, a special 10% tax credit in the National Energy Act for industrial process heat equipment purchases, a 15% tax credit on woodburning stoves installed in principal residences, permanent exemption of gasohol fuel from the four-cent federal gasoline excise tax, over $1 billion in federal expenditures over fiscal 1980, and enhanced efforts to develop solar energy and coordimate solar programs in the government. [June 21, 1979] EN. USERS REP. (BNA) 3. The 20% goal, however, is not based solely on direct solar applications:

> The broad goal of 20 percent by 2000 should be reachable, if only because definitions of solar generally include energy from every renewable source for which the sun can be held accountable. Like others, the Administration lumps in its definition much more than power derived directly from sunlight; biomass energy is included . . . and so are wind power, hydroelectric power, and even power that can be generated by temperature differences between the surface and depths of tbe ocean. Biomass and hydropower alone are expected to provide half of the energy required to meet the "solar" goal.

Burck, *Solar Comes Out of the Shadows*, FORTUNE, Sept. 24, 1979, at 67.

7. In new residential construction a solar hot water system costs between $1,000 and $2,000, and the cost of a combined water and space heating system is between $8,000 and $14,000 or more. GENERAL ACCOUNTING OFFICE, COMMERCIALIZING SOLAR HEATING: A NATIONAL STRATEGY NEEDED 9 (1979) (report to the Congress by the Comptroller General).

8. Energy Tax Act of 1978, Pub. L. No. 95-618, 92 Stat. 3174 (codifiod in scattered

acted solar tax incentives. In addition, the Solar Energy and Energy Conservation Bank[10] was created by Congress to facilitate low-interest financing to help reduce the economic impact to the consumer of the initial cost of installing a solar unit. Other economically focused legal reponses are concerned with protecting solar investments[11] and the legal interrelationship between utilities and solar energy development.[12]

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sections of 19, 23, 26, 42 U.S.C. (Supp. II 1978)), *as amended by* Crude Oil Windfall Profit Tax Act of 1980, Pub. L. No. 96-223, 94 Stat. 229 (to be codified in scattered sections of 7, 19, 26, 31, 42 U.S.C.).

9. For a relatively recent listing and description of state tax incentive legislation, see Johnson, *State Approaches to Solar Legislation: A Survey*, 1 SOLAR L. REP. 55, 57-92 (1979). For additional discussion of solar tax incentive legislation, see Adams, *An Analysis of Solar Legislation—Taxes and Easements*, 14 LAND & WATER L. REV. 393 (1979); Minan & Lawrence, *Encouraging Solar Energy Development Through Federal and California Tax Incentives*, 32 HASTINGS L.J. 1 (1980); Minan & Lawrence, *Legislative Comment: The Windfall Profit Tax Act and Taxpayer "Double Dipping,"* 2 SOLAR L. REP. 571 (1980); Minan & Lawrence, *State Tax Incentives to Promote the Use of Solar Energy*, 56 TEX. L. REV. 835 (1978).

10. Energy Security Act, Pub. L. No. 96-294, § 505, 94 Stat. 722 (1980).

11. A property owner installing a solar collector, for example, needs assurance that the sunlight crossing a neighbor's property will not be obstructed in the future. Several commentators have noted the common law's inability to provide the necessary guarantee to lateral access. *See, e.g.*, Gergacz, *Solar Energy Law: Easements of Access to Sunlight*, 10 N.M. L. REV. 121 (1979); Moskowitz, *Legal Access to Light: The Solar Energy Imperative*, 9 NAT. RESOURCES LAW. 177 (1976); Myers, *The Common Law of Solar Access: An Insufficient Protection for Users of Solar Energy*, 6 REAL EST. L.J. 320 (1978); Zillman, *Legal Aspects of Solar Energy Development*, 1976 ARIZ. ST. L.J. 25; Comment, *Securing Solar Energy Rights: Easements, Nuisance, or Zoning?*, 3 COLUM. J. ENVT'L L. 112 (1976); 29 BAYLOR L. REV. 1013 (1977); 45 BROOKLYN L. REV. 357 (1979); 67 CALIF. L. REV. 350 (1979); 7 FORDHAM URB. L.J. 283 (1979); 57 OR. L. REV. 94 (1977).

A number of commentators have focused on land use planning techniques and various legislative solutions as an appropriate response to this problem. *See, e.g.*, G. HAYES, SOLAR ACCESS LAW (1979); S. KRAEMER, SOLAR LAW 33-167 (1978); Eisenstadt, Long & Utton, *A Proposed Solar Zoning Ordinance*, 15 URB. L. ANN. 211 (1978); Eisenstadt & Utton, *Solar Rights and Their Effect on Solar Heating and Cooling*, 16 NAT. RESOURCES J. 363 (1976); Reitze, *Solar Rights Zoning Guarantee: Seeking New Law in Old Concepts*, 1976 WASH. U. L.Q. 375; Comment, *Legislative Approach to Solar Access: Transferable Development Rights*, 13 NEW ENG. L. REV. 835 (1978); 19 NAT. RESOURCES J. 957 (1979); 47 U. COLO. L. REV. 421 (1976); 17 WASHBURN L.J. 147 (1977).

12. The principal focus in this area is on the effect of utility competition on solar investors and the rates that will be charged by the utilities for backup energy to solar users. An alternate energy source is required whenever a solar system, because of insufficient capacity or limited storage capability, cannot fully satisfy the consumer's energy demand. Many solar users will have to turn to electricity or natural gas as a backup source of energy. The main federal legislation is the National Energy Conservation Policy Act of 1978, Pub. L. No. 95-619, 92 Stat. 3206, *as amended by* Energy Security Act, Pub. L. No. 96-294, §§ 546(a), 562, 565, 94 Stat. 611 (1980) (to be codified at 42 U.S.C. §§ 8217, 8235(a)-(i), 8281-8284). *See also* Danziger, *Renewable Energy Resources and Cogeneration: Community Systems and Grid Interaction as a Public Utility Enterprise*, 2 WHITTIER L. REV. 81 (1979); Dean & Miller, *Utilities at the Dawn of a Solar Age*, 53 N.D. L. REV. 329 (1977); Feuerstein,

The need to demonstrate and enhance solar technological capability also has stimulated legal activity. The Solar Heating and Cooling Demonstration Act of 1974,[13] the first major federal legislation in its field, was intended "to provide for the demonstration within a three-year period of the practical use of solar heating technology, and to provide for the development and demonstration within a five-year period of the practical use of the combined heating and cooling technology."[14] The residential grants for the final cycle of the Residential Solar Heating and Cooling Demonstration Program were completed in 1979.[15] Other national programs include continuing evaluation of demonstrations,[16] procurement of equipment,[17] research and development,[18] and dissemination of information to the public.[19]

Utility Rates and Solar Commercialization, 1 SOLAR L. REP. 305 (1979); Gilmer & Meunier, *Electric Utilities and Solar Energy: The Service Contract in a New Social Context*, 30 MERCER L. REV. 377 (1979); Goble, *Increasing the Use of the Sun: A Potential Role for the Energy Utilities*, 14 TULSA L.J. 63 (1978); Laitos & Feuerstein, *May Regulated Utilities Monopolize the Sun?*, 8 DEN. J. INT'L L. & POL'Y 31 (1979); Lawrence & Minan, *The Competitive Aspects of Utility Participation in Solar Development*, 54 IND. L.J. 229 (1979); Lawrence & Minan, *Solar Energy and Public Utility Rate Regulation*, 26 U.C.L.A. L. Rev. 550 (1979); Sparrow, *Public Utility Involvement with Distributed Solar Systems*, 1 SOLAR L. REP. 955 (1980).

13. 42 U.S.C. §§ 5501-5517 (1976).

14. 42 U.S.C. § 5501(b) (1976).

15. 1 SOLAR L. REP. 268-69, 894-97 (1979-1980). "These demonstration projects provide builders and developers an opportunity to gain actual experience with solar installations, offer the public a chance to see and buy solar homes, and permit HUD to collect data on solar system performance and market experience." *Foreword* to REAL ESTATE RESEARCH CORPORATION, SELLING THE SOLAR HOME '80: MARKET FINDINGS FOR THE HOUSING INDUSTRY (1980) [hereinafter cited as RERC MARKET FINDINGS] (prepared under contract to U.S. Dep't of Housing and Urban Development).

16. 1 SOLAR L. REP. 897 (1980).

17. For example, the Federal Photovoltaic Utilization Act, which is part 4 of Title V of the National Energy Conservation Policy Act, 42 U.S.C. §§ 8272, 8278 (Supp. 1979), authorized appropriations up to $98,000,000 for the period beginning October 1, 1978, and ending September 30, 1981, for procurement and installation of photovoltaic systems for federal buildings. The Federal Photovoltaic Utilization Act is amended by Title V, § 565 of the Energy Security Act, Pub. L. No. 96-294, 94 Stat. 752 (1980) (to be codified at 42 U.S.C. §§ 8281-8284).

18. *See* ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION, A NATIONAL PLAN FOR ENERGY RESEARCH, DEVELOPMENT & DEMONSTRATION: CREATING ENERGY CHOICES FOR THE FUTURE (vol. 1 & 2) (1976). *See also* Solo, *The Research and Development Program for Solar Energy*, in FEDERAL TRADE COMMISSION, THE SOLAR MARKET: PROCEEDINGS OF THE SYMPOSIUM ON COMPETITION IN THE SOLAR ENERGY INDUSTRY 146 (1978).

19. For example, the National Energy Conservation Policy Act requires utilities 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. The Act also makes the utility a project manager by requiring it to offer to inspect residential buildings, estimate purchase and in-

Although legal analysis in these areas is crucial and must be expanded, one should not assume that once the technological and economic barriers are lowered solar use will significantly increase. Solar energy is already technologically and economically viable in several areas.[20] Many solar products are already commercially available, and improvements are inevitable.[21] Moreover, as the cost of environmental energy sources increases, solar energy's competitive position will improve.[22] Even in the face of a mounting energy crisis, however, technical and economic viability of solar energy products may not be sufficient to assure their widespread use. Before successful commercialization will occur, there must be greater consumer confidence and institutional acceptance of solar equipment.

If a commercialization effort is to be successful, it must be directed toward four major groups: consumers, builders, building and housing code officials, and tax and other government benefit officials. Consumers are the ultimate users of both buildings equipped with solar systems and solar equipment used to retrofit existing structures.[23] Builders are important because they generally make

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stallation costs of conservation measures and anticipated savings, and arrange for installation and financing.

Lawrence & Minan, 54 IND. L.J., *supra* note 12, at 266 (referring to § 215(a)). Utility energy audit programs are established for multi-family dwellings and small commercial buildings in the Energy Security Act, Pub. L. No. 96-294, § 565, 94 Stat. 752 (1980) (to be codified at 42 U.S.C. §§ 8281-8284). The Energy Security Act also includes provisions for the coordination of information dissemination in general. *Id.* § 404, 94 Stat. 716 (to be codified at 42 U.S.C. § 7373).

20. The technological feasibility of a number of solar innovations, including flat plate collectors, evacuated tubes, photovoltaic cells, and passive applications, has been clearly established. For a general description of these basic technologies, see Lawrence & Minan, 54 IND. L.J., *supra* noto 12, at 21-34.

21. The Energy Information Administration (EIA) of the Department of Energy prepares six-month surveys of production, exports, and imports. *See* SOLAR ENERGY INTELLIGENCE REP., Nov. 12, 1979, at 454. "EIA's study also indicates a rise in prototype development in the industry. Some 243 firms are working on 417 new collectors, up from 201 firms and 350 prototypes." *Id.*

22. Solar use is presently economical in many areas. *See* Ben-David, Schulze, Balcomb, Katson, Noll, Roach & Thayer, *Near Term Prospects for Solar Energy: An Economic Analysis*, 17 NAT. RESOURCES J. 169 (1977). Additionally, continued oil price increases by the Organization of Petroleum Exporting Countries (OPEC) and the deregulation of natural gas under the Natural Gas Policy Act of 1978, Pub. L. No. 95-621, 92 Stat. 3352, have made traditional energy sources increasingly more costly. The Department of Energy predicts "that the world price of oil will rise from its present price of over $32 per barrel to $42.75 by 1985 and to $48.25 by 1990." [Oct. 30, 1980] EN. USERS REP. (BNA) 7.

23. Rotrofitting homes will be essential if the solar technology is to have any significant impact as an energy source for residences. "New buildings account for roughly 2-4 percent of the existing stock of buildings at a given time." R. SCHOEN, A. HIRSHBERG & J.

the initial determination whether to use solar or conventional heating and cooling appliances in new construction. Code officials play a significant role because they must finally approve the solar applications. Tax and other government benefit officials, such as loan or grant officers, are also important because they must determine solar eligibility for state or federal incentive purposes.

This Article examines the use of warranties and product standards in solar marketing as ways to bring about the needed confidence in and acceptance of solar equipment. The first part of the Article analyzes relevant warranty law from the perspectives of solar sellers and buyers. Some government and private groups have argued that warranties can provide the needed impetus for solar development, and there is thus a great tendency today to view warranties as the means to encourage solar usage. The premise advanced in this part of the Article, however, is that warranty law, operating independently, is unlikely to instill adequate buyer confidence or provide sufficient buyer protection to develop solar markets. The second part examines the major types of product standards promulgated in the United States in the context of solar energy and demonstrates their importance as a means of overcoming reluctance on the part of consumers, builders, code officials, and government benefit officials. The final part of the Article assesses how warranties and product standards can be used most successfully in the solar commercialization effort. The Article argnes that given the shortcomings of warranties, greater emphasis must be placed on the development of product standards if solar energy is to become a viable commercial enterprise in this country. The implementation of sound product standards is one of the most important and necessary acts to stimulate widespread solar use. The role of solar warranties is more modest; their primary contributions will be in a support capacity for product standards.

II. WARRANTIES

Providing express warranties is a common merchandising technique to instill consumer confidence in products. The express warranty is designed to increase a product's attractiveness by reducing the buyer's risk on the quality or performance capabilities of the product offered for sale. Implied warranties are also imposed as a matter of law in many sales transactions. These warranties are intended to assure purchasers that the products comply with at

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WEINGART, NEW ENERGY TECHNOLOGIES FOR BUILDINGS 125 (1975).

least minimum fitness standards.

Because of the success of warranty law in promoting both consumer confidence and customer protection in many sales transactions, warranties often are advocated as a means of advancing consumer acceptance of solar energy products.[24] Express warranties for solar products have even been required by legislation in a few states. For example, California conditions the availability of its solar state income tax credit[25] on the existence of solar equipment warranties,[26] and Maine subjects sellers to monetary penalties for failure to provide the required warranties to purchasers of solar energy equipment.[27] Warranties, however, have only a limited potential to create buyer confidence or provide buyer protection. Furthermore, relying on warranties as the principal response to these consumer needs is likely to retard rather than to promote solar energy development.

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24. *See* C. LUNDAHL, AN INVESTIGATION OF THE ACCEPTANCE OF SOLAR HEATING AND COOLING IN THE HOUSING INDUSTRY IN NEW MEXICO 70 (1976), *cited in* BEHAVIORAL STUDIES GROUP, GEORGE WASHINGTON UNIVERSITY, ANALYSIS OF POLICY OPTIONS FOR ACCELERATING COMMERCIALIZATION OF SOLAR HEATING AND COOLING SYSTEMS 448 n.42 (1977); BEHAVIORAL STUDIES GROUP, GEORGE WASHINGTON UNIVERSITY, ANALYSIS OF POLICY OPTIONS FOR ACCELERATING COMMERCIALIZATION OF SOLAR HEATING AND COOLING SYSTEMS 449; RERC MARKET FINDINGS, *supra* note 15, at 7; Jaroslovsky, *Solar Equipment Warranties: Consumer Problems in California*, 55 CAL. ST. B.J. 236, 239 (1980); Johnson, *supra* note 9; 30 MERCER L. REV. 547, 548-52 (1979). *See generally* FLORIDA SOLAR ENERGY CENTER, PROCEEDINGS OF SOLAR ENERGY CONSUMER PROTECTION WORKSHOP, OPENING AND FINAL PLENARY SESSIONS (1979).

25. CAL. REV. & TAX. CODE § 23601(a)(2) (West Supp. 1980). Legislative action was recently taken to extend the availability of the tax credit. CAL. REV. & TAX. CODE § 17052.5 (West Supp. 1980).

26. CAL. ADMIN. CODE tit. 20, § 2601 (West ___). Legislation similar to California's was introduced in the 1979 session of the Arizona legislature. ARIZ. REV. STAT. ANN. § 44-1762 (West Supp. 1980).

27. The Maine provision, enacted in 1979, establishes a five-year manufacturer's express warranty against defects in materials or construction and a one-year warranty on proper installation of the system. ME. REV. STAT. ANN. tit. 10, §§ 1491-1494 (1980). The New York Solar Energy Products Warranty Act requires all solar purchases to be recordod in writing. Although warranties are not mandated, disclosure of specific information is required, and the absence of a warranty must be conspicuously noted. N.Y. ENERGY LAW §§ 12-101, -104 (Consol. Supp. 1980).

The first imposed warranties came with the Department of Housing and Urban Development's Hot Water Initiative Program. Manufacturers were required to provide five-year warranties against defects in materials or manufacture; installers had to provide one-year warranties against defects in materials, manufacture, or installation. Similar warranties were required in Cycles 4 and 5 of the HUD Residential Solar Demoustration Program. *See* Mara & Engel, *Institutional Barriers to Solar Energy: Early HUD Demonstration Experiences*, 1 SOLAR L. REV. 1095, 1114 (1980).

A. Buyer Confidence

1. The Limitations of Warranties

Prospective solar users are understandably cautious about making solar purchases. Solar equipment uses a technology unfamiliar to most people, and its initial cost is greater than that of most comparable conventional energy systems. The potential buyer legitimately wants some assurances that a solar system will meet anticipated energy needs. These assurances are critical to overcome buyer hesitancy.

Recent data indicates that consumer concern about solar purchases is justified. A number of difficulties in the construction and installation of solar systems have been documented.[28] A study of consumer experiences with solar energy systems in Florida revealed major inadequacies;[29] the "data suggests that a disturbingly low fraction of the systems now being installed are free of significant problems or major potential problems."[30] The 1978 and 1979 results of the Solar Reliability and Materials Program conducted by the Argonne National Laboratory[31] indicate four problem areas concerning system reliability: freezing, interconnection leaks, controls, and collectors.[32] The number of these occurrences, although declining, is disturbingly large.[33] In addition, widespread adverse publicity can heighten consumer concern. Appropriate assurances to allay these concerns will be necessary for the successful marketing of solar systems.

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28. *See* Wysocki, *Solar-Energy Devices Abound, But Many Are Useless or Inefficient*, The Wall St. J., Apr. 28, 1977, at 1, col. 1. The General Accounting Office examined 91 residential units that had been installed as solar demonstration projects. Fifty-two percent of the units were either not working or were experiencing operational problems; 17% were not in operation long enough to assess their reliability. Only 31% of the units were maintaining reliable operations. GENERAL ACCOUNTING OFFICE, FEDERAL DEMONSTRATIONS OF SOLAR HEATING AND COOLING ON PRIVATE RESIDENCES—ONLY LIMITED SUCCESS 14 (1979) (report to the Congress by the Comptroller General).

29. M. Yarosh & A. Litka, Solar Commercialization—The Consumer Experience (undated) (unpublished thesis on file with Vanderbilt Law Review) (preliminary report on a study initiated in September 1977 by the Florida Solar Energy Center involving approximately 1,500 solar users in Florida).

30. *Id.* at 17. The problems centered on improper installation, system design, and sizing difficulties. Attempts to defraud and deceive consumers did not appear to be widespread. *Id.*

31. P. CHOPRA, RELIABILITY AND MATERIALS PERFORMANCE OF SOLAR HEATING AND COOLING SYSTEMS (1979).

32. *Id.* at 8. The effects of materials corrosion and heat-transfer fluid degradation on system reliability and thermal performance are currently being assessed. *Id.* at 14-18.

33. *Id.* at 8. *See also* Mara & Engel, *supra* note 27, at 1114.

A comprehensive manufacturer's warranty undoubtedly would provide the needed assurances to many interested consumers. This type of warranty, for example, might warrant the workmanship, installation, and performance characteristics of the unit for its life and offer to correct without charge any defects, malfunctions, or failures to conform to stated performance levels. In addition, the manufacturer might not disclaim or limit the duration of any implied warranty or exclude or limit consequential damages for breach of the warranty. This type of guarantee would significantly advance consumer confidence in solar products.

For a variety of reasons, however, solar manufacturers and suppliers cannot realistically provide such a comprehensive warranty. Essentially, the potential liability under this warranty would be too great. First, the most common solar applications create relatively high heat concentrations, which involve obvious dangers.[34] Second, many hot-water-heating or space-conditioning units use corrosive transfer fluids. Leaks of these fluids can damage the surrounding structure or contaminate the water supply. Third, a complete solar energy system is extensive. Typically, it might extend from panels on the roof—with plumbing, wiring, and ducts throughout the structure—to storage tanks and heat exchangers in the basement or under the structure. Repairing or replacing defective parts might be both difficult or expensive because of accessibility problems. Fourth, solar systems can provide hot water, space heating and conditioning, and electricity—services now commonly expected. A breakdown in a solar energy unit could lead to substantial costs in securing substitute energy forms. Because the consequences of a defective unit arguably may be foreseeable, a war-

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34. The dangers are not limited to heat concentration. Possible problems cited by the insurance company officials [interviewed by the Government Accounting Office] include increased fire hazards due to the high temperatures created in the solar collector, damage to property from water leaks, bodily injury and/or property damage from antifreeze leaks, and possible structural damage because of the additional weight of collectors.

GENERAL ACCOUNTING OFFICE, COMMERCIALIZING SOLAR HEATING: A NATIONAL STRATEGY NEEDED 17 (1979) (report to the Congress by the Comptroller General). The lack of current data on the extent of the risk involved also presents problems for insurance companies, since they need information on reliability, durability, and safety. The Insurance Services Office (ISO) examines new technologies to determine whether special rates are justified by any additional risk. "The ISO is a nonprofit organization based in New York and owned by 1,200 property and casualty companies. It is the major national rating service for the insurance industry and works closely with state insurance departments in setting contract terms and underwriting criteria." BEHAVIORAL STUDIES GROUP, *supra* note 24, at 447 n.37. The ISO does not yet have sufficient data to make a decision on solar energy systems. *Id.* at 447.

rantor is potentially liable for damages resulting from the breakdown.[35] A defect in an industrial solar heat process application, for example, could force a loss of plant production and subject a warrantor to a claim for lost profits.[36] Finally, since most modern solar applications are relatively new, the full extent and form of potential liability is uncertain.

Many solar manufacturers have not yet marketed enough units to have sufficient data upon which to base any extensive warranty. Manufacturers need time to ascertain and assess the actual operational characteristics of their products after they are sold.[37] This field data is essential because only after the equipment is sufficiently marketed is it exposed to the wide range of consumer uses, weather conditions, and other variables bearing on liability.

The sensitive nature of solar equipment also should make manufacturers hesitant to give comprehensive warranties. A potential solar purchaser is typically motivated by a desire to reduce the need for expensive conventional energy forms and thus will want to know the performance capabilities of a solar unit before buying it.[38] Representations given in response to performance inquiries are likely to be disclaimed as guarantees because of the large number of external variables affecting the performance capabilities of an installed system. In addition to obvious weather variations, performance will be affected by the sizing of the solar units to the application, installation, the amount of insulation, energy con-

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35. U.C.C. § 2-715(2) provides,

Consequential damages resulting from the seller's breach include

(a) any loss resulting from general or particular requirements and needs of which the seller at the time of contracting had reason to know and which could not reasonably be prevented by cover or otherwise; and

(b) injury to person or property proximately resulting from any breach of warranty.

For cases applying § 2-715(2), see Burrus v. Itek Corp., 46 Ill. App. 3d 350, 360 N.E.2d 1168 (1977)(defective printing press); Valley Die Cast Corp. v. A.C.W. Inc., 25 Mich. App. 321, 181 N.W.2d 303 (1970) (defective car wash system). *See also* Farnsworth, *Legal Remedies for Breach of Contract*, 70 COLUM. L. REV. 1145, 1199-1210 (1970); Special Project, *Article Two Warranties in Commercial Transactions*, 64 CORNELL L. REV. 30, 158-67 (1978).

36. *See, e.g.*, Lewis v. Mobil Oil Corp., 438 F.2d 500, 510 (8th Cir. 1971)(loss of profits is a natural consequence of the disruption of production of a manufacturing enterprise). *See also* Comment, *Lost Profits as Contract Damages: Problems of Proof and Limitations on Recovery*, 65 YALE L.J. 992 (1956).

37. A vicious circle exists: "Until manufacturers install enough solar systems to know what problems can be expected, they cannot prudently offer broad warranties; meanwhile, consumers hesitate to buy unwarranted systems, thus retarding the collection of information on which warranties are necessarily based." BEHAVIORAL STUDIES GROUP, *supra* note 24, at 449.

38. "The most frequently asked question [by buyers of solar homes] concerns the utility cost savings a homeowner should expect." RERC MARKET FINDINGS, *supra* note 15, at 14.

sumption patterns, and other factors.[39] Solar manufacturers are thus unlikely to want to warrant performance at any specific level; they are more likely to limit warranties to guaranteeing an absence of defects in materials or workmanship.

The warranties actually given are also likely to be restricted to relatively short time periods, which will further influence the general value of warranties as a method of promoting consumer confidence. Due largely to the absence of sufficient field data, and in many cases to the lack of capacity to ensure greater product responsibility,[40] most warranties against defects in materials and workmanship will extend for only one to three years.[41] This warranty period may seem too short to some prospective consumers. Of course, many industries regularly sell products without encountering consumer resistance even though their warranties fall far short of the projected life of the product. For example, in the automobile industry the warranty is substantially less than the expected useful life of the product. The situation for the solar energy industry is likely to be different, however. Consumers have a history of experience with automobiles and conventional appliances that satisfies them that these products will retain their value after the warranty period. Conversely, many consumers have no experience with solar equipment and are therefore uncertain of product value. Solar purchasers are more likely to expect representations on product life from the seller, thus making product life central to the bargaining process. If the seller guarantees the product for only a fraction of its asserted useful life, consumers are likely to demand an additional form of quality assurance. Moreover, unlike the automobile, alternatives to solar systems are available to meet energy needs.

The nature of the industry is another factor militating against the provision of extensive solar equipment warranties by manufacturers. The solar manufacturing industry is characterized by ease of entry and low start-up costs. Consequently, many of the entrants are newly formed small businesses incapable of guaranteeing

39. "Utility savings are affected by the kind of solar systems used, when it is expected to operate most efficiently, the occupant's lifestyle and utility usage, and the price of conventional fuels." *Id.* at 15.

40. Examples of additional considerations leading to short warranty periods, based primarily upon product characteristics of appliances and consumer goods of a mechanical, electrical, or electronic nature, are provided in Eddy, *Effects of the Magnuson-Moss Act Upon Consumer Product Warranties*, 55 N.C. L. REV. 835, 840-45 (1977).

41. One-year warranties on mechanical and electronic parts are common. 30 MERCER L. REV. 547, 551 (1979).

extensive product responsibility. Furthermore, the industry lacks vertical integration. Manufacturers often make only discrete parts, such as collectors, storage tanks, and controls, which are then assembled and installed by others to create a working system. When no single business entry is responsible for manufacturing, distributing, selling, and installing solar equipment, firms are unlikely to warrant features over which they have no control.[42]

Solar equipment manufacturers will thus undoubtedly be inclined to provide far less than the maximum warranty. Moreover, existing laws allow significant limitations on warranties, and in some cases, even their disclaimer. Article Two of the Uniform Commercial Code (U.C.C.), enacted in all jurisdictions except Louisiana,[43] governs express warranties[44] and two forms of implied warranties. The generally applicable implied warranty of merchantability assures the fitness of an item for ordinary purposes,[45] while the more limited implied warranty of fitness for a particular purpose gnarantees that the goods will meet the buyer's specified needs.[46] Article Two, however, also permits the modification or limitation of buyer remedies for a breach of warranty[47] and allows limitation or complete disclaimer of both express and implied warranties.[48] Under the U.C.C., therefore, a solar manufacturer can combine express warranties and limitations to shape the extent of the responsibility that it is willing to undertake. Given this freedom, a manufacturer is not likely to provide full gnarantees for its products.

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42. *See generally* FLORIDA SOLAR ENERGY CENTER, WARRANTIES (1978)(prepared for participants at the Solar Energy Consumer Protection Workshop, Atlanta, Georgia).

43. J. WHITE & R. SUMMERS, THE UNIFORM COMMERCIAL CODE 1 (1980).

44. U.C.C. § 2-313.

45. U.C.C. § 2-314(c). Unlike the other warranties under the U.C.C., the seller must be a merchant to create an implied warranty of merchantability. The term "merchant" is defined in § 2-104(1).

46. U.C.C. § 2-315.

47. The measure of recovery of a buyer's damages for breach of a warranty is provided in U.C.C. § 2-714. Section 2-719 permits the contractual modification or limitation of remedies. *See generally* Eddy, *On the "Essential" Purposes of Limited Remedies: The Metaphysics of UCC Section 2-719(2)*, 65 CALIF. L. REV. 28 (1977); Peters, *Remedies for Breach of Contracts Relating to the Sale of Goods Under the Uniform Commercial Code: A Roadmap for Article 2*, 73 YALE L.J. 199, 250-53, 268-72 (1963); Special Project, *supra* note 35, at 106-30, 212-43; 63 VA. L. REV. 791 (1977).

48. U.C.C. § 2-316(1) governs the disclaimer of express warranties. The disclaimer of implied warranties is covered by § 2-316(2) and (3).

2. The Magnuson-Moss Act

The Magnuson-Moss Act, a federal consumer warranty law enacted in 1975,[49] prohibits many combinations of express warranties, implied warranties, disclaimers of warranties, and limitations of remedies possible under the Uniform Commercial Code. The Act, however, does not mandate the use of any warranties. Rather it regulates the use of written warranties, which are defined in the Act as

> (A) any written affirmation of fact or written promise made in connection with the sale of a consumer product by a supplier to a buyer which relates to the nature of the material or workmanship and affirms or promises that such material or workmanship is defect free or will meet a specified level of performance over a specified period of time, or
>
> (B) any undertaking in writing in connection with the sale by a supplier of a consumer product to refund, repair, replace, or take other remedial action with respect to such product in the event that such product fails to meet the specifications set forth in the undertaking.[50]

When a consumer product supplier makes any written warranty with respect to the product sold, the Act prohibits the disclaimer or modification of any implied warranty created by state law.[51] The duration of the implied warranties, however, can be limited to the same time period as any express warranty, but it may not be limited to a shorter period.[52] The Magnuson-Moss Act thus prevents sellers from extending narrow express warranties in conjunction with a disclaimer of the implied warranties provided in Article Two.[53]

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49. Pub. L. No. 93-637, 88 Stat. 2183 (1975). The full title of the legislation is the Magnuson-Moss Warranty—Federal Trade Commission Improvement Act. Title I of the Act deals with consumer product warranties. 15 U.S.C. §§ 2301-2312 (1976). Title II deals with expanded rulemaking powers of the Federal Trade Commission. 15 U.S.C. § 57a-c (1976).

50. 15 U.S.C. § 2301(6) (1976).

51. 15 U.S.C. § 2308(a) (1976).

52. 15 U.S.C. § 2308(b) (1976). Warrantors providing a "full" warranty, as distinct from a "limited" warranty, are precluded from limiting even the duration of the implied warranties. 15 U.S.C. § 2304(a)(2) (1976). Full and limited warranty requirements under the Magnuson-Moss Act are discussed at notes 97-100 *infra* and accompanying text. The allowed limitations on the duration of implied warranties must be "conscionable and . . . set forth in clear and unmistakable language and prominently displayed on the face of the warranty." 15 U.S.C. § 2308(b) (1976). The cautious seller will also comply with any additional state requirements for modification of implied warranties. For example, U.C.C. § 2-316(2) requires that with respect to modifications of the implied warranty of merchantability, the word "merchantability" must be specifically mentioned. *See* Denicola, *The Magnuson-Moss Warranty Act: Making Consumer Product Warranty a Federal Case*, 44 FORDHAM L. REV. 273, 292 (1975).

53. Four major empirical studies on the effectiveness of warranties in the marketplace

Decisionmaking by members of the solar equipment industry is complicated considerably by the interrelationship of the U.C.C. and the Magnuson-Moss warranty provisions.[54] The application of their provisions to the various solar marketing activities raises difficult questions. Because of the nature of the products and their uses, decisions will be more complex for solar suppliers than for other retailers and manufacturers. Since solar equipment has residential, commercial, and industrial uses, the Magnuson-Moss Act's application to "consumer products" raises the issue of the Act's coverage of each of these uses. Moreover, because solar products are generally affixed to real property, the issue arises whether these products are personal property, and thus covered by the statutes, or real property. Confusion about applicability may also result because the various solar system component parts will often make a single system categorization impossible. Finally, since contractors might be hired to supply as well as install the equipment, the Article Two goods/services dichotomy must also be addressed to determine whether the U.C.C. warranties apply. Each of these issues is analyzed in greater detail below.

(a) Solar Equipment as a "Consumer Product"

As noted above, the Magnuson-Moss Act applies to written warranties on "consumer products."[55] The Act defines a consumer product as "any tangible personal property which is distributed in

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preceded the enactment of the Magnuson-Moss Act. *See* STAFF OF SUBCOMM. ON COMMERCE & FINANCE, HOUSE COMM. ON INTERSTATE & FOREIGN COMMERCE, H.R. REP. NO. 1107, 93D CONG., 2D SESS., REPORT ON CONSUMER PRODUCT WARRANTIES (1974); FEDERAL TRADE COMM'N, DEP'T OF COMMERCE, DEP'T OF LABOR, & SPEC. ASS'T TO THE PRES. FOR CONSUMER AFFAIRS, REPORT OF THE TASK FORCE ON APPLIANCE WARRANTIES AND SERVICE (1969); FEDERAL TRADE COMM'N, REPORT ON AUTOMOBILE WARRANTIES (1970); Whitford, *Law and the Consumer Transaction: A Case Study of the Automobile Warranty*, 1968 WIS. L. REV. 1006. For discussions of these studies in the context of the passage of the Magnuson-Moss Act, see Brickey, *The Magnuson-Moss Act—An Analysis of the Efficacy of Federal Warranty Regulation as a Consumer Protection Tool*, 18 SANTA CLARA L. REV. 73, 74-80 (1978); Rothschild, *The Magnuson-Moss Warranty Act: Does It Balance Warrantor and Consumer Interests?*, 44 GEO. WASH. L. REV. 335, 350-53 (1976).

54. "Perhaps the most complex formula for federal-state interaction in the consumer field is the Magnuson-Moss Warranty Act." O'Neil, *State Consumer Protection in a Federal System*, 1975 ARIZ. ST. L.J. 715, 718. "Counsel for large retailers and for manufacturers of consumer products should beware; there are many problems lurking in the words of the Magnuson-Moss Act and in the regulations promulgated under it." J. WHITE & R. SUMMERS, *supra* note 43, at 371. "The exact scope of the [Magnuson-Moss] Act is vague and ill-defined, and its relationship to existing state law remains perplexing despite protracted efforts at explication." Denicola, *supra* note 52, at 300.

55. 15 U.S.C. §§ 2302-2303 (1976).

commerce and which is normally used for personal, family, or household purposes."[56] Although some ambiguity associated with the term "normally used" has been removed from regulations promulgated by the Federal Trade Commission (FTC), the application of those regulations to many solar products is still in doubt. The Act obviously covers residential solar equipment even when the product is used by a business,[57] because the FTC regulations specify that "the use to which a product is put by any individual buyer is not determinative."[58] Thus, a solar system designed for single family residence use is a consumer product under the Magnuson-Moss Act even though installed in a doctor's office. On the other hand, the Act's applicability to equipment designed for commercial and industrial uses is less clear, particularly if some of the equipment is actually used for residential purposes. Although the proposed FTC regulations indicated that "where *an appreciable portion* of a product category is normally sold to consumers for personal, family, or household purposes, . . . all warranties and services contracts applicable to such products must conform with the Act,"[59] the final regulations appear to set forth a contrary rule. The final regulations declare that "[t]he percentage of sales . . . is not determinative."[60] The impact of this declaration on the classification of solar products for purposes of the Act is unclear. Some type of "appreciable portion" test would appear to be inherent in both the statutory standard of "normally used" and the requirement that "the use of that type of product . . . not [be] uncommon."[61] Moreover, the FTC stated in its final regulations that "[t]he fact that some items from the earlier statement [of statutory interpretation] are omitted from these interpretations does not mean that the Commission no longer holds those views."[62] In light of these factors, the final regulations' position on classification by use seems less resolute.

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56. 15 U.S.C. § 2301(1) (1976).

57. In this respect the Act's definition differs from that of the U.C.C. Under U.C.C. § 9-109(1), goods are classified as "consumer goods" if "they are used or bought for nse primarily for personal, family or household purposes." If the goods are actually used or bought for use primarily in business, they are classified as "equipment." U.C.C. § 9-109(2). Article 2 incorporates the Article 9 definition of consumer goods. U.C.C. § 2-103(3).

58. 16 C.F.R. § 700.1(a) (1980).

59. Federal Trade Commission, Magnuson-Moss Warranty Act Implementation and Enforcement Policy, 40 Fed. Reg. 25,721, 25,722 (1975) (emphasis added).

60. 16 C.F.R. § 700.1(a) (1980).

61. *Id.*

62. 42 Fed. Reg. 36,112 (1977).

While solar equipment designed for commercial or industrial applications but used in a personal or household context is thus arguably subject to Magnuson-Moss coverage, the actual application of the Act to such equipment will depend on how both the Act and solar equipment are viewed by the courts. A court could conceivably treat all solar units alike and apply the Act without distinguishing residential, commercial, and industrial systems. This route would be the simplest one for a court to take. If, on the other hand, a court should choose to make a distinction between systems, it could face severe interpretive problems because some of the systems' components are easily interchangeable. For example, the use of commercial or industrial systems on apartments or condominiums could be interpreted as a use for family or household purposes. Additionally, even commercial or industrial systems supplied by a manufacturer exclusively for industrial applications could fall within the Act's coverage if similar products from other suppliers are used for personal or household purposes. In light of these interpretive variations, suppliers should be aware of the regulations' caveat that ambiguities will be resolved in favor of coverage.[63]

(b) Solar Equipment and Real Property

The Magnuson-Moss definition of "consumer product" also includes tangible personal property that is intended to be attached to or installed in any real property without regard to whether it is actually so attached or installed.[64] The FTC regulations distinguish between "separate items of equipment" and "integral component parts of the structure." Products classified as separate equipment are covered by the Act irrespective of whether they are sold over the counter, provided pursuant to an installation contract, or are already installed at the time of sale of the real property.[65] On the other hand, whether certain integral components are covered by the Act depends on "the nature of the purchase transaction."[66] Although coverage extends to any building materials sold over the counter or purchased "in connection with the improvement, repair, or modification of a home,"[67] building products other than separate items of equipment are not consumer products—and are

63. 16 C.F.R. § 700.1(a) (1980).
64. 15 U.S.C. § 2301(1) (1976).
65. 16 C.F.R. § 700.1(c), (e), (f) (1980).
66. *Id.* § 700.1(e).
67. *Id.*

therefore not covered—"when they are sold as part of real estate covered by a written warranty"[68] or when they are acquired through a contract "with a builder to construct a home, a substantial addition to a home, or other realty (such as a garage or an in-ground swimming pool)."[69] Under this "purchase-transaction" analysis, solar equipment components characterized as "integral component parts of the structure" and sold as part of real estate or supplied in an initial construction contract will be excluded from Magnuson-Moss coverage.

Given this dichotomy in categories, the characterization of some solar system components for purposes of the Act will be relatively simple. Solar collectors, for example, will always be "separate items of equipment" and will be covered when normally used for personal, family, or household purposes.[70] Similarly, many other components—wiring, plumbing, ducts, and roofing[71]—are clearly "integral component parts of the structure" and will thus be subject to the purchase-transaction analysis to determine coverage. The characterization of other components, however, will not be so easy. Whether a product will be considered a "separate item of equipment" or an "integral component" under the regulations does not depend upon the physical separateness of the item. Instead, the item must be "*functionally* separate from the realty" to fall within the former category;[72] otherwise, it is an integral component. The difficulty—if not absurdity—with this distinction is demonstrated by the FTC's classifications themselves: "The FTC would classify as a consumer product a thermostat but not a light fixture; an oven hood, but not a shower stall; a boiler, but not a radiator; and a whirlpool bath, but not a bidet."[73] Other solar system components, such as heat exchangers, controls, storage tanks,

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68. *Id.*

69. *Id.* § 700.1(f).

70. The regulations include illustrations of equipment such as "air conditioners, furnaces, and water heaters" and indicate that the equipment category "includes, but is not limited to, appliances and other thermal, mechanical, and electrical equipment." *Id.* § 700.1(c), (d).

71. The regulations specifically refer to these products as falling within the "integral component parts" category. *Id.* § 700.1(d), (e).

72. FTC Advisory Opinion, Home Owners Warranty Corp. & Nat'l Ass'n of Home Builders, [1976-1979 Transfer Binder] TRADE REG. REP. (CCH) ¶ 21,245, at 21,140 (1976) (emphasis in original).

73. Schroeder, *Private Actions under the Magnuson-Moss Warranty Act*, 66 CALIF. L. REV. 1, 6 (1978). The statement is based upon the classifications provided in FTC Advisory Opinion, Home Owners Warranty Corp. & Nat'l Ass'n of Home Builders, [1976-1979 Transfer Binder] TRADE REG. REP. (CCH) ¶ 21,245 (1976).

and insulation, present similar difficult characterization questions.

Even though the Magnuson-Moss Act applies to written warranties for separate items of equipment sold as part of the real estate or acquired through realty construction contracts, the Act's prohibition on the disclaimer of implied warranties should not affect solar products dealers who give such warranties—at least with regard to the U.C.C. implied warranties.[74] The applicability of implied warranties to fixtures under the U.C.C. is limited to instances in which the goods are to be severed from the realty by the seller, or in which they are sold separately from the land and can be severed without material harm to the realty.[75] These conditions will not be satisfied in cases in which the buyer acquires solar equipment from real estate sales or construction contracts.[76]

The U.C.C. is not the only source of implied warranties, however. Other state laws might create such warranties,[77] and in fact several states now include implied warranties with the sale of real property.[78] The disclaimer prohibition of the Magnuson-Moss Act could reach such warranties.[79] Under the law governing the sale of land or buildings, the buyer traditionally assumed the risk of quality.[80] The seller had no responsibility for defects discovered after the sale unless an express warranty was included in the deed, or

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74. The Magnuson-Moss prohibition on disclaimers of implied warranties will apply to solar components sold over the counter that are covered by a written warranty. The U.C.C. provides implied warranties for such sales. Under U.C.C. § 2-102, Article 2 warranties apply to contracts for the sale of goods, which are defined as "all things . . . which are movable at the time of identification to the contract for sale . . . ." U.C.C. § 2-105(1).

75. U.C.C. § 2-107(1), (2).

76. For holdings that air conditioners are part of the realty and not subject to the U.C.C. warranty provisions, see Voight v. Ott, 86 Ariz. 128, 341 P.2d 923 (1959); Gable v. Silver, 258 So. 2d 11 (Fla. Dist. Ct. App.), *aff'd per curiam*, 264 So. 2d 418 (Fla. 1972). The U.C.C. warranty provisions could be extended by analogy. *See* Murray, *Under the Spreading Analogy of Article 2 of the Uniform Commercial Code*, 39 FORDHAM L. REV. 447 (1971).

77. *See, e.g.*, LA. CIV. CODE ANN. arts. 2520-2548 (West 1952).

78. *See generally* Bearman, *Caveat Emptor in Sales of Realty—Recent Assaults Upon the Rule*, 14 VAND. L. REV. 541 (1961); Haskell, *The Case for an Implied Warranty of Quality in Sales of Real Property*, 53 GEO. L.J. 633 (1965); Jaeger, *The Warranty of Habitability*, 46 CHI.-KENT L. REV. 123 (1969); Roberts, *The Case of the Unwary Home Buyer: The Housing Merchant Did It*, 52 CORNELL L.Q. 835 (1967); Note, *Caveat Emptor in the Sale of Real Property—Epitaph to an Inequitable Maxim*, 4 MEM. ST. U.L. REV. 54 (1973); 26 OKLA. L. REV. 111 (1973); 16 ST. LOUIS U.L.J. 167 (1971); 23 U. FLA. L. REV. 626 (1971); 26 U. MIAMI L. REV. 838 (1972).

79. Even if state law does not provide any implied warranties for fixtures, which would make the Magnuson-Moss prohibition on disclaimer of implied warranties irrelevant, the "consumer product" characterization is still relevant to determine the applicability of the other provisions of the Act to written warranties on the product.

80. J. CRIBBET, PRINCIPLES OF THE LAW OF PROPERTY 263-67 (1975).

fraud or misrepresentation had occurred.[81] Gradually, however, many of the principles governing the sale of commercial goods were applied to real property transactions. In the 1960s courts began to apply an implied warranty of fitness to real property, and by the late 1970s over one-half of the states held builder-vendors to an implied standard of reasonable workmanship, at least with respect to new housing.[82] If implied warranties of this sort are held to be applicable to solar equipment attached to realty, manufacturers and dealers will be subject to them because of the Magnuson-Moss Act's rule against disclaimers.

(c) Solar Equipment Installed Under Contract

The implied warranty disclaimer prohibition in the Magnuson-Moss Act might be irrelevant if the solar unit is acquired through a contract to improve or modify a home. While the Act clearly applies to written warranties on any of the system's components, the U.C.C. implied warranties might not be applicable. Since Article Two applies only to contracts for the sale of goods, some courts have held that it does not apply to transactions in goods when services are included as part of the contract.[83] In-

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81. "The great weight of authority does not support implied warranties in real estate transactions but requires any purported warranties to be in written contractual form. No decision has come to our attention which permitted recovery by the vendee of a house upon the theory of implied warranty." Druid Homes, Inc. v. Cooper, 272 Ala. 415, 416, 131 So. 2d 884, 885 (1961) (citations omitted), *overruled*, Cochran v. Keeton, 287 Ala. 439, 440, 252 So. 2d 313, 314 (1971).

82. 29 MERCER L. REV. 323, 330 n.43 (1977). The following observation by the California Supreme Court is illustrative of judicial reasoning on this issue:

> In the setting of the marketplace, the builder or seller of new construction—not unlike the manufacturer or merchandiser of personalty—makes implied representations, ordinarily indispensable to the sale, that the builder has used reasonable skill and judgment in constructing the building. On the other hand, the purchaser does not usually possess the knowledge of the builder and is unable to fully examine a completed house and its components without disturbing the finished product. Further, unlike the purchaser of an older building, he has no opportunity to observe how the building has withstood the passage of time. Thus he generally relies on those in a position to know the quality of the work to be sold, and his reliance is surely evident to the construction industry.

Pollard v. Saxe & Yolles Dev. Co., 12 Cal. 3d 374, 379, 525 P.2d 88, 91, 115 Cal. Rptr. 648, 651 (1974) (en banc).

83. For discussions of the development of the law in this area, see Farnsworth, *Implied Warranties of Quality in Non-Sales Cases*, 57 COLUM. L. REV. 653 (1957); Greenfield, *Consumer Protection in Service Transactions—Implied Warranties and Strict Liability in Tort*, 1974 UTAH L. REV. 661; Note, *The Application of Implied Warranties to Predominately "Service" Transactions*, 31 OHIO ST. L.J. 580 (1970); Note, *Contracts for Goods and Services and Article 2 of the Uniform Commercial Code*, 9 RUT.-CAM. L.J. 303 (1978); Comment, *Sales-Service Hybrid Transactions: A Policy Approach*, 28 SW. L.J. 575 (1974).

deed, many courts have found construction and home improvement contracts to be contracts for labor and materials rather than contracts for sales of goods.[84] Contracts for the sale and installation of air-conditioning systems, furnaces, plumbing, and boilers, all of which are closely analogous to components of solar energy systems, have been held to be contracts for services.[85] Other jurisdictions, however, have held the Code applicable to such contracts.[86] Implied warranty liability has even been applied to the installation of electrical wiring.[87] Clearly, then, determining the applicability of warranties in service-sale cases involving installation of household fixtures adds to the legal uncertainties facing the supplier of solar products. It is important to note, however, that in other contexts the FTC has taken the position that a service con-

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84. R. ANDERSON, ANDERSON ON THE UNIFORM COMMERCIAL CODE § 2-105:11, at 230 (2d ed. 1970). Various tests have been developed to distinguish sales contracts from contracts for services. Professor Farnsworth identified four rules that evolved in the statuta of frauds context that also have been applied to other issues affecting sales-service transactions. The English Rule prohibited an action for breach of contract to sell goods if the agreement did not result in the sale of a chattel; such a sale precluded an action for work and labor. Lee v. Griffin, 121 Eng. Rep. 716, 718 (Q.B. 1861). The New York Rule designated contracts for goods already in existence as contracts for the sale of goods and contracts for goods to bo manufactured as agreements for services. Parsons v. Loucks, 48 N.Y. 17 (1871). The Massachusetts Rule held that goods specially manufactured for the buyer that are not suited for sale to others in the ordinary course of the seller's business are the subject of a contract for the sale of services. Goddard v. Binney, 115 Mass. 450 (1874); Mixer v. Howarth, 38 Mass. (21 Pick.) 205 (1938). Finally, the "essence test" determines "whether work is the essence of the contract, or whether it is the materials supplied." Clay v. Yates, 156 Eng. Rep. 1123, 1125 (Ex. 1856). *See also* Rebinson v. Graves, [1935] 1 K.B. 579, 580; Farnsworth, *supra* note 83, at 663-65. The essence test has been followed in a number of U.C.C. cases: "The test for inclusion or exclusion is . . . whether their predominant factor, their thrust, their purpose, reasonably stated, is the rendition of service, with goods incidentally involved . . . or is a transaction of sale, with labor incidentally involved . . . ." Bonebrake v. Cox, 499 F.2d 951, 960 (8th Cir. 1974).

85. Mingledorff's, Inc. v. Hicks, 133 Ga. App. 27, 209 S.E.2d 661 (1974) (installation of air conditioner and heating system); Airco Refrigeration Serv., Inc. v. Fink, 242 La. 73, 134 So. 2d 880 (1961) (installation of air conditioner); Meyn v. Ross, 9 U.C.C. Rep. Serv. 1357 (Pa. Ct. C.P. 1971) (installation of plumbing).

86. Pittsburgh-Des Moines Steel Co. v. Brookhaven Manor Water Co., 532 F.2d 572 (7th Cir. 1976) (construction of water tank); Gateway Co. v. Charlotte Theaters, Inc., 297 F.2d 483 (1st Cir. 1961) (supply and installation of air conditioning equipment); Aced v. Hobbs-Sesack Plumbing Co., 55 Cal. 2d 573, 360 P.2d 897, 12 Cal. Rptr. 257 (1961) (en banc) (installation of radiant heating system); Kunian v. Development Corp. of America, 165 Conn. 300, 334 A.2d 427 (1973) (installation of plumbing and equipment for air conditioning and heating); Hamilton Fixture Co. v. Anderson, 285 So. 2d 744 (Miss. 1973) (heating system); Worrell v. Barnes, 87 Nev. 204, 484 P.2d 573 (1971) (connection of a water heater); Dunn Buick, Inc. v. Belle Isle Plumbing, Heating & Air Conditioning Co., 9 U.C.C. Rep. Serv. 827 (Okla. Ct. App. 1971) (supply and installation of boiler).

87. Insurance Co. of N. America v. Radiant Elec. Co., 55 Mich. App. 410, 222 N.W.2d 323 (1974).

tract that includes the sale of consumer products is subject to the Magnuson-Moss Act—no matter how incidental the goods are to the service transaction.[88]

3. The Impact of the Magnuson-Moss Act on Sellers of Solar Products

The Magnuson-Moss Act arguably benefits consumers by preventing sellers from giving express warranties that appear to provide good coverage while concurrently disclaiming implied warranties that are more substantial. The Act, however, can have an adverse effect on the solar equipment industry. Because many solar purchasers will be inexperienced, they will of necessity rely upon the seller to supply an adequate product. In this situation, an implied warranty of fitness for a particular purpose will be involved. The three conditions set forth in the U.C.C. for such a warranty's existence will be met: (1) the seller has reason to know the buyer's particular purposes, (2) the seller has reason to know that the buyer is relying on the seller's skill or judgment to select or furnish suitable goods, and (3) the buyer relies upon the seller's skill or judgment.[89] The buyer will essentially rely upon the seller's estimation of a particular solar unit's performance capability to satisfy the buyer's specific needs.[90] Under these circumstances the seller's implied warranty of fitness becomes basically a performance guarantee—a warranty that solar equipment suppliers cannot realistically undertake because of the variety of factors that, in addition to product quality, can significantly affect system performance.[91]

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88. *See FTC Staff Explains Details of Magnuson-Moss Warranty Act*, [1976] ANTITRUST & TRADE REG. REP. (BNA) No. 759, at A-1 ("undercoating applied to passenger vehicles is subject to the statute").

89. U.C.C. § 2-315.

90. "Buyers who are interviewed immediately after purchasing their home cite potential energy and cost savings as the most attractive features of the solar system." RERC MARKET FINDINGS, *supra* note 15, at 3.

91. "One of the major causes of dissatisfaction with solar equipped homes is that people believe that the system does not produce the utility savings 'promised' by the builder." *Id.* at 14. Dissatisfied buyers are likely to turn to litigation. One recent incident is illustrative of this point:

> In Colorado in May 1979, J. Harvey and Ruby Smith filed a complaint against Perl-Mack Enterprises Co., concerning a home specially equipped with a solar heating system which the Smiths had purchased from Perl-Mack in the summer of 1978. The Smiths claim damages for the value of the solar system, lost value of their home, increased utility bills, and repairs. They claim that Perl-Mack misrepresented the quality, capability, and expense of operating the solar system. Mr. Smith says that, when he bought the home, he was told the system would furnish 70% of domestic hot water and

Many solar suppliers will thus avoid using written express warranties in order to retain the legal right to disclaim the implied warranties.[92] If they do respond to buyers' requests for performance data, they must do so carefully in order to avoid the argument that they are supplying a product that will meet the buyer's particular needs. Since many of the suppliers' comments will be oral, the potential for unintentional over-statement is great. On the other hand, a sales representation disclaiming all implied warranties, which also either disclaims or at least avoids written express warranties, or which does not include the buyer's specific needs as part of the bargain, does not promote consumer confidence.

The Magnuson-Moss Act's prohibition on disclaiming implied warranties also applies when the supplier enters into a service contract on a product within ninety days after its sale.[93] A service contract is a written contract to perform maintenance or repair services over a fixed time period or for a specified duration.[94] Suppliers commonly offer them with the sale of conventional major appliances. Solar service contracts could significantly enhance consumer confidence in solar products by assuring customers of the availability of maintenance and repair services. Predictably, however, many solar suppliers will be hesitant to offer service contracts because the Magnuson-Moss Act again prohibits disclaimers of implied warranties. Thus, another opportunity to advance consumer confidence in solar products may be lost because the statute shifts an excessive product risk to the seller.

Another aspect of the Magnuson-Moss Act might also induce solar suppliers to avoid providing written warranties. The Act[95] compels anyone offering a written warranty on a consumer product to comply with FTC rules requiring the disclosure of certain information.[96] The Act also requires that all written warranties be des-

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heat. Yet Mr. Smith paid more last winter to heat his home using his solar system with electric backup than other Denver homeowners paid using all-electric systems in homes of similar size. Perl-Mack maintains that the system is operating as designed and that no additional repairs or modifications are necessary.

1 SOLAR L. REP. 729 (1979).

92. This course has already been followed by some industries. FLORIDA SOLAR ENERGY CENTER, *supra* note 42, at 4; FLORIDA SOLAR ENERGY CENTER, *supra* note 24, at 0-62.

93. 15 U.S.C. § 2308(a) (1976). *See* Note, *Consumer Product Warranties Under the Magnuson-Moss Warranty Act and the Uniform Commercial Code*, 62 CORNELL L. REV. 738, 749 n.75 (1977).

94. 15 U.S.C. § 2301(8) (1976).

95. 15 U.S.C. § 2302(a) (1976).

96. 16 C.F.R. § 701.3 (1980). The items that must be disclosed in a written warranty

ignated as "full" or "limited."[97] Because a full warranty must incorporate certain statutory minimum standards,[98] their use is the

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are:

(1) The identity of the party or parties to whom the written warranty is extended . . .;

(2) A clear description and identification of preducts, or parts, or characteristics, or components or properties covered by . . . the warranty;

(3) A statement of what the warrantor will do in the event of a defect, malfunction or failure to conform with the written warranty, including the items or services the warrantor will pay for or provide . . .;

(4) The point in time or event on which the warranty term commences, if different from the purchase date, and the time peried or other measurement of warranty duration;

(5) A step-by-step explanation of the procedure which the consumer should follow in order to obtain performance of any warranty obligation . . .;

(6) Information respecting the availability of [any] informal dispute settlement mechanism . . .;

(7) Any limitations on the duration of implied warranties, disclosed on the face of the warranty . . ., accompanied by the following statement:

Some states do not allow limitations on how long an implied warranty lasts, so the above limitation may not apply to you;

(8) Any exclusion of or limitations on relief such as incidental or consequential damages . . .;

(9) A statement in the following language:

This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

Id.

97. 15 U.S.C. § 2303 (1976); 16 C.F.R. § 700.6 (1980). "Evidently, the 'full' and 'limited' labels are intended to create a bright line that consumers will bo able to recognize clearly and, thus, to meet objections voiced about the minimal competitive effect to be expected from the disclosure rules." Eddy, *supra* note 40, at 862.

98. 15 U.S.C. §§ 2303(a)(1), 2304 (1976). The minimum standards for a "full" warranty are:

In order for a warrantor warranting a consumer product by means of a written warranty to meet the Federal minimum standards for warranty—

(1) such warrantor must as a minimum remedy such consumer product within a reasonable time and without charge, in the case of a defect, malfunction, or failure to conform with such written warranty;

(2) notwithstanding [the section allowing limitations on the duration of implied warranties] such warrantor may not impose any limitation on the duration of any implied warranty on the product;

(3) such warranter may not exclude or limit consequential damages for breach of any written or implied warranty on such preduct, unless such exclusion or limitation conspicuously appears on the face of the warranty; and

(4) if the product (or a component part thereof) contains a defect of malfunction after a reasonable number of attempts by the warranter to remedy defects or malfunctions in such product, such warrantor must permit the consumer to elect either a refund for, or replacement without charge of, such product or part (as the case may be). The Commission may by rule specify for purposes of this paragraph, what constitutes a reasonable number of attempts to remedy particular kinds of defects or malfunctions under different circumstances. If the warranter replaces a component part of a consumer product, such replacement shall include installing the part in the product without

exception rather than the rule.[99] Competitive pressure has not influenced suppliers to provide the broader coverage.[100] Indeed, the opposite result has occurred. Many small solar businesses have stopped giving written warranties because of the expense of complying with the Act.[101]

The consequences of erroneous decisions by sellers under Magnuson-Moss should dictate caution to any business contemplating written warranties. If a warranty is designated as "full," but does not comply with the minimum standards, the standards are nevertheless implied by law.[102] A disclaimer of implied warranties included in a written warranty on a consumer product is simply not given legal effect.[103] The consequences become even more severe when one considers that a supplier might unintentionally create a written warranty. While under the U.C.C. a seller can limit a buyer's remedy to "return of the goods and repayment of the price or to repair and replacement of non-conforming goods or parts,"[104] "the [Magnuson-Moss] Act elevates an 'undertaking in writing . . . to refund, repair, replace or take other remedial action' from the status of an 'agreed' *remedy* to the status of a *warranty* which, if broken, gives the consumer a right to a remedy fixed by the statute."[105] A violation of the Magnuson-Moss Act or the rules promulgated thereunder is also a violation of the Federal Trade Commission Act.[106] The penalty for each violation can be a fine of $10,000.[107] Moreover, a consumer prevailing in a breach of warranty action may recover costs and expenses, including attorney fees.[108] These provisions are therefore likely to further discour-

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charge.

15 U.S.C. § 2304(a) (1976).

99. Eddy, *supra* note 40, at 877. *See* Brickey, *supra* note 53, at 96; Note, *An Empirical Study of the Magnuson-Moss Warranty Act*, 31 STAN. L. REV. 1117, 1138-39 (1979).

100. "[W]hile the disclosure requirements probably will prevent deceptions which stem from unarticulated terms and conditions of warranty coverage, it is doubtful that they will provide the incentive to make available product information that enables consumers to make meaningful choices." Brickey, *supra* note 53, at 87.

101. FLORIDA SOLAR ENERGY CENTER, *supra* note 42, at 4.

102. "If a supplier designates a warranty applicable to a consumer product as a 'full' (statement of duration) warranty, then the warranty on such product shall . . . be deemed to incorporate at least the minimum requirements of this section and rules prescribed under this section." 15 U.S.C. § 2304(e) (1976).

103. 15 U.S.C. § 2308(c) (1976).

104. U.C.C. § 2-719(1)(a).

105. Note, *supra* note 93, at 754 (footnotes omitted).

106. The violation is of 15 U.S.C. § 45(a)(1) (1976). 15 U.S.C. § 2310(b) (1976).

107. 15 U.S.C. § 45(m)(1)(A) (1976).

108. These expenses are available if "determined by the court to have been reasonably

age solar suppliers from extending written warranties.

Solar suppliers must also consider that the Magnuson-Moss Act eliminates the horizontal privity requirement for parties covered by "full" warranties. The U.C.C. provides three alternatives to determine the beneficiaries of express and implied warranties. The most restrictive approach limits the warranty to "any natural person who is in the family or household of the buyer or who is a guest in his home,"[109] while the broadest coverage extends the warranties "to any person who may reasonably be expected to use, consume, or be affected by the goods."[110] In contrast, the Magnuson-Moss Act extends a cause of action to "consumers," a term that includes within its definition an initial buyer for purposes other than resale and any subsequent transferee.[111] Note, however, that the Act specifically eliminates the privity requirement only for "full" warranties.[112] This provision suggests that "limited" warranties and implied warranties may not be affected. If so, the extension of these warranties apparently would be governed by state law, although poor draftsmanship of the Act leaves the accuracy of this interpretation open to some doubt.[113] The confusion in this area is aggravated by an FTC regulation allowing warrantors to limit even "full" warranties to first purchasers by simply defining the duration of a written warranty in terms of

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incurred by the plaintiff for or in connection with the commencement and prosecution of such action, unless the court in its discretion shall determine that such an award of attorney's fees would be inappropriate." 15 U.S.C. § 2310(d)(2) (1976).

109. U.C.C. § 2-318, Alternative A. The additional limitations imposed are twofold: "that such person may use, consume or be affected by the goods" and that such person is "injured in person by breach of the warranty." *Id.* As of January 1, 1979, 28 jurisdictions had adopted Alternative A or a similar provision. J. WHITE & R. SUMMERS, *supra* note 43, at 403 n.14.

110. U.C.C. § 2-318, Alternative C. Any such person "injured by breach of the warranty" becomes a beneficiary of the warranty even though the injury is not to the person. *Id.* As of January 1, 1979, 11 states had adopted Alternative C or a similar provision. J. WHITE & R. SUMMERS, *supra* note 43, at 404 n.19. The middle-ground alternative extends sellers' warranties to "any natural person who may reasonably be expected to use, consume or be affected by the goods and who is injured in person by breach of the warranty." U.C.C. § 2-318, Alternative B. As of January 1, 1979, this provision or one similar to it had been adopted in 5 states. J. WHITE & R. SUMMERS, *supra* note 43, at 404 n.18. Another 5 states have adopted their own expansive approach. *Id.* at 404.

111. *See* 15 U.S.C. §§ 2301(3), 2310(d)(1) (1976). *See generally* Note, *Horizontal Privity Under the Magnuson-Moss Warranty Act: A Practitioner's Guide*, 51 NOTRE DAME LAW. 775 (1976).

112. 15 U.S.C. § 2304(b)(4) (1976).

113. "Despite the inclusion of subsequent transferees in the definition of consumer irrespective of the type of warranty involved, Congress expressly rejected the horizontal privity bar only for full warranties." Schroeder, *supra* note 73, at 13.

ownership.[114] "For example, an automotive battery or muffler warranty may be designated as 'full warranty for as long as you own your car.' "[115] The FTC's interpretation of the Act, however, appears to be incorrect because the statute extends warranty benefits to subsequent transferees.[116] Moreover, the regulation ignores the continued viability of the implied warranties whose duration, in cases of "full" warranties,[117] can neither be disclaimed nor limited.

4. The Impact of the Magnuson-Moss Act on Builders

A builder occupies a unique position that gives rise to some special concerns. As the initial purchaser of a solar product, the builder's confidence in the product, like that of any other consumer, must be developed. Unlike the ultimate consumer, however, the supplier's written warranty will not run to the builder since the purchase is for resale.[118] Indeed, the builder, as a seller must himself comply with the FTC regulations concerning the presale availability of the manufacturer's warranties.[119] If the builder also provides a written warranty on the structure sold, he must comply

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114. As stated in 16 C.F.R. § 700.6(b) (1980),

> [A] full warranty may not expressly restrict the warranty rights of a transferee during its stated duration. However, where the duration of a full warranty is defined in terms of first purchaser ownership there can be no violation . . . since the duration of the warranty expires, by definition, at the time of transfer . . . . Thus, these provisions do not preclude the offering of a full warranty with its duration determined exclusively by the period during which the first purchaser owns the product, or uses it in conjunction with another product.

115. *Id.*

116. 15 U.S.C. § 2304(b)(4) (1976).

117. 15 U.S.C. § 2304(a)(2) (1976). For a good discussion criticizing the FTC rule, see Brickey, *supra* note 53, at 88-92.

118. The builder would not be a consumer for purposes of the Act since the definition of consumer eliminates buyers for purposes of resale. 15 U.S.C. § 2301(3) (1976).

119. The regulation governing presale availability of written warranty terms provides four alternatives. The text of the warranty can be displayed clearly and conspicuously in close proximity to each warranted product. 16 C.F.R. § 702.3(a)(1)(i) (1980). If the text of the warranty is disclosed on the package of a consumer product, the package itself can be displayed at the point of sale. *Id.* § 702.3(a)(1)(iii). A notice disclosing the text of the written warranty can be placed in close proximity to the warranted consumer product. *Id.* § 702.3(a)(1)(iv). Alternatively, an indexed binder containing copies of the warranties on all of the consumer products can be maintained and prominently displayed. *Id.* § 702.3(a)(1)(ii). Builders are likely to find the nse of a binder to be the most expeditious means of satisfying the presale availability regulation. The other alternatives require display close to each consumer product. This approach is not very practical for a sale involving several warranties, such as the sale of a building furnished with appliances and fixtures. In addition, it would not be very effective for solar components located in such relatively inaccessible places as the roof.

with the Magnuson-Moss Act's requirements to the extent that the warranty covers consumer products involved in the structure.

If a builder wants to warrant all of the consumer products in a structure in accordance with the Magnuson-Moss Act but desires to cover the remainder of the structure in some other fashion, significant problems can arise in regard to the disclosure requirements. As previously discussed,[120] the FTC regulations classify "separate items of equipment" as consumer products subject to the Act and distinguish these items from "integral component parts of the structure," even when both types of items are already installed at the time of sale of the real property.[121] The distinction, however, is sometimes very difficult to apply, especially when classifying certain solar system components.[122] Nevertheless, the warrantor's disclosure of all required information must be "in simple and readily understood language."[123] As one commentator has stated, "The builder thinking of bifurcating his warranty therefore faces the task of articulating in layman's language an essentially inarticulable concept, on pain of civil liability if he does so incorrectly or with insufficient clarity; he must not only respect his customers' rights, he also must *explain* them."[124] Given this stringent requirement, the regulations create a strong incentive for builders simply to forego providing their own warranties.[125]

Because of federal warranty regulation, suppliers of solar energy products must be very careful in drafting their warranties. The complexities involved in accurately interpreting the Magnuson-Moss Act provisions and the Act's prohibition on the disclaimer of implied warranties greatly increase the supplier's risk of liability. These factors combine to suggest that warranties will

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120. *See* notes 54-76 *supra* and accompanying text.

121. *See* notes 64-65 *supra* and accompanying text.

122. *See* note 73 *supra* and accompanying text.

123. 15 U.S.C. § 2302(a) (1976); 16 C.F.R. § 701.3(a) (1980).

124. Peters, *How the Magnuson-Moss Warranty Act Affects the Builder/Seller of New Housing*, 5 REAL ESTATE L.J. 338, 350 (1977) (emphasis in original).

125. The FTC contends that the Home Owners Warranty Corporation sought legislation to exempt it from the coverage of the Magnuson-Moss Act. FTC Advisory Opinion, Home Owners Warranty Corp. & Nat'l Ass'n of Home Builders, [1976-1979 Transfer Binder] TRADE REG. REP. (CCH) ¶ 21,245 (1976). "The HOW (Home Owners Warranty) Program, adopted in September 1973 by the National Association of Home Builders (NAHB), is a potentially comprehensive industry-sponsored mechanism designed to prevent and resolve disputes arising out of new home purchases. . . HOW provides a 10-year warranty and insurance protection package for new owner-occupied single-family houses, townhouses and condominiums." Note, *The Home Owners Warranty Program: An Initial Analysis*, 29 STAN. L. REV. 357, 357-58 (1976).

not provide a sufficient basis to generate adequate consumer and builder confidence in solar energy equipment.

B. Buyer Protection

The solar industry needs products of quality workmanship and performance capability. Each sale of unsatisfactory merchandise leads to individual buyer disenchantment and, consequently, to the development of a poor industry reputation. Unfortunately, warranties are even less suited to ensuring solar product quality and performance than they are to promoting confidence. For a number of reasons warranties alone simply will not prevent the sale of unsatisfactory merchandise.

First, active solar systems usually require backup systems to provide energy during periods of low insolation.[126] Some solar users may be unable to distinguish between the energy provided by the solar unit and that provided by a public utility backup source. Without special devices or meters monitoring the backup utility service, the user may well assume that the solar unit is operating satisfactorily when in fact the utility is providing the energy being used.[127] On-site visits to installed solar hot water units in Florida, for example, revealed that often when owners had a sufficient supply of hot water, the backup heating element was actually supplying all their hot water needs.[128] With rapidly escalating utility bills, the customer may have trouble ascertaining any breach of warranty.

The need for backup energy for solar energy systems can also create difficulties in defining the legal standards for breach of the implied warranty of merchantability. The most commonly used definition is fitness for ordinary use[129]—an extremely vague standard.[130] Acceptable performance levels for mechanical and electrical products cannot be precisely defined under this standard; thus,

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126. *See* note 12 *supra*.

127. "Systems should be designed so that the builder or homeowner can easily determine when the system is operating and how well it is performing. Thermometers and operating lights can be used to show that the system is gathering and delivering heat for home use." *RERC* MARKET FINDINGS, *supra* note 15, at 7.

128. One pair of observers noted that "[b]ecause the domestic hot water load represents between one-fourth to one-fifth of the average residential energy load in Florida, any reductions in utility usage due to the solar system may be masked by variations in the remainder of the load." M. Yarosh & A. Litka, *supra* note 29, at 13-14.

129. "Goods to be merchantable must be at least such as . . . (c) are fit for the ordinary purposes for which such goods are used." U.C.C. § 2-314(2)(c).

130. *See* J. WHITE & R. SUMMERS, *supra* note 43, at 352-56.

the likelihood of disputes arising about the fitness of the product after the fact is increased.[131] The difficulties are increased with solar equipment because the market place expectations for conventional hot water heaters, furnaces, and air-conditioners, though likely to be used, generally are not appropriate. Instead of supplying the purchaser with all of the hot water or space conditioning requirements, most solar systems are capable only of reducing the demand for conventional energy needs. Solar units are also much more sensitive than conventional systems to variables like climate, insulation, and use patterns. These factors suggest that the standard of fitness for ordinary use will be highly individualized. Consequently, the burden of proof for the disappointed solar buyer will be difficult to carry.[132]

Another characteristic of solar systems can make warranties ineffective in protecting consumers. Sometimes a defect will manifest itself by causing a relatively slow deterioration in the unit's efficiency, thus rendering detection more difficult. Suppose, for example, a manufacturer cuts the cost of production by using a relatively cheap fiber-glass product in insulating its flat-plate collectors. With prolonged use, the temperature levels in the collectors will cause some degree of chemical breakdown of the fiber-glass, creating a film on the inside glass of the collector. Additional film accumulation will create a barrier to the sunlight and decrease the collector's efficiency. Problems of this type might not become detectable until after the passage of the warranty period.

Consumer experience with solar energy systems has revealed another serious problem that is not remedied by warranties: many solar systems are improperly installed.[133] Common problems are corrosion resulting from the joining of incompatable metals, the use of wrong grades of solder causing leaks at the joints, and improper alignment of solar panels.[134] Although these installation problems are not product defects, they can decrease the solar system's efficiency and reliability. Mandatory training courses, installation procedures, licensing of installers, and bonding require-

131. *See* Eddy, *supra* note 40, at 842.

132. Under the Magnuson-Moss Act, a supplier extending a "full" warranty must remedy any consumer product with "a defect, malfunction, or failure to conform with such written warranty." 15 U.S.C. § 2304(a)(1) (1976). The consumer with such a "full" warranty would have an easier burden than would be requirod under the U.C.C. "A consumer suing under a full warranty need not prove a breach of the written warranty, but need ouly establish the existence of product defect or malfunction." Schroeder, *supra* note 73, at 18.

133. *See* M. Yarosh & A. Litka, *supra* note 29, at 17.

134. P. CHOPRA, *supra* note 31, at 8-18.

ments, rather than warranties, will be necessary to deal with this type of problem.[135]

Unless expressly provided by the installer, warranties often will be ineffective to correct installation problems. Nevertheless, a solar manufacturer providing a "full" warranty could conceivably be held responsible under the Magnuson-Moss Act for improper installations. This potential liability has led many manufacturers either to provide only "limited" warranties or to forego warranties entirely. Although an installer who provides and installs the solar unit would technically be covered by the U.C.C. in those jurisdictions rejecting the sales-service dichotomy,[136] he could avoid written warranties and thereby avoid liability by disclaiming the Code's implied warranties.[137]

Unscrupulous business practices cannot be avoided through the use of warranties. Since warranties simply involve promises on the part of the person making or selling the product, unprincipled operators might be willing to extend the most attractive warranties because they have no intention of honoring them. Solar consumers who rely upon these exaggerated warranty claims not only will be misled but also will be unprotected.

The limited value of warranties was vividly demonstrated when the FTC requested fifty solar manufacturers to send copies of their warranty documents as part of a study on warranty issues. Only twenty-eight manufacturers responded to the FTC's request and sent their warranties. Of these, only one was found to be in full compliance with applicable laws, including the Magnuson-Moss Act; most of the warranties were found to be deficient in many key respects, including such basic problems as omitting or

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135. Some steps in these directions have already occurred. For example, the California Solar Energy Industries Association has initiated a bonding program for solar installation. In addition to covering the installation, the bonding program supports guarantees that the installer makes regarding the system. 1 SOLAR L. REP. 15-17 (1979).

136. *See* notes 83-88 *supra* and accompanying text. Other courts that use the essence test probably would find a sale of goods if the installer also sold a complete solar system. *See* note 84 *supra*.

137. Courts have frequently found an implied warranty of workmanlike performance. "It is apparent from these cases, however, that the implied warranty of workmanlike performance is nothing more than an implied warranty not to be negligent, since the test of liability is whether the defendant failed to exercise that degree of care and skill that a reasonable, prudent, skilled, and qualified person would have exercised under the circumstances." Greenfield, *Consumer Protection in Service Transactions—Implied Warranties and Strict Liability in Tort*, 1974 UTAH L. REV. 661, 665-66. *See* cases cited *id.* at 665 n.20, 666 n.21. The obligation to perform in a workmanlike manner is sometimes required by statute. *See, e.g.*, CAL. BUS. & PROF. CODE §§ 9830, 9841(a)(7), 9884, 9884.6, 9884.7(1)(g) (West 1975).

incorrectly providing the designation as a "full" or "limited" warranty and disclaiming or limiting all implied warranties.[138] Similar problems have been reported in California, where state law requires warranties by manufacturers and installers as a prerequisite to qualifying for the state income tax solar credit.[139]

Existing warranty laws limit their own usefulness as a means of protecting purchasers of solar systems. Warrantors have too many "loopholes" that can be manipulated to the detriment of the consumer. The manufacturer's promise to repair or replace the defective parts can be conditioned upon returning the item to the factory, with transportation costs borne by the purchaser. Similarly, the customer can be required to pay the labor costs under a replacement warranty, which can create a situation in which "the warrantor will replace the fifty-cent part 'free' if the buyer will pay the $37.50 labor charge."[140] Moreover, a warrantor can disavow responsibility for product removal and reinstallation costs. Each of these "loopholes" could have serious economic implications for the solar purchaser. The Magnuson-Moss Act prevents the use of these clauses in "full" warranties,[141] but the conditions can still be imposed in "limited" warranties. The only protection that the Act provides purchasers under "limited" warranties is the requirement of clear disclosure by the warrantor.[142] As one commentator has noted, "The Act does not require that express undertakings be practical unless a full warranty has been created."[143]

Warranty law can provide a remedy for aggrieved purchasers, but even here the protection for solar buyers is incomplete. Obviously, a warranty is only as good as the company behind it. The established, well-capitalized firms will stand behind their products. Their continuing economic prosperity depends in large part upon their general reputation. This point is significant because many

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138. 1 SOLAR L. REP. 271-72 (1979).

139. Jaroslovsky, *supra* note 24, at 236.

140. Eddy, *supra* note 40, at 864.

141. 15 U.S.C. § 2304(b)(1) (1976): "[T]he warrantor shall not impose any duty other than notification upon any consumer as a condition of securing remedy of any consumer product which malfunctions, is defective, or does not conform to the written warranty. . . ." The prohibition specifically exempts those cases in which "the warrantor has demonstrated in a rulemaking proceeding, or can demonstrate in an administrative or judicial enforcement proceeding (including private enforcement), or in an informal dispute settlement proceeding, that such a duty is reasonable." *Id.*

142. 15 U.S.C. §§ 2302(a), 2304(a)(3) (1976). For rules promulgated by the FTC to effectuate this requirement of full disclosure, see 16 C.F.R. § 701.3 (1980). *See* note 96 *supra.*

143. Brickey, *supra* note 53, at 96.

established firms will also sell other products. Continued business existence will probably become impossible, however, for those firms entering the market with product lines containing uncorrected design defects. Moreover, initial warranty claims can not only threaten the existence of poorly capitalized firms, but also may leave dissatisfied purchasers with inadequate protection.[144] In short, a warranty will not guarantee that only good products enter the marketplace, nor will it guarantee that the warrantor will either want or be able to respond to a subsequent warranty claim.

III. Product Standards

A. *The Function of Product Standards*

As just discussed, warranties alone cannot ensure the successful development of solar energy in the United States. Warranties are too uncertain to instill adequate confidence in consumers and are too easily circumvented as well. Moreover, warranties often expose manufacturers and sellers to far too much risk of liability, which therefore discourages their use. Nevertheless, all is not lost for the solar energy industry. The proper utilitization of product standards in the industry can achieve many of the objectives of warranties with few, if any, of the undesirable consequences.

In general, standards are agreed-upon statements of minimally acceptable characteristics of materials, products, systems, or services.[145] Because they are essentially a measure of adequacy, standards provide a basis for comparison of such features as quantity, capacity, content, extent, value, and quality. Unlike warranties, standards therefore provide some objective, tangible criteria by which consumers can evaluate solar products. Consumers will know before they purchase a given solar item whether it will meet their needs and expectations. Moreover, standards by their very nature facilitate uniformity in goods and services. If all solar items con-

144. At the legislative hearings on federal warranty legislation, the fear was voiced that a relatively small concern could be forced out of business by one successful class action. *See Warranties and Guarantees: Hearing on H. R. 18056; H.R. 10690, H.R. 12656, and H.R. 16782; H.R. 13390; H.R. 18758; H.R. 19293, and S. 3074 Before the Subcomm. on Commerce and Finance of the House Comm. on Interstate and Foreign Commerce*, 91st Cong., 2d Sess. 168 (1970) (statement of Nat'l Small Business Ass'n).

145. *See* J. Ashworth, B. Green, B. Pollack, R. Odland, R. Saltonstall & L. Perelman, The Implementation of State Solar Incentives: A Preliminary Assessment 97 (1979) [hereinafter cited as State Solar Incentives] (Solar Energy Research Institute report to the Department of Energy); D. Waksman, J. Pielert, R. Dikkers, E. Streed & W. Niessing, Plan for the Development and Implementation of Standards for Solar Heating and Cooling Applications 4 (1978) [hereinafter cited as Plan].

form to minimum, uniform specifications, the confidence of consumers and other purchasers in the solar industry will assuredly grow. Product standards are essential if solar energy is to be accepted and successful in this country—especially in light of the shortcomings of warranties. Three types of product standards—voluntary consensus, regulatory, and eligibility—are now in use in the United States. Each type of standard is discussed in detail below, and the role that each standard can play in the development of solar energy is set forth.

B. Types of Product Standards

1. National Voluntary Consensus Standards

Most standards developed and implemented in the United States result from a voluntary consensus process.[146] Interested representatives of industry, government, and consumer groups voluntarily participate in their preparation.[147] These standards have a number of applications. They provide a basis for standardization that enables precise communication about products and materials requirements and provides assurance that component parts will be uniform to permit interchangeability. Consensus standards are frequently used as purchase specifications by both private and government organizations. In addition, they facilitate the generation of information about different products and systems and thus provide a basis for comparison. Unless specifically adopted through legislative or regulatory agency action, the use of such standards is voluntary.

In order to assure the widest range of acceptance, voluntary standards are based upon the principle of agreement.[148] General opinion is ascertained through procedures that seek broad-based agreement in the formulation of the standards.[149] The American Society for Testing and Materials, for example, defines a consensus

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146. AMERICAN SOCIETY FOR TESTING AND MATERIALS, THE VOLUNTARY STANDARDS SYSTEM OF THE UNITED STATES OF AMERICA 1 (1975) [hereinafter cited as ASTM].

147. Organizations involved in the development of consensus standards usually include trade associations, professional and technical organizations, the federal government, testing laboratories, building code organizations, consumer groups, and manufacturers. Descriptions of the various standards-setting organizations and their activities can be found in PLAN, *supra* note 145, at 7.

148. *Id.* at 5.

149. The standards development process is described in ASTM, *supra* noto 146, at 6-15; J. RILEY, R. ODLAND & H. BARKER, STANDARDS, BUILDING CODES, AND CERTIFICATION PROGRAMS FOR SOLAR TECHNOLOGY APPLICATIONS 4-5 (1979) (Solar Energy Research Institute report prepared for the Department of Energy).

standard as "a standard produced by a body selected, organized, and conducted in accordance with the procedural *standards of due process.* In standards-development practice a consensus is achieved when substantial agreement is reached by concerned interests according to the *judgment of a duly appointed review authority.*"[150] Procedural due process here generally includes adequate notice to interested parties of proposed actions, an opportunity for full participation and representation of concerned interests, maintenance of records, proper balloting procedures, periodic review by recognized authorities, observance of the right to dissent, and other similar requirements.[151]

National consensus solar standards can help convince builders and consumers of the merit of solar energy systems. As noted in the prior discussion of warranties, the novelty of solar equipment leaves many consumers uncertain about performance reliability,[152] and the durability of solar systems is a major concern.[153] In addition, since most consumers do not have experience with solar products, they are legitimately concerned about their ability to detect and deal with problems. The inadequacies in installed systems, as revealed by various studies, provide justification for these consumer concerns.[154]

Standards can alleviate consumer uncertainty by instilling a measure of confidence in the products. Knowing that a particular component complies with certain minimum guidelines provides a buyer assurance that the product has been tested and meets at least some basic criteria. Of course, this increased consumer confidence could be betrayed by diluted or noncomprehensive standards that negligibly affect consumer protection. The undesirability of such betrayal is all too obvious.

A significant number of the national standards-writing organizations have already become involved in the development of solar energy equipment standards. One of the first organizations to undertake this activity was the American Society of Heating, Refrig-

150. ATSM, *supra* note 146, at 7 (emphasis in original).

151. *Id.*

152. *See* 1 OFFICE OF TECHNOLOGY ASSESSMENT, APPLICATION OF SOLAR TECHNOLOGY TO TODAY'S ENERGY NEEDS 100-01 (1978).

153. "Many of the components and materials used in solar energy will be exposed to extremes of weather, so test methods for assessing the durability and reliability of the materials are also critical at an early point." Heyman, *Solar Heating & Cooling: Standards for a Maturing Industry,* DIMENSIONS, Dec. 1978, at 6.

154. *See* notes 28-31 *supra* and accompanying text.

erating and Air-Conditioning Engineers, Inc. (ASHRAE).[155] The two published standards set out by ASHRAE provide test methods to determine the thermal performance of solar collectors and storage devices.[156] In addition, the American Society for Testing and Materials (ASTM)[157] and the American Society of Mechanical Engineers (ASME) are in the process of developing solar equipment standards. The ASTM work is directed toward the safety, durability, and reliability of systems and materials.[158] ASME efforts relate to mechanical performance, focusing on the centralized generation of electricity with solar energy and the heating and cooling of commercial and residential buildings.[159]

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155. ASHRAE's involvement was precipitated by a request in 1975 from the Energy Research and Development Administration (ERDA) (now the Department of Energy) to provide assistance in implementing the Solar Heating and Cooling Demonstration Act of 1974. Appropriate committees within ASHRAE were formed and the development and review process was undertaken. Lorsch, *ASHRAE Standards 94-77, 95 and 96*, in SECOND NATIONAL CONFERENCE ON STANDARDS FOR SOLAR ENERGY USE 19 (sponsored by Am. Soc'y for Testing & Materials 1979) [hereinafter cited as SECOND NATIONAL CONFERENCE]; Yellott & Wood, *ASHRAE Standard 93-77: Testing Procedure to Determine the Thermal Performance of Solar Collectors*, in SECOND NATIONAL CONFERENCE, *supra*, at 18.

156. ASHRAE STANDARD 93-77: METHODS OF TESTING TO DETERMINE THE THERMAL PERFORMANCE OF SOLAR COLLECTORS (1977); ASHRAE STANDARD 94-77: METHODS OF TESTING THERMAL STORAGE DEVICES BASED ON THERMAL PERFORMANCE (1977). "ASHRAE Standard 90-75: 'Energy Conservation in New Building Design' is the first in a series of documents which provides design requirements for improved utilization of energy." American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., *What is ASHRAE?*, in SECOND NATIONAL CONFERENCE, *supra* note 155, at 56. Experience with 93-77 indicates that although some improvements and expansion in the document are needed, "the majority of the solar community is well served by the standard and obtains useful and meaningful data from it." Dokos, Putman, Zerlaut & Whitaker, *Performance Testing to ASHRAE Standard 93-97* [sic], in SECOND NATIONAL CONFERENCE, *supra* note 155, at 21. The authors stress that "it is important to note that the consensus opinion we have encountered and indeed share, is that ASHRAE 93-77 is philosophically and technically adequate for determining the thermal performance of collectors within the constraints stated in the document, and that it is either applicable or had the potential of being applicable to a wide variety of solar collectors." *Id.* ASHRAE's efforts are continuing; Committee 93 is monitoring the operation and effectiveness of 93-77 and is determining whether changes are needed for high temperature concentrating collectors. Yellot & Wood, *supra* note 155. Committee 94 is extending 94-77 to cover off-peak electric storage units. Lorsch, *supra* note 155. Thermal performance test procedures are being developed by Committees 95 and 96 for domestic hot water and swimming pool systems, respectively. PLAN, *supra* note 145, at 15. ASHRAE Standard 95 on "Methods of Testing Solar Energy Portable Water Heaters" will pertain to a complete system rather than a component. Lorsch, *supra* note 155.

157. ASTM entered the solar standards field at about the same time and under similar circumstances as ASHRAE. PLAN, *supra* note 145, at 16.

158. Streed, *ASTM Standards on Durability and Reliability*, in SECOND NATIONAL CONFERENCE, *supra* note 155, at 30.

159. J. RILEY, R. ODLAND & H. BARKER, *supra* noto 149, at 7; Baldwin, *ASME Solar Standards*, in SECOND NATIONAL CONFERENCE, *supra* note 155, at 32.

The development of solar energy product standards through the national voluntary consensus standards system is coordinated by the American National Standards Institute (ANSI).[160] ANSI oversees the activities of the standards-writing organizations and seeks to avoid duplication of efforts in the creation of standards. ANSI does not write the standards itself; rather, it identifies specific needs, assigns them to the appropriate organization, and monitors these activities. The ANSI Steering Committee on Solar Energy Standards Development[161] has approved and formally endorsed a "Plan for the Development and Implementation of Standards for Solar Heating and Cooling Applications"[162] prepared by the National Bureau of Standards. This plan serves as a blueprint for solar standards development by identifying areas in which standards are needed, assigning priorities, determining the organizations responsible for spearheading the development process, and outlining timetables for these activities.[163] Thus, the plan projects the solar energy activities likely to be undertaken in the near future through the national voluntary consensus standards system.

2. Regulatory Standards

Regulatory standards have the imprimatur of the law. They are either enacted by a legislature or adopted by a government regulatory body in response to delegated rulemaking authority.[164] Many regulatory standards control the health and safety qualities of products and activities. The standards enabling legislation often prohibits the manufacture, sale, or distribution of products not complying with the standards.[165] Not all regulatory standards are

160. PLAN, *supra* note 145, at 16.

161. Twenty-three organizations are represented on the Steering Committee. Dikkers, *The ANSI Steering Committee on Solar Standards Development*, in SECOND NATIONAL CONFERENCE, *supra* note 155, at 14.

162. PLAN, *supra* note 145.

163. *Id.* at 21-47.

164. Rulemaking "is typically concerned with broad policy considerations rather than review of individual conduct," American Airlines, Inc. v. Civil Aeronautics Bd., 359 F.2d 624, 629 (D.C. Cir.), *cert. denied*, 385 U.S. 843 (1966), and results in "agency statements of general applicability and future effect, designed to implement, interpret and prescribe [agency] policy." California Citizens Band Ass'n v. United States, 375 F.2d 43, 49-50 (9th Cir.), *cert. denied*, 389 U.S. 844 (1967).

165. The provision for standards in the Consumer Product Safety Act is illustrative: "It shall be unlawful for any person to manufacture for sale, offer for sale, distribute in commerce, or import into the United States any consumer product which is not in conformity with an applicable consumer product safety standard under this chapter." 15 U.S.C. § 2068(a)(1) (1976). Air and water quality standards illustrate regulatory requirements in activities affecting health. *See* 40 C.F.R. Part 403 (1980) (effluent guidelines and standard

oriented toward protection of health and safety, however. Governmental requirements are increasingly used to effectuate other policies. Fuel economy measures for automotive manufacturers, for example, are related to energy policies.[166]

(a) The State Experience

Presently, the federal government has not enacted regulatory solar product standards. A few states, however, have implemented some form of standards on their own. Florida, for example, has an impressive regulatory solar standards program. Initiated by the Florida Solar Energy Standards Act of 1976,[167] the program is designed to develop and promulgate standards, as well as to test criteria and capability. The Florida Solar Energy Center (FSEC), charged with administering the Act,[168] has to date developed minimum standards, test methods,[169] and a certification program.[170] A 1978 amendment to the Solar Energy Standards Act that became effective on January 1, 1980, made the program mandatory. The amendment provides that "[a]ll solar energy systems manufactured or sold in the state must meet the standards established by the center and shall display accepted results of approved performance tests in a manner prescribed by the center."[171]

California is the only other state that has enacted a comprehensive standards certification program. Unlike the Florida legislation, however, compliance with the California regulations is voluntary. A 1977 statute required the California Energy Commission (CEC) to promulgate regulations designed to encourage the use and development of solar equipment and to generate solar product information for the general public.[172] Under that statute the CEC was to develop "[s]tandards for testing, inspection, certification, sizing, and installation of solar devices,"[173] as well as provisions for

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pretreatment regulations for existing and new sources of pollution); 40 C.F.R. Part 50 (1980) (ambient air quality standards).

166. *See* 40 C.F.R. Part 600 (1980).

167. FLA. STAT. ANN. § 377.705 (West Supp. 1981).

168. *Id.* § 377.705(4).

169. *See* FLORIDA SOLAR ENERGY CENTER, TEST METHODS AND MINIMUM STANDARDS FOR SOLAR COLLECTORS, FSEC 77-5 (1979).

170. FLORIDA SOLAR ENERGY CENTER, OPERATION OF THE COLLECTOR CERTIFICATION PROGRAM, FSEC 77-6 (1978). Over 80 solar collectors received certification by 1978 under the program. The failure rate of the units tested was about 10%. FLORIDA SOLAR ENERGY CENTER, FLORIDA SOLAR ENERGY CENTER ACTIVITIES FOR 1978, FSEC 79-2, at 19 (1978).

171. FLA. STAT. ANN. § 377.705(4)(d) (West Supp. 1981).

172. CAL. PUB. RES. CODE § 25605 (West Supp. 1980).

173. *Id.* § 25605(a).

enforcement of the standards.[174] The California Testing and Inspection Program for Solar Equipment (TIPSE) resulted from this legislative mandate. TIPSE is concerned with both the testing of solar components to acquire information on the equipment and the certification of equipment meeting minimum testing requirements.[175] The program is designed to provide reliable information about solar products to consumers and other interested groups such as builders, lenders, and insurers.[176]

Minnesota has adopted a program designed to disseminate information on solar units; unlike California, however, it does not involve direct governmental oversight of the information provided. The Building Code Division of the Department of Administration promulgated its "Standards of Performance for Solar Energy Systems and Subsystems Applied to Energy Needs of Buildings"[177] in response to a 1976 legislative directive.[178] Under this directive manufacturers or retailers in Minnesota are required to "disclose to each bona fide potential purchaser of a system the extent to which the system meets or exceeds" the adopted quality standards.[179] State officials are required neither to test systems for compliance nor to determine the accuracy of the information provided by the manufacturer or retailer. The state government does maintain at least a minimal degree of oversight in the program, however, for no building or housing permit is issued in the absence of completion and delivery of the disclosure statement.[180]

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174. *Id.* § 25605(b).

175. Certification guidelines for solar equipment have already been promulgated in California. CALIFORNIA ENERGY RESOURCES CONSERVATION AND DEVELOPMENT COMMISSION, GUIDELINES FOR CERTIFICATION OF SOLAR ENERGY EQUIPMENT (1978). A label is attached to equipment that passes the minimum testing requirements. *Id.* at 9.

176. SOLAR OFFICE, CALIFORNIA ENERGY COMMISSION, THE CALIFORNIA TESTING AND INSPECTION PROGRAM FOR SOLAR EQUIPMENT (undated). California has also accredited private testing laboratories to test solar equipment. ALTERNATIVES DIVISICN, SOLAR ENERGY OFFICE, CALIFORNIA ENERGY COMMISSION, STANDARDS AND PROCEDURES: ACCREDITATION OF TESTING LABORATORIES FOR SOLAR COMPONENTS AND SYSTEMS (1978). "In order to become accredited, each laboratory must show adequate capabilities in the areas of physical resources, personnel resources, financial independence and must fulfill minimum requirements relating to solar collector testing in each of these areas." SOLAR OFFICE, CALIFORNIA ENERGY COMMISSION, THE CALIFORNIA TESTING AND INSPECTION PROGRAM FOR SOLAR EQUIPMENT § 3 (undated). Seven private testing laboratories have been accredited to perform testing. By mid-1979 test data had been published on 65 collector models under the TIPSE program. CALIFORNIA ENERGY COMMISSION, INITIAL RESULTS OF THE CALIFORNIA TESTING AND INSPECTION PROGRAM FOR SOLAR EQUIPMENT 2-9 (1979).

177. MINN. CODE OF AGENCY RULES §§ 1.16101-.16108 (1977).

178. MINN. STAT. ANN. § 116H.127 (West 1977).

179. *Id.*

180. STATE SOLAR INCENTIVES, *supra* note 145, at 105.

(b) Regulatory Standards and the Local Codes

As the Minnesota approach indicates, one area in which regulatory solar energy standards are likely to have a significant impact is building and housing codes. A building permit must usually be obtained before construction is undertaken. This requirement allows building officials to determine whether the project conforms to the applicable building or housing codes.[181] Building codes apply to new construction, while housing codes refer to changes in existing structures.[182] A typical code regulates the construction, alteration, maintenance, repair, and demolition of buildings and structures.[183] Additional companion regulatory codes cover plumbing, electrical, and mechanical systems and provide regulations for fire prevention.[184] Both types of codes are relevant to solar use since solar technology may be retrofitted or used in new construction.

Building and housing codes are normally enacted into law by local government bodies exercising their specifically delegated police powers.[185] Most local codes are based upon one of the model building codes promulgated and annually revised by regional associations.[186] Despite the influence of these model codes, considerable diversity exists at the local level because individual govern-

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181. A building code is "a legal document which sets forth requirements to protect the public health, safety and general welfare as they relate to the general construction and occupancy of buildings and structures." R. SANDERSON, CODES AND CODE ADMINISTRATION 139 (1969). Building and housing codes generally both deal with internal structural matters, but though the two types of codes frequently are not distinguished, they are different. *See* D. HAGMAN, URBAN PLANNING 227 (1971). For an analysis of building codes in general, see C. FIELD & S. RIVKIN, THE BUILDING CODE BURDEN (1975).

182. Building codes should not be confused with zoning ordinances. "Zoning laws regulate the use of the land and buildings by dividing the community into zones or districts and prescribing the types of land uses that are permitted in each alone." C. RHYNE, SURVEY OF THE LAW OF BUILDING CODES 5 (1960).

183. *Id.* at 3; R. SANDERSON, *supra* note 181, at 14.

184. C. RHYNE, *supra* note 182, at 5; R. SANDERSON, *supra* note 181, at 14.

185. C. RHYNE, *supra* note 182, at 6-8.

186. The Uniform Building Code was initially published in 1927 by an organization now known as the International Conference of Building Officials; the code is influential primarily in the western and central midwestern states. INTERNATIONAL CONFERENCE OF BUILDING OFFICIALS, UNIFORM BUILDING CODE (current ed. 1976); PLAN, *supra* note 145, at 9. The Southern Building Code Congress International, Inc., published the Standard Building Code for southern states in 1945. SOUTHERN BUILDING CODE CONGRESS INTERNATIONAL, INC., STANDARD BUILDING CODE (current ed. 1976); PLAN, *supra* note 145, at 9. The Basic Building Cede was produced in 1950 by the Building Officials Conference of America; it has been predominantly influential in the eastern and north-central states. BUILDING OFFICIALS AND CODE ADMINISTRATORS INTERNATIONAL, INC., BASIC BUILDING CODE (current ed. 1978); PLAN, *supra* note 145, at 9.

ments frequently alter provisions in the model codes.[187]

In many ways present codes pose tremendous difficulties for the development of solar energy in this country. For one thing, current building codes generally do not include references to solar equipment. Each of the three model codes has a companion model mechanical code that includes provisions for heating, ventilating, cooling, and hot water appliances.[188] None of the definitions for these appliances includes solar equipment.[189] Moreover, solar energy systems do not specifically fall within the provisions of the mechanical codes. Despite the assertions to the contrary by some commentators,[190] such omissions place solar equipment at a disadvantage compared to products specifically included in the codes because it is more difficult to establish that the equipment's design and installation are an acceptable alternative to products that comply with the code.

Although the lack of specific reference to solar equipment in the mechanical codes theoretically should not prevent building or housing code approval,[191] in practice code officials have considera-

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187. One commentator noted,

> [E]ven though the same model code may be used by many communities in a given region, the enabling legislation which is used by each community to make that code a local ordinance may create so many exceptions and variances to the model form, that different, often conflicting, and even mutually contradictory and exclusive requirements actually exist within a region . . . even between communities sharing contiguous boundaries.

R. SCHOEN, A. HIRSHBERG & J. WEINGART, *supra* note 23, at 96.

188. F. MEEKER, BUILDING CODES AS BARRIERS TO SOLAR HEATING AND COOLING OF BUILDINGS 21 (1978) (Environmental Law Institute study).

189. Heating applicances, for example, are defined in one code as "any device desigued or constructed for the generation of heat from solid, liquid or gaseous fuel or electricity." BUILDING OFFICIALS AND CODE ADMINISTRATORS INTERNATIONAL, INC., BASIC MECHANICAL CODE § 201.0 (1975).

190. "[R]ather than serving as a retardant, existing building codes have no bearing at all on the development of solar systems." Rivkin, *Regulatory Analysis and Consumer Rights and Powers*, in AIA RESEARCH CORPORATION, EARLY USE OF SOLAR ENERGY IN BUILDINGS 152 (1976). A similar assertion was made by Schiflett, *State and Municipal Impediments and Incentives to the Use of Solar Energy* 7 (paper presented at Solar Energy Barriers and Incentives Conference, Houston, Texas, Aug., 19-24, 1976), *noted in* BEHAVIORAL STUDIES GROUP, *supra* note 24, at 414.

191. The Council of American Building Officials (CABO) coordinates the three model code organizations. PLAN, *supra* note 145, at 10. Following a coordinated study, a CABO report concluded that "there is nothing in the present codes that would prohibit the installation of properly designed solar heating, cooling and hot water systems in any occupancy classification of any building." NATIONAL INSTITUTE OF BUILDING SCIENCES, *Summary Report: Model Solar Energy Code Project for Heating and Cooling in Housing and Building*, in I SOLAR BUILDING REGULATORY STUDY pt. 3, at 7 (National Institute of Building Sciences comp. 1978).

ble discretion to disapprove the use of materials, equipment, or methods not mentioned in the codes.[192] The failure to refer specifically to solar energy systems in the mechanical codes[193] thus makes them subject to the discretionary powers of local building and housing officials. Leaving the decisions to local officials results in case-by-case decisionmaking. Because each determination is a local one, the regulation of solar equipment will tend to vary from place to place. These local responses in turn lead to market fragmentation.

Approval for solar systems can also be difficult to secure under present codes.[194] Demonstrating equivalence to conventional appliances on the criteria of strength, fire resistance, and safety "may be difficult, and having to demonstrate this in a different way for each building official, in each jurisdiction, for each installation, may be infeasible."[195] Solar energy systems are new products, and building officials and inspectors must be convinced of their acceptability as an alternative energy source. The discretionary building regulatory process thus represents a formidable barrier to solar use, as it is to any innovative product in the construction industry.[196]

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192. F. MEEKER, *supra* note 188, at 20. Building code officials are allowed less discretion under the ICBO Uniform Building Code than under other codes because they can neither supplement the code with regulations nor utilize special case-by-case requirements. *Id.* at 14. A discussion of constitutional and judicial limitations on the discretion of administering officials is provided in C. RHYNE, *supra* note 182, at 15-18.

193. Certain solar applications for heating and cooling purposes do not use mechanical parts and thus would be outside the scope of the mechanical code. For example, thermosiphon systems operate hy natural convection. Mechanical codes would also be irrelevant to passive solar applications. Nevertheless, the problems identified in the text would also operate to place code approval of such systems at a disadvantage. In fact, the problems could be even greater in these cases since code officials are accustomed to applying the mechanical code to the heating and cooling features of buildings, whereas other code provisions would have to apply to these applications.

194. *See* R. SCHOEN, A. HIRSHBERG & J. WEINGART, *supra* note 23, at 179-80.

195. F. MEEKER, *supra* note 188, at 20.

196. One commentator explained that,

> Plastic pipe is similarly cost-effective beth in terms of material and installed costs. It has been proven to be at least technically and functionally equal to its traditional cast-iron counterpart in appropriate uses. Builders are eager to use it and do so where they can. However, up to recently, plastic pipe has been prohibited by almost all building codes. Acceptance has been a long, costly, community-by-community, code-by-code battle. Building codes not only protect "health and safety" they also directly or indirectly reflect local concerns and prejudices, including those of the building industry and its unions. The unions have been bitterly opposed to plastic pipe. While claiming that they would not refuse to put in plastic pipe which was equal or better in the way of material and thereby standing in the way of progress, they have insisted that the materials are unquestionahly inferior. The argument is a proxy for a real fear over loss

Solar systems suffer other disadvantages as well under the current building regulatory process. Mechanical systems bearing the label of an approved testing agency or laboratory indicating compliance with a set of nationally recognized standards are routinely approved.[197] For most kinds of construction, materials, and equipment, the codes specify nationally recognized standards, test methods, and testing agencies.[198] The Underwriters Laboratories, Inc. and the American Gas Association, for example, respectively regulate electrical and gas equipment.[199] While most conventional heating and cooling equipment can achieve code approval by showing a label of compliance, solar equipment approval depends upon a case-by-case demonstration of equivalency sufficient to satisfy the local building official.

Certain barriers to builders' acceptance of solar energy relate directly to the problems of securing code approval. Primarily due to its dependence on external sources of funding and the effects of inflation on the cost of materials, the construction industry is very sensitive to initial costs.[200] This sensitivity places solar energy systems at a disadvantage, for even though a considerable savings may be realized over the life of the device, initial costs are generally higher than those for competing systems. More importantly, anything that adds to construction time for a project adds to the total construction costs and is thus more likely to encounter resistance. Because time must be spent seeking code approval for solar products, this resistance is likely to continue. The development of solar standards should reduce the time required to secure code approval and therefore benefit the builder who seeks to use solar

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of work, since plastic pipe installs much quicker than traditional huh and spigot or even hubless cast-iron pipe. As might be expected, plastic pipe is also being strongly opposed on similar grounds by manufactures of the cast-iron products. Resistance to plastic pipe is not due to shared industry-wide attitudes, but to forceful opposition by certain segments most directly involved with its use.

R. SCHOEN, A. HIRSHBERG & J. WEINGART, *supra* note 23, at 45.

197. OFFICE OF TECHNOLOGY ASSESSMENT, *supra* note 152, at 181-82.

198. For example, blowers and fans must bear the label of an approved testing or inspection agency. BUILDING AND CODE ADMINISTRATORS INTERNATIONAL, INC., BASIC MECHANICAL CODE § 318.1 (1975).

199. OFFICE OF TECHNOLOGY ASSESSMENT, *supra* note 152, at 181.

200. Because of the large sums of primarily outside capital needed to finance construction, the industry is attuned to interest rates, which results in cyclical building activity depending on the supply and costs of capital within the national economy. The added financial charges can make the difference between success or failure for the builder. In addition, the cost of construction is rising at the rate of 18-24% per year or 1-1½% per month, a trend not expected to be stemmed in the near future.

R. SCHOEN, A. HIRSHBERG & J. WEINGART, *supra* note 23, at 51.

energy.

The number of building codes and the variations among them also represent a barrier to solar use. One commentator noted that "[i]n viewing three major metropolitan areas, Cleveland, Minneapolis and Chicago, the Advisory Commission on Intergovernmental Relations found that builders there had to contend with no less than 50, 30, and 50 different building codes respectively."[201] As with any form of model legislation, each locality may make individual variations in order to reflect local concerns. These variations have been particularly common in building codes.[202] The time required for securing code approval is thus magnified for a builder who works in more than one code jurisdiction. Equipment that properly complies with the regional model codes, however, is less likely to be subject to such local variations. The development of uniform certification programs for solar equipment will therefore make solar products more attractive to builders who operate in several code areas.

3. Eligibility Standards

Eligibility criteria or guidelines are used to determine which products or activities qualify for legislative benefits. For example, homes financed through the mortgage loan insurance programs administered by the Federal Housing Administration, the Veterans Administration, and the Farmers Home Administration must meet established Minimum Property Standards.[203] Current development of eligibility standards for solar energy products has centered primarily on provisions to determine what equipment qualifies for demonstration projects, loan support programs, and tax incentive benefits.

The federal government's role in the development of these eligibility standards was precipitated by the Solar Heating and Cooling Act of 1974.[204] The Act required the Secretary of Housing and Urban Development to promulgate and publish interim perform-

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201. *Id.* at 176.

202. "[T]here are about 4,000 separate local code agencies operating in U.S. cities with populations over 5,000 persons, and more than 30,000 building code variations around the country." *Id.* (citing REPORT OF THE PRESIDENT'S COMMITTEE ON URBAN HOUSING, A DECENT HOME (1969)).

203. U.S. DEP'T OF HOUSING AND URBAN DEVELOPMENT, HUD MINIMUM PROPERTY STANDARDS, ONE-AND-TWO-FAMILY DWELLINGS (1973, revised 1974); U.S. DEP'T OF HOUSING AND URBAN DEVELOPMENT, HUD MINIMUM PROPERTY STANDARDS, MULTIFAMILY HOUSING (1974); PLAN, *supra* note 145, at 6.

204. 42 U.S.C. §§ 5501-5566 (1976).

ance criteria for solar heating and combined solar heating/cooling components and systems for use in residential dwellings. The Act also provided criteria for the evaluation of the dwellings themselves.[205] The National Bureau of Standards prepared the interim performance criteria for use in the residential demonstration project.[206] Subsequently, the National Aeronautics and Space Administration provided interim performance criteria for use by the Department of Energy in the commercial application of solar technology.[207] The interim performance criteria have been used principally for purposes of procurement and awarding funds in the demonstration projects. The data developed from these projects will be used to promulgate definitive performance criteria that are also mandated by the 1974 Act.[208] These definitive standards will relate to the safety and functioning of solar energy equipment.[209]

Despite these achievements, the federal government is not itself presently inclined to proceed any further in solar standards development. Although the agencies and officials involved encourage additional development and implementation of standards, certification programs, and testing facility accreditation, and exhibit a willingness to assist the development process in the private sector,[210] their basic attitude is that the affected parties should move forward through the voluntary consensus process to develop nationally accepted criteria.[211] The government's standards in this

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205. 42 U.S.C. §§ 5503(b)(1), 5504(b)(1) (1976).

206. NATIONAL BUREAU OF STANDARDS, INTERIM PERFORMANCE CRITERIA FOR SOLAR HEATING AND COMBINED HEATING/COOLING SYSTEMS AND DWELLINGS (1975).

207. NATIONAL AERONAUTICS AND SPACE ADMINISTRATION, INTERIM PERFORMANCE CRITERIA FOR COMMERCIAL SOLAR HEATING AND COMBINED HEATING/COOLING SYSTEMS AND FACILITIES (1975). The National Bureau of Standards has revised these interim criteria. NATIONAL BUREAU OF STANDARDS, INTERIM PERFORMANCE CRITERIA FOR SOLAR HEATING AND COOLING SYSTEMS IN COMMERCIAL BUILDINGS (1976). The NBS plans further revisions as additional data from the demonstration programs is obtained. PLAN, *supra* note 145, at 12.

208. 42 U.S.C. § 5506 (1976).

209. PLAN, *supra* note 145, at 15.

210. "The Federal Government, according to DOE officials, would prefer not to certify solar equipment or systems; however, it will play a role in accrediting laboratories capable of testing solar equipment and developing a certification plan that can be used by others." GENERAL ACCOUNTING OFFICE, *supra* note 7, at 28. "NBS is helping to lay the technical groundwork for the standards which are needed if solar heating and cooling technologies are to make the transition from the unusual to the commonplace." Heyman, *supra* note 153, at 5.

211. Ron Scott, then Assistant Director for Solar Heating and Cooling at the Department of Energy, told attendees at the Second National Conference on Standards for Solar Energy Use that the "role of the Federal Government is to assist and, where necessary, stimulate the industry." He added, "We do not consider ourselves as policemen or as regulators." Heyman, *supra* note 153, at 6.

area consequently serve as a basis for the further development of national consensus standards, rather than as final standards themselves.

Eligibility standards have also been developed for solar loan programs. Two intermediate sets of standards have been developed to complement two Department of Housing and Urban Development (HUD) programs.[212] Some states have also undertaken programs that require eligibility standards for financing benefits. Oregon, for example, enacted a provision entitling eligible veterans to acquire loans for alternative energy devices.[213] The Veterans Administration and the Small Business Administration have similar authority through national legislation.[214]

The federal government and a large number of states also have enacted tax incentive legislation to promote energy conservation and the private development of alternative energy sources. Eligibility standards are required in order to determine which types of systems and components qualify for the tax benefits. For example, Internal Revenue Service regulations specify that to be eligible for the federal income tax credit,[215] renewable energy source property must meet certain performance and quality standards to be specified by the Secretary of the Treasury.[216]

The importance of the standards promulgated by the Secretary of the Treasury cannot be understated. The Energy Tax Act provision affecting the residential energy credit specifies that

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212. Intermediate Minimum Property Standards supplement similar Federal Housing Administration (FHA) standards and are used by HUD and the FHA as a means of determining acceptance of solar preducts for mortgage insurance. NATIONAL BUREAU OF STANDARDS, INTERMEDIATE MINIMUM PROPERTY STANDARDS FOR SOLAR HEATING AND DOMESTIC HOT WATER SYSTEMS (1977). The Intermediate Standards for Solar Domestic Hot Water Systems are based on the same standards for use in the HUD Solar Hot Water Initiative Program. This Program provided financial assistance for solar hot water installations to home owners in eleven states located primarily in New England. NATIONAL BUREAU OF STANDARDS, INTERMEDIATE STANDARDS FCR SOLAR DOMESTIC HOT WATER SYSTEMS/HUD INITIATIVE (1977).

213. OR. REV. STAT. § 407.048 (1979).

214. The Small Business Energy Loan Act, Pub. L. No. 95-315, 92 Stat. 377 (1978), empowers the Small Business Administration to make energy-related loans to small businesses. The Veterans Housing Benefits Act of 1978, Pub. L. No. 95-476, 92 Stat. 1497, gives the Veterans Administration authority to make or guarantee loans for veterans who wish to install conservation measures, including solar energy systems, in their personal residences.

215. The federal tax credit was instituted by the Energy Tax Act of 1978 as part of the National Energy Act, Pub. L. No. 95-618, 92 Stat. 3174. The Energy Tax Act was amended by the Crude Oil Windfall Profit Tax Act of 1980, Pub. L. No. 96-223, 94 Stat. 229 (to be codified in scattered sections of 7, 19, 26, 31, 42 U.S.C.).

216. Treas. Reg. § 1.44C-2(e)(2) (1980).

"[t]he term 'renewable energy source property' means property which . . . transmits or uses solar energy . . . for the purpose of heating or cooling . . . and which meets the performance and quality standards (if any) which have been prescribed by the Secretary by regulations . . . ."[217] This provision could be construed liberally by the IRS to include as many solar system designs as accomplish the objectives of the Act. The Act further provides that "the term 'renewable energy source expenditure' does not include any expenditure properly allocable . . . to any energy storage medium which has a primary function other than the function of such storage."[218] Both the proposed and the final IRS regulations interpreting the latter provision specify that only materials and components whose sole purpose is to transmit or use solar radiation are included within the term "solar energy property."[219] Under this interpretation, most passive systems are not eligible because they employ a combination of materials and components that are integrated into the structure of the residence.[220]

Much of the initial state tax incentive legislation was deficient because it did not adequately define relevant terms or otherwise indicate with precision the extent of coverage.[221] Imprecise statements of legislative policy make regulatory standards even more important, for taxpayers must have an indication of coverage to remove uncertainty over eligibility. Tax officials also need this indication in order to administer the incentive programs adequately. As with all cases of legislative delegation to administrative agencies, a broad delegation involves more administrative discretion to shape the details of the program. Liberal or restrictive interpretations by tax officials concerning solar eligibility will significantly determine the inducement value of these programs.

Among state incentive programs, the California Tax Credit Labeling Program is unique. A state agency and a private trade association work closely together to carry out the Program[222] and to date have developed several tax credit criteria.[223] The Labeling Program, also known as Cal Seal, is a joint venture of the Califor-

217. I.R.C. § 44C(c)(5).

218. I.R.C. § 44C(c)(2)(C).

219. Treas. Reg. § 1.44C-2(f) (1980).

220. Minan & Lawrence, 32 HASTINGS L.J., *supra* note 9.

221. *See* Minan & Lawrence, 56 TEX. L. REV. *supra* note 9, at 838-43.

222. The enabling legislation actually calls for the creation of standards by two state agencies. CAL. REV. & TAX. CODE § 17052.5 (West 1978).

223. CALIFORNIA ENERGY COMMISSION, GUIDELINES AND CRITERIA FOR THE CALIFORNIA SOLAR ENERGY TAX CREDIT (1978); California Administrative Regulations §§ 2601-2608.

nia Solar Energy Industries Association (CAL SEIA) and the California Energy Commission (CEC).[224] As CAL SEIA describes the program, "The Cal Seal label signifies that in the opinion of CAL SEIA and the CEC, the system to which it is attached meets all applicable requirements of the California Energy Commission's Regulations (or gnidelines) for the California Solar Energy Tax Credit."[225] Having the label is not required in order to receive the tax credit, nor is such certification conclusive. Final authority to determine eligibility lies with the state Tax Franchise Board. The program is designed to provide guidance on tax credit eligibility, to aid inspectors in investigating consumer complaints, and to help arbitrate disputes.

IV. The Relative Roles of Standards and Warranties

The development of solar energy equipment standards is comparatively recent and largely incomplete. In the next few years proposals for product standards and warranty requirements will undoubtedly increase. Consequently, the experiences to date with the various types of standards and warranties—and the emerging trends or patterns—should be analyzed in light of certain fundamental legal and policy principles in order to affect and shape the future direction of solar commercialization. This part of the Article argues that although warranties can play a useful role in solar energy commercialization, the primary focus of solar energy proponents should be on the development of mandatory product standards. If solar energy is to be commercially successful in this country, product standards are necessary to place solar equipment on par with traditional energy systems in the minds of consumers. This part of the Article consequently first discusses the role that product standards must play in the future of solar energy. It then discusses the task that warranties can perform in support of the product standards.

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224. Several concerns have been voiced concerning the close relationship between the public and private sector that exists without the benefit of enabling legislation. The program is run by the California Solar Energy Industries Association, but the California Energy Commission's name also appears on the certification label. Concerns have been expressed over the prospects of improper delegation of authority. An additional fear is that consumers will mistakenly interpret the label as a state guarantee. Concern over potential liability of the Energy Commission in instances in which the State Tax Franchise Board ultimately denies eligibility for the tax credit has also been registered. State Solar Incentives, *supra* note 145, at 117.

225. California Solar Energy Industries Association, Press Release, Feb. 7, 1979.

A. Product Standards

Standards for solar energy equipment are crucial. A viable market for solar energy equipment will not develop until consumers are given assurances that the available products are dependable and sufficient to meet their needs. Consumers want to be certain that the product they purchase will work and be durable. Obviously the absence of such assurances has not deterred those persons who have already invested in solar equipment. Many of these individuals, however, have been motivated by a "pioneering" spirit,[226] and assuredly this attitude is not sufficiently pervasive to support a mass commercialization effort. Consumer assurance is needed, but "the fact [is] that there are few well-documented applications in most of the country on which to base sound answers to questions of reliability, product life-term, long-term performance, and maintenance costs."[227] The development of standards will spur the process of getting these answers and providing the basic product information that consumers expect.

Although one study assessing solar marketing concluded that "there are alternatives to regulation, and solar policy-makers at all levels will promote the general welfare by searching for those alternatives rather than assuming that traditional forms of government intervention are the best way to promote the commercialization of solar energy,"[228] this Article is based on a contrary premise. The regulatory approach is absolutely necessary. Solar energy products must compete directly with established conventional heating and cooling equipment, and only standards can overcome the barriers to successful solar commercialization resulting from the novelty of solar equipment and the existing regulatory process. Solar equipment must be integrated into the regulatory process if it is to compete effectively. Only mandatory standards for all of solar's potential uses—regulatory functions, incorporation into building codes, and incentives eligibility criteria—can ensure that integration.

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226. Members of the building industry have indicated that they "have been self-motivated in their capability development." AIA RESEARCH CORPORATION, EARLY USE OF SOLAR ENERGY IN BUILDINGS 27 (1976). Evidence is also available to establish similar attitudes among homeowners who have purchased solar units in Florida. "They are sold on solar and are willing to make allowances for problems in a new and developing technology." M. Yarosh & A. Litka, *supra* note 29, at 11. Additional characteristics that demonstrate that these early users are probably atypical are also provided in this source. *Id.* at 15.

227. AIA RESEARCH CORPORATION, *supra* note 226, at 60.

228. J. RILEY, R. ODLAND & H. BARKER, *supra* note 149, at 50.

1. Regulatory Functions

Buyer confidence and protection can be promoted most successfully through required regulatory product standards. The manufacture or sale of solar equipment not complying with prescribed standards should be prohibited. Product confidence would then be advanced in two respects. First, prospective buyers would have the assurance that the products have been tested and found to comply with certain standards. Second, the purchased product is more likely to perform satisfactorily. Individual positive experiences will, in turn, promote general confidence in solar equipment.[229] A prohibition on the manufacture or sale of solar products that does not comply with promulgated standards will prevent the marketing of products that are poorly designed or structurally defective and will provide the most direct form of buyer protection.

Independent action by the states and the federal government could result in an undesirable proliferation of regulatory solar standards. Variations in standards would fragment the market and prevent national testing for compliance. Moreover, businesses operating in several states would have to meet multiple standards. This foreseeable problem, however, needs to be placed in its proper perspective. To the extent that a product must be specially designed or tested in order to meet the needs of a particular environment, the proliferation argument loses its persuasiveness, for some proliferation is inevitable. Different specifications and tolerances are required in different regions "due to the environmentally specific nature of the technology."[230] Solar equipment design must

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229. According to the Department of Energy,

> An exceedingly powerful factor in the acceptance of innovation is the achievement of social support or consensus. There is a tendency of the large majority to have its behavior validated in almost ritualized stages:
> —the innovation is tested by the innovater who takes risks as a result of his need to tinker and/or be "first on the block";
> —it is judged to be valuable hy the gatekeeper, the respected individual whose judgment is more widely accepted than that of the innovator;
> —it is approved by a critical number of peers who indicate that this is safe, socially acceptable behavior.
> By this time, the buyer himself is ready to invest in what is now a socially and economically acceptable technology. This has been the history of the automobile, air travel, hybrid grain, central air conditioning and other innovations. It is supported not only by the psychological and sociological processes, but by the economics of the technology as well. It was not by chance that several consumers stated directly, "I'd rather be the third or fourth on my block."

DEP'T OF ENERGY, PSYCHO-ECONOMIC FACTORS AFFECTING THE DECISION MAKING OF CONSUMERS AND THE TECHNOLOGY DELIVERY SYSTEM 33 (1978).

230. AIA RESEARCH CORPORATION, *supra* note 226, at 4.

be matched to specific geographical and climatic conditions to a much greater extent than conventional heating and cooling products.[231] In short, while uniformity in general is needed, absolute uniformity is neither possible nor desirable.

Individuals or groups involved in the standards development process should purposefully focus on those solar energy system components and functions that are susceptible to geographic and climatic variations, and realistic tolerances for deviations should be developed. The national effort, in particular, should develop options reflecting these regional differences. The states would then be provided with a set of equipment standards that are uniform in certain respects but allow choice on variables needed to reflect local conditions.

The standards implementation process can range from individual state implementation to the imposition of national criteria. The latter course is available through the broad powers of Congress to regulate commerce.[232] Until Congress acts, however, the states can exercise their police powers pursuant to the tenth amendment of the Constitution.[233] As long as the adopted standards reflect local conditions and do not unreasonably burden interstate commerce in solar equipment, they will be held constitutional.[234] Alternatively, the federal government could encourage or compel the states to adopt national standards. Incentives for adoption could be offered, or legislation could require states to adopt a program or have one imposed by the federal government.

Current federal plans rely on incentives to encourage state and local action.[235] Because sufficient standards to support a mandatory implementation program have yet to be developed, this course of action is presently appropriate. Once standards are developed, however—particularly if they incorporate the necessary flexibility for application to diverse regional conditions—Congress should consider requiring state adoption. Promulgation of a na-

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231. *See* J. EASTERLY, ENGINEERING CONCERNS IN SOLAR DESIGN AND OPERATION (1979) (National Solar Data Program report for the Department of Energy).

232. U.S. CONST. art. I, § 8. *See* Katzenback v. McClung, 379 U.S. 294 (1964); Heart of Atlanta Motel v. United States, 379 U.S. 241 (1964); Wickard v. Filburn, 317 U.S. 111 (1942).

233. "The powers not delegated to the United States by the Constitution, nor prohibited by it to the States, are reserved to the States respectively, or to the people." U.S. CONST. amend. X.

234. *See, e.g.*, Huron Portland Cement Co. v. City of Detroit, 362 U.S. 440 (1960); South Carolina State Highway Dep't v. Barnwell Bros., 303 U.S. 177 (1938).

235. F. MEEKER, *supra* note 188, at 27; PLAN, *supra* note 145.

tional set of standards is as close to uniformity as can be realistically expected.

A fundamental objection to current development and implementation of solar equipment standards centers on the impact that such standards might have on subsequent solar innovation. This concern centers around the fear that the present adoption of a regulatory program will stifle additional technological creativity because the criteria adopted will be based on the current state of tbe art.[236] Arguably this consequence is undesirable and will assuredly occur because changes in technology can be reflected in an established standards program only after a slow amendment procedure.[237]

While new innovations may face some initial delays in commercial acceptance the concern is easily overemphasized and is insufficient, standing alone, to justify delaying the promulgation and implementation of standards and certification programs. Some manufacturers and commercial firms will certainly focus their efforts on the commercialization of systems that satisfy existing standards and can be readily certified. Nothing is wrong with this orientation. By helping to overcome many of the barriers that currently impede commercialization efforts, standards will achieve their objective.

Since two to five years are generally required to develop standards, the time required to amend those standards is a significant consideration.[238] Two points should be recognized, however. First, the problem in acceptance of a new technology is not the existence of prior standards that cannot accommodate innovation. Any new solar product wonld face the same long, arduous process required for the development of the original standards. Second, without any

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236. *See* J. RILEY, R. ODLAND & H. BARKER, *supra* note 149, at 23, 42. *See also* Heyman, *supra* note 153.

237. The amendment process for standards adopted through the voluntary consensus system, like the original promulgation, follows the principles of due process and democratic participation of all interest parties. The procedures followed involve preparation of drafts, committee and subcommittee approval, submission of drafts, approval procedures, and possible revisions. A discussion of the system in general and the procedures of some of the better known standards-writing organizations is provided in ASTM, *supra* note 146, at 6-8, 10-15. The incorporation of standards into building codes involves an additional delay due to the time required for testing and approving the model code organizations and their acceptance by the local code authorities. "The model code associations operate on a committee basis. Changes in materials, products, systems, or specifications are considered by the committee. Upon the committee's recommendation, changes are voted upon by the membership." J. RILEY, R. ODLAND & H. BARKER, *supra* note 149, at 12.

238. *Id.*

standards in existence, this new product would encounter all the same barriers to acceptance that now inhibit solar energy development. Rather than retarding the present development of standards, the solution to this potential problem is for persons involved in developing standards programs to recognize that significant technological developments are likely to occur during the next few years and to provide for regular review of adopted criteria. Additionally, to the extent possible, they should adopt an accelerated amendment process.

Despite some present fears, the current development of standards and certification programs is unlikely to cut off other technological change in the field. Solar exploitation is still in its early stages, and it does not appear to be a field lacking in innovation.[239] The potential market for alternative energy devices is viable enough to provide a strong catalyst for innovation.[240] Furthermore, continued federal support for research and development projects can strengthen the resolve of those innovators who are inclined to advance solar technology. Concerns about the effects on innovation, therefore, should not be permitted to delay development of solar equipment standards.

2. Incorporation into Building Codes

The development and implementation of solar standards could significantly reduce the burden currently borne by solar energy systems in the building regulatory process. The first step in this direction involves the development of standards that adequately deal with the relevant criteria used in building and housing codes. Once these standards have been developed, they would be available for adoption as amendments to existing building codes. "The most widely accepted method of utilizing standards as an integral part of code requirements is to reference them in the appendix of the code and then spell out the conditions of their applicability in the text of the code."[241] Continuous revision of standards is both easy and inexpensive when the standards appear in the appendix rather than in the text of the entire code.

The alternative approach to incorporating solar standards into building codes is the adoption of a separate code dealing solely

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239. The Solar Energy Intelligence Report, a weekly publication, includes a regular feature describing recent solar patents.

240. "Since over 40 percent of the Nation's energy is used for heating purposes, solar heating also has a large potential market." GENERAL ACCOUNTING OFFICE, *supra* note 7, at 1.

241. R. SANDERSON, *supra* note 181, at 27.

with solar standards. An initial assessment of this issue, undertaken in 1977 by the National Institute of Building Sciences (NIBS), reported that "[t]he preponderance of opinion among the participants is in the direction of a model solar energy code, supported by standards, manuals of accepted practice, and guides to design."[242] After reviewing responses to the initial report, however, NIBS found that "[t]here is no clear demand for model solar energy codes" as the "respondents were almost equally divided on the issue."[243] A subsequent report indicated that primary support for model codes comes mostly from "those persons most closely associated with the generation of model codes, national standards, and similar documents," whereas "[t]hose persons most closely associated with the actual development, application, and regulation of solar energy technologies, although somewhat divided in their views, appear to question the need for a desirability of a separate national model solar energy code, particularly at this time."[244] NIBS concluded that "due to this lack of unanimity and seriousness with which objections are raised and arguments presented, such an action at this time would be premature."[245]

The model solar energy code concept is not just premature—it is wrong. Segregating solar provisions into a separate code will only emphasize the unique characteristics of solar applications.[246] Existing barriers to solar commercialization will not be overcome by approaches that treat solar differently. The integration of solar

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242. NATIONAL INSTITUTE OF BUILDING SCIENCES, SUMMARY REPORT: *Model Solar Energy Code Project for Heating and Cooling in Housing and Building*, in I SOLAR BUILDING REGULATORY STUDY pt. 3, at 4 (National Institute of Building Sciences comp. 1978). An excerpt from the CABO report is provided. "The studies conducted by the model code organizations and CABO indicate that the proper way to regulate solar installations and components is to develop one medel solar energy code. This code would have to be flexible enough to allow innovative materials and components to be utilized, but stringent enough to protect consumers." *Id.*

243. NATIONAL INSTITUTE OF BUILDING SCIENCES, ANALYSIS OF REVIEWER COMMENTS, in SOLAR BUILDING REGULATORY STUDY, *supra* note 242, pt. 2, at 1.

244. NATIONAL INSTITUTE OF BUILDING SCIENCES, *Report of the National Institute of Building Sciences*, in SOLAR BUILDING REGULATORY STUDY, *supra* note 242, pt. 1, at 2.

245. *Id.* pt. 1, at 4.

246. The first model code for solar heating and cooling was prepared by the International Association of Plumbing and Mechanical Officials (IAPMO). The first edition was published in 1976. This code has been adopted in areas of southern California, Arizona, and elsewhere. For a description of its provisions and a devastatingly critical analysis of this model code, see F. MEEKER, *supra* note 188, at 34-41. Another model has been prepared under contract with the Department of Energy. COUNCIL OF AMERICAN BUILDING OFFICIALS, RECOMMENDED REQUIREMENTS TO CODE OFFICIALS FOR SOLAR HEATING, COOLING AND HOT SYSTEMS (1980).

uses into existing traditional processes and ways of doing business is crucial to effective solar development. Except for photovoltaic applications, most solar energy equipment is used for space heating and cooling, ventilating, and hot water heating—all very traditional functions. The sooner solar is recognized and treated as an analogous regulatory concern, the sooner it will be able to make significant market penetrations.

A model solar energy code would also result in undesirable duplication. Most solar systems components are not unique to solar applications. Standards already exist for pipes, ducts, valves, controls, wiring, and other components.[247] Because those standards may not have contemplated solar applications when written, they certainly should be revised to accommodate these applications. An index of all the code provisions covering components used in solar applications might also aid code officials, builders, and other interested parties. The implementation of solar standards into the building codes should be accomplished, however, through appropriate amendments to existing codes rather than through the adoption of a separate solar code.[248]

Most codes use specification standards that state which kinds of materials and components may be used and in what manner.[249] For example, a code might provide that glass be of a particular thickness or that all gas water heaters be AGA-approved. Performance standards, on the other hand, indicate the performance characteristics that must be satisfied.[250] Any materials and construction techniques are satisfactory provided that they can accomplish the result specified in the standard. For example, the code might provide for certain fire resistance ratings based on a period of one hour for interior or exterior walls.

Although most codes use specific standards, the argument has been made that the adoption of solar system performance standards is a preferable course to follow. The objection to specification standards is that they allegedly stifle innovation. Specification standards unquestionably favor existing products and techniques. Performance standards appear largely to alleviate this concern since they allow achievement of a desired result by either conventional or new techniques. Nevertheless, practical considerations

247. OFFICE OF TECHNOLOGY ASSESSMENT, *supra* note 152, at 182.

248. *Contra*, J. RILEY, R. ODLAND & H. BARKER, *supra* note 149, at 52.

249. *See* R. SCHOEN, A. HIRSHBERG & J. WEINGART, *supra* note 23, at 97; F. Meeker, *supra* note 188, at 1; PLAN, *supra* note 145, at 5.

250. *See* PLAN, *supra* note 145, at 5.

suggest the general use of specification standards. Performance solar standards are unlikely to facilitate the prompt acceptance of innovative solar designs. The building codes departments are generally staffed, funded, and prepared only to deal with straightforward specification determinations. Unless additional funding and personnel are provided, which would in turn increase coustruction costs, acquiring approval under the performance code provisions could require more time.[251]

The performance versus specification debate is not limited to solar applications in building codes. It also exists for any other innovative construction technique or material. The existing codes are based on specification standards. Performance codes may be a more desirable approach, and efforts in that direction have been undertaken and should continue.[252] Performance solar equipment standards should not, however, be engrafted onto specification codes.

> Instantaneous reforms and change on a wholesale scale are neither reasonable to expect nor feasible to bring about. In fact, careless use of the term performance code and indiscriminate legislative attempts to change only the one subsystem without consideration of larger systemic impacts could damage the concept and the well-intended reform such actions are ostensively designed to carry out.[253]

3. Incentives Eligibility Criteria

Solar equipment standards can favorably affect the implementation and enforcement of incentive eligibility programs. Generally, tax and loan incentives sbould extend only to products that are certified as meeting the regulatory product standards. Tax incentives, in particular, create a new marketing climate affording dealers the opportunity to market unreliable systems. Standards certification eliminates the likelihood of this occurrence. It also promotes the public interest by assuring that public resources are used for effective solar applications that actually further the objective of increased solar energy use.

Some degree of fiexibility is necessary in designing and implementing eligibility criteria. Government grants and loans are

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251. R. SCHOEN, A. HIRSHBERG & J. WEINGART, *supra* note 23, at 58, 115.

252. For a good discussion of the proposals for building code reforms, see *id.* at 181-98. For a discussion of legislative changes affecting building code administration, see Finger, *Operation Breakthrough's Approach to Building Codes, Zoning, and Site Design*, 39 GEO. WASH. L. REV. 764 (1971). For a discussion of the use of litigation, see Rivkin, *Courting Change: Using Litigation to Reform Local Building Codes*, 26 RUTGERS L. REV. 774 (1973).

253. R. SCHOEN, A. HIRSHBERG & J. WEINGART, *supra* note 23, at 196.

designed in part to promote innovative solar applications. These applications need incentives and should be encouraged. Exemptions for homemade systems eligibility may also be desirable. In most cases, eligibility criteria will serve the interested parties well. Taxpayers and loan applicants will receive guidance and protection in selecting a system. Government officials will be able to administer the incentive programs more efficiently, and the public interest will be promoted significantly.

4. Drafting the Product Standards

The solar standards adopted for regulatory functions, building codes, and eligibility criteria must be well conceived to balance the competing considerations. The basic objective of facilitating the commercialization of quality solar products through increased buyer confidence and protection, building code acceptance, and protection of the public fisc used to finance tax and loan incentives must underlie the final determinations. The economic reality of the marketplace must also be seriously considered, however, since commercial success or failure is ultimately ruled by economic constraints.

Because the uses of solar energy systems vary, the economic factor is particularly relevant in devising a program for solar products. The health and safety hazards addressed by building code requirements are illustrative. They involve "risks of leakage or explosion from excessive temperatures, high pressures, corrosion, and other component failures."[254] The degree of risk in these cases, however, will be affected by the use of the system, for some applications involve relatively low temperatures and pressures.[255] To require equal standards in such lower risk uses greatly increases the cost of compliance for an arguably excessive safety margin. Promulgated safety standards should allow for such distinctions.

The persons and organizations developing the standards should recognize that the most desirable standards are those that regulate the entire solar heating or cooling system. If only certain components are subject to adequate standards, the weakest component in the solar system affects the workability of the entire sys-

254. OFFICE OF TECHNOLOGY ASSESSMENT, *supra* note 152, at 182.

255. Although temperatures in flat-plate glass collectors can achieve high temperatures in the range of 140 degrees, they do not operate efficiently at higher temperatures. Other solar devices use concentrating devices that increase the temperature and efficiency. Photovoltaic systems introduce an additional risk factor since they convert solar energy into electricity.

tem. For example, if a highly efficient and dependable collector is used but the storage tank is not properly insulated, the efficiency of the whole system suffers. Systems standards are thus desirable to avoid this problem. Alternatively, standards must at the very least apply to all components that affect safety, durability, and performance. Moreover, the interchangeability of the various components must be rated.

5. Implementing the Standards

While the standards themselves state the minimum requirements that solar energy systems must satisfy, a means of ensuring compliance must also be provided if standards are to achieve their objective. Test methods, laboratory accreditation, certification programs, and installation practices must accompany the standards. Test methods indicate the testing and performance evaluation procedures used to determine compliance with the standards.[256] The establishment of a set of criteria to evaluate and accredit laboratories can lead to a group of widely respected private or public testing laboratories that are competent to perform the required testing and compliance assurance functions.[257] Certification programs allow the demonstration of compliance with the standard by a label or form provided by the testing laboratory or other organization.[258] Installation practices provide guidelines to ensure that the product will be installed in a safe and workable manner. Solar energy equipment standards must include these additional criteria and procedures in order to ensure that they are used effectively.

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256. The American Society for Testing and Materials defines a test method as "a form of standard that covers sampling and describes the subsequent testing procedures used in determining the properties, composition, or performance for materials, products, systems, or services that may be specified. A test method shall not include the kind of numerical limits for the properties, composition, or performance that should normally be included in a specification. AMERICAN SOCIETY FOR TESTING AND MATERIALS, REGULATIONS GOVERNING ASTM TECHNICAL COMMITTEES (1977), *cited in* PLAN, *supra* note 145, at 4.

257. The ARI Foundation, Inc., a subsidiary of the Air-Conditioning and Refrigeration Institute, has already developed a laboratory accreditation and certification program. Munger, *Air-Conditioning and Refrigeration Institute Certification Program,* in SECOND NATIONAL CONFERENCE, *supra* note 155, at 38; PLAN, *supra* note 145, at 18.

258. The Solar Energy Research and Education Foundation, a subsidiary of the Solar Energy Industries Association (SEIA), has developed a collector rating, labeling, and certification program for solar collectors. Kirkpatrick, *The SEREF Rating, Certification and Labeling Program for Solar Collectors,* in SECOND NATIONAL CONFERENCE, *supra* note 155, at 37; PLAN, *supra* note 145, at 18. S.E.I.A. PRODUCT CERTIFICATION STANDARD, S.E.I.A. CERTIFIED THERMAL PERFORMANCE RATING STANDARD FOR SOLAR COLLECTORS (1979). These certification standards must be reviewed and revised based upon experiences, and additional standards must be developed for additional solar system components and for entire systems.

Certification by testing laboratories will allow solar equipment to compete for building code approval on equal footing with conventional equipment.[259] Certification will also promote consumer assurance of product quality and ensure eligibility for tax and loan incentives. The California approach, which involves two separate programs for equipment certification and tax credit labeling,[260] should be avoided since multiple certifications will generate consumer confusion. Although eliminating dual programs will require greater coordination between various governmental agencies, such efforts are neither impossible nor unique.[261] A uniform certification requirement for incentive eligibility and code approval would also eliminate the use of compliance certifications based on manufacturers' representations either directly or through trade associations. Presently all three of the model building codes require certification by qualified testing laboratories despite the increased cost of certification. This requirement exists, at least in part, because many manufacturers do not have adequate data on their products to be able to accurately ascertain various characteristics.[262]

The large number of improperly installed systems demonstrates the need for regulated installation practices.[263] Faulty installation not only creates health and safety risks, but also diminishes the performance capabilities of systems.[264] A serious need

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259. This certification will not, however, satisfy the structually related safety aspects of the building and housing codes, such as roof support requirements mandating that the support be sufficient to bear the weight of solar panels. These factors are part of the health and safety measures that must be addressed in the codes.

260. *See* notes 172-76, 222-25 *supra* and accompanying text.

261. Illustrations in the solar energy field can be found within California. The California Public Utilities Commission and the California Energy Resources Conservation & Development Commission have enterod into an unprecedented joint investigation of solar energy applications in order to coordinate their actions and to benefit from the perspective that each brings to the task. The California tax credit legislation itself identified beth the Energy Resources Conservation and Development Commission and the Franchise Tax Board as agencies of the program. CAL. REV. AND TAX. CODE § 17052.5 (West 1978).

262. GENERAL ACCOUNTING OFFICE, *supra* note 7, at 10.

263. *See* notes 28-30 *supra* and accompanying text.

264. "Many systems are probably not working near their maximum potential level." M. Yarosh & A. Litka, *supra* note 29, at 17.

> In an experimental project being conducted by the New England Electric Company on 100 solar water heaters, for example, a number of problems such as malfunctioning controls, inadequate pipe insulation and freeze-ups severely limited the performance of the solar heating systems. Although it was originally hoped that the solar equipment would reduce water-heating costs by 50 percent, because of the aforementioned problems, the overall average energy savings during the first 6 months of operation amounted to only 17 percent.

GENERAL ACCOUNTING OFFICE, *supra* note 7, at 12.

exists for training programs to qualify solar installers[265] because the tolerance for deviation is much less for solar systems than for conventional heating and cooling equipment.[266] Standards themselves, of course, will not provide this necessary training. They can, however, require all installations to be performed in accordance with established practices. In addition, all installers should be required to be certified.

B. Warranties

Unlike product standards, warranties should not be legislatively mandated for sales of solar products, at least not so long as the Magnuson-Moss Act requirements are applicable. The expense and complexity of complying with the Act has caused many small businesses to stop giving any warranties.[267] Mandating warranties will simply force many solar manufacturers and contractors to withdraw from the solar market. This withdrawal would be unfortunate because it would undermine, rather than further, the goal of expanded solar use. Furthermore, mandatory warranties are likely to be ineffective. The FTC study demonstrates extensive noncompliance with the Act by even those solar suppliers providing written warranties on their own initiative.[268] The California experience with mandatory warranties for the state income tax solar credit, which requires Magnuson-Moss "full" warranties,[269] is one of extensive noncompliance.[270] Enforcement is very difficult due to the California Franchise Tax Board's reluctance to deny the tax credit and thereby penalize the purchaser-taxpayer for the warranty impropriety of the seller.[271] If the state were to prevent both the sale and the tax credit eligibility of solar products not complying with promulgated standards, the enforcement problem would

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265. The Florida study "found much evidence of inadequacies in design and installation capabilities." M. Yarosh & A. Litka, *supra* note 29, at 17. In another case a builder in southern California purchased a number of solar collecters manufactured in Australia. The instructions stated, "install units facing North," which the builder did. Unfortunately, the instructions did not indicata they were applicable only in the southern hemisphere. Address by Howard Kraye, California Building Industry Association Solar Seminar, in San Diego, California, Sept. 26, 1979.

For a discussion of federal and state efforts in the area of training programs, see GENERAL ACCOUNTING OFFICE, *supra* note 7, at 35-36; 1 SOLAR L. REP. 26-28 (1979).

266. J. EASTERLY, *supra* note 231, at 2.

267. FLORIDA SOLAR ENERGY CENTER, *supra* note 42, at 14.

268. *See* note 138 *supra* and accompanying text.

269. Cal. Solar Tax Regs. § 2601(e)(2)(D) (1979).

270. *See* note 139 *supra* and accompanying text.

271. Jaroslovsky, *supra* note 24, at 239.

be addressed more directly and effectively. Fortunately, few states have legislatively required solar warranties.[272] With increased solar commercialization, however, more states may adopt this mandatory approach as a logical response to consumer concerns. Demonstrating the shortcomings of this approach to state legislators will then be crucial.

Congress has evidenced a commitment to the principle of maintaining an active role for small businesses in solar energy development.[273] The Small Business Energy Loan Act[274] is one illustration. Additionally, the Department of Energy Act of 1978[275] requires the Secretary of Energy to provide a realistic and adequate opportunity for small business concerns to participate in DOE programs.[276] Nevertheless, federal warranty requirements have been imposed. The first federal warranties requirements were created as part of the Department of Housing and Urban Development's Hot Water Initiative Program and its Residential Solar Demonstration Program.[277] Manufacturer's warranties are also referred to in the National Energy Conservation Policy Act.[278] Federal authorities should reconsider such mandatory warranty requirements because they might actually preempt participation by the small business firms that Congress is seeking to encourage.[279] Standards hold far greater benefits for small businesses.

Product standards, however, will not in all respects be more advantageous to small businesses than warranties. Costs for standards certification clearly would be relatively greater for small business enterprises since they must be amortized over fewer units. Forms of public subsidy could be implemented, but this solution may not comport with today's political attitude toward curtailed government spending. This attitude, however, does not affect the

272. *See* notes 25-27 *supra.*

273. For an indication of the general congressional concern for small businesses, see SUBCOMM. NO. 5 OF THE SELECT COMM. ON SMALL BUSINESS, PROMOTIONAL PRACTICES BY PUBLIC UTILITIES AND THEIR EFFECT UPON SMALL BUSINESS, H.R. REP. No. 1984, 90th Cong., 2d Sess. (1968).

274. Pub. L. No. 95-315, 92 Stat. 377 (1978).

275. Pub. L. No. 95-238, 92 Stat. 47 (1978).

276. 42 U.S.C. § 7256 (1976).

277. *See* note 27 *supra.*

278. 42 U.S.C. § 8211 (ii) (1976); 10 C.F.R. §§ 456.105(j), .312(b)(ii) (1980).

279. For a critical assessment of the Department of Energy's efforts to encourage small business participation in its solar energy programs, see GENERAL ACCOUNTING OFFICE, SMALL BUSINESS PARTICIPATION IN THE DEPARTMENT OF ENERGY'S SOLAR ENERGY PROGRAMS (1980) (report by the Comptroller General to the Chairman of the Select Committee on Small Business).

validity or desirability of some form of public subsidy. A progressive fee schedule based on business size is also possible, but is objectionable to many. Thus, in all likelihood the initial cost for such services, although recoupable from subsequent sales, will require an extra capital investment for each product line of solar equipment.

On the other hand, a testing and certification program will provide significant benefits to all producers, particularly the small businesses. Typically, small firms cannot afford their own testing and laboratory facilities. Regulatory testing and certification facilities will provide them with needed information concerning performance and safety characteristics of the firm's product and comparisons with competitors' models. Requiring products to comply with the regulatory standards would enable suppliers to promote their products more easily. Risks for liability based on negligence and strict liability would also be lessened, since a product defect might be discovered during compliance testing rather than after several thousand units had been distributed in commerce. The entire industry will benefit from the elimination of noncomplying products from the marketplace. The amounts for testing and certification, although particularly significant to the smallest firms, do not seem excessive when compared with the benefits to the firms and the industry.

Recognizing the limited value of warranties is essential to creating and implementing methods better suited to promote buyer confidence and protection. Although warranties are unlikely to be comprehensive enough to instill adequate consumer confidence, they can make a contribution. Warranties should operate in conjunction with a program of standards, testing, and certification. Published results of testing by an independent accredited laboratory would provide a seller with information that could be used as the basis for representations to buyers.

Information derived from a standards certification program would enable a solar supplier to make written representations that would constitute an express warranty under Article Two of the U.C.C., but not a written warranty under the Magnuson-Moss Act.[280] The supplier could state, for example, that the product complies with a given standard, or it could provide test data re-

280. For a comparison of express warranty requirements under the U.C.C. with those under the Magnuson-Moss Act, see Note, *Consumer Product Warranties Under the Magnuson-Moss Act and the Uniform Commercial Code*, 62 CORNELL L. REV. 738, 745-46 (1977).

sults. If such statements become part of the "basis of the bargain,"[281] they would create Article Two express warranties since they would be "[a]n affirmation of fact or promise made by the seller to the buyer which relates to the goods" and would not be "a statement purporting to be merely the seller's opinion or commendation of the goods."[282] Though written, the statements would not constitute a written warranty making the Magnuson-Moss Act applicable[283] since the statements would not be an affirmation of fact or promise that the product "is defect free or will meet a specified level of performance over a specified period of time."[284] Consequently, the implied warranty of fitness for a particular purpose could still be disclaimed. A standards testing program could thus provide a basis for solar suppliers to provide consumers with realistic information on system performance capabilities without incurring the "excessive" regulatory burden associated with the Magnuson-Moss Act.

Unless properly marketed, standards testing data is unlikely to be effective in assuaging consumer concerns. The standards used must obviously include performance standards. Beyond that feature, the nature of the product must be recognized. Ratings of conventional appliances, such as toasters or electric ranges, promote confidence because the buyer knows they will perform identically irrespective of the electrical outlet used. Solar applications, however, involve too many variables to achieve similar performance uniformity. The marketing of the standards testing data must recognize that actual solar product results will vary depending upon use and environment. The solar industry would be well advised to follow a case similar to that of the automobile manufacturers in utilizing the results of the Environmental Protection Agency (EPA) gas mileage ratings.[285] Just as actual gas mileage of a given automobile can vary, solar system performance can vary depending

281. For background on the "basis of the bargain" concept, see Note, *"Basis of the Bargain"—What Role Reliance?*, 34 U. PITT. L. REV. 145 (1972).

282. U.C.C. § 2-313.

283. Differences between the U.C.C. and the Magnuson-Moss Act can be traced to the different purposes of the two statutes. "The objective of the U.C.C. is protection of the bargain, as found from all the facts and circumstances of the transaction. The purpose of Magnuson-Moss, on the other hand, is to prevent warranty deception. It is mainly intended to deal with sellers passing off something as a warranty which either is illusory or disclaims more liability than it creates." Schroeder, *supra* note 73, at 9.

284. 15 U.S.C. § 2301(6)(A) (1976). The regulations provide that certain representations, "such as energy efficiency ratings for electrical applicances," are not written warranties under the Act. 16 C.F.R. § 700.3(a) (1980).

285. *See* 42 U.S.C. § 7525 (1976).

upon factors such as proper installation, maintenance, adequate insulation, and other considerations. The likelihood of variations must be communicated to the consumer to avoid creating improper expectations. The public's experience with the EPA test results should be helpful in this regard. Most consumers now understand that some products are affected by use patterns and that performance certification is more of an approximation than a guarantee. Consumers also recognize the value of using certification data for comparison purposes. The standards approach to warranties for solar products thus has the additional benefit of providing an impetus to manufacturers to upgrade the quality of their products.[286]

Magnuson-Moss regulation can still create some limitations on a desirable solar warranty program, despite the ability to avoid such regulation through representations based on performance standards. Ideally, warranties should be directed toward ensuring that each unit sold has been properly produced. Standards would ensure product line performance capability, while warranties would protect against materials or workmanship defects that might occur in the manufacturing process. A written assertion or promise that the material or workmanship is defect-free, however, constitutes a written warranty under the Magnuson-Moss Act and again raises the problem of disclaiming implied warranties.

In the final analysis, a customer is likely to have warranty coverage for a defective item, even though the supplier merely represents that the item complies with the product standards, because the defective product will be unlikely to comply with the standard. The buyer's cause of action would be based on breach of the Article Two express warranty. This approach is circuitous, however, and complicates the issue.

The problem could be addressed by mandatory warranties that avoid the previously discussed deficiencies related to such an approach. The requirement of an express written warranty against defects in materials or workmanship could be added to legislation prohibiting the manufacture or sale of solar products that do not comply with the mandated standards. Federal legislation is desirable because the Magnuson-Moss Act is "inapplicable to any written warranty the making or content of which is otherwise governed

286. One commentator has pointed out that although the clear disclosure requirements of the Magnuson-Moss Act "can improve the information that a consumer receives . . . it has no effect at all on the information-handling capacity of the recipient." Eddy, *supra* note 40, at 860. Mandatory standards can require the disclosure of test results in a form that will facilitate consumer comparisons.

by Federal law."[287] The legislation should also create the right for solar product suppliers to disclaim the implied warranty of fitness for a particular purpose. If only a portion of the warranty were governed by the law, the Magnuson-Moss Act would govern the remaining portion.[288] Some state laws also prohibit the disclaimer of implied warranties in conjunction with sales of consumer goods.[289] Federal legislation would override any inconsistent state provisions.

Most solar manufacturers would probably be willing to undertake an express warranty against defects in addition to standards compliance if they could also avoid guaranteeing satisfaction of the personal needs of the customers. Due to current federal warranty regulation, however, suppliers of solar products must be careful when drafting their warranties. The complexities involved in accurately interpreting the Magnuson-Moss provisions and their prohibition on the disclaimer of implied warranties increase the supplier's risk of liability. These considerations suggest that unless solar suppliers are relieved of some of these restraints, solar warranties will be of only limited value in promoting solar commercialization. Irrespective of whether separate solar warranty provisions are federally legislated, however, the best use of solar warranties will be in a support role for performance standards.

V. CONCLUSION

Each of the concerns discussed in this Article reflects fundamental policy considerations that deserve continuous scrutiny and evaluation. The objective here has not been to resolve fully each of these issues. Indeed, complete resolution of such basic issues is impossible. The objective, rather, has been to place these issues into perspective by focusing upon the ultimate goal of solar commer-

287. 15 U.S.C. § 2311(d) (1976). An example of written warranty requirements appears in the Clear Air Amendments of 1970, 42 U.S.C. § 1857f-5(a) (1976) (automobile manufacturers must provide new car buyers with a warranty that new cars meet federal emission control standards).

288. *See* 15 U.S.C. § 2311(d) (1976).

289. *E.g.*, ALA. CODE § 7-2-316 (1977); CAL. CIV. CODE §§ 1790-1794.2 (West 1973); KAN. STAT. ANN. §§ 50-623 to -643 (Supp. 1976); ME. REV. STAT. ANN. tit. 11, § 2-316(5) (Supp. 1980); MD. COM. LAW CODE ANN. § 2-316.1 (1975); MASS. GEN. LAWS ANN. ch. 106, § 2-316A (West Supp. 1980); MINN. STAT. ANN. § 325G.18 (West Supp. 1980); WASH. REV. CODE ANN. § 62A.2-316 (Supp. 1980); W. VA. CODE § 46A-6-107 (1980). Some of these legislative enactments are broader than prohibiting disclaimers only for consumer products. *See generally* Clark & Davis, *Beefing Up Product Warranties: A New Dimension in Consumer Protection*, 23 KAN. L. REV. 567 (1975); Millspaugh & Coffinberger, *Seller's Disclaimers of Implied Warranties: The Legislatures Strike Back*, 13 U.C.C. L.J. 1960 (1980).

cialization and the consequences of pursuing alternative courses of action. An extensive solar energy standards program is necessary to overcome the existing barriers to significant solar use that will remain even when technological and economic viability is attained. Warranties can play an important supplemental role. Solar commercialization should be established and developed on these basic premises.