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Barriers To Commercialization Of Solar Energy In Florida

Florida Solar Energy Center

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Contract Report

Barriers to Commercialization of Solar Energy in Florida

FSEC-CR-728-94
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Prepared for:
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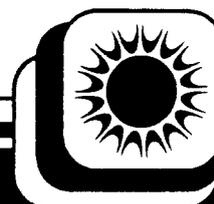


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BARRIERS TO COMMERCIALIZATION OF SOLAR ENERGY IN FLORIDA

Final Report
for
FEO Contract No. 94SE20061505-113

Florida Solar Energy Center

Colleen Kettles
David L. Block

July 1994

INTRODUCTION

Florida has a distinct history of solar system development and use. Solar systems have been operating in the State since the 1920s. During the past several decades, solar technologies have advanced and matured, as have the business entities that deliver solar products to the end user. Solar products made in Florida are U.S. and world industry leaders. Quality control measures, such as collector and system testing and certification, contractor training and licensing, and follow-up site inspection, have assured consumer confidence in solar equipment and installation.

Energy costs soak up a large portion of consumer discretionary income. Use of solar energy represents an investment in domestic energy resources with a guaranteed return. A solar energy system is a unique "appliance" in that, unlike other household appliances, it will pay for itself. And the economic benefits of solar energy are not limited to those accrued directly to the end user. The environmental benefits, as well as the employment potential of a strong solar industry, also result in positive impacts on Florida's and the nation's economy.

Florida has declared multiple policies which seek to encourage greater use of solar energy in all sectors. The basis for these policies centers on Florida's abundant supply of sunshine and the many benefits of solar energy. Prior to 1993, a variety of legislative initiatives were enacted to implement these policies. These initiatives are:

- **Solar Energy Standards:** Authorizes the Florida Solar Energy Center to adopt testing and standards for solar energy systems; requires all systems manufactured or sold in Florida to comply with those standards (Sec. 377.705, F.S.)
- **Solar Rights:** Prohibits local governments and homeowner associations from adopting measures which directly or effectively prohibit the use of solar (Sec. 163.04, F.S.)
- **Solar Easements:** Allows property owners to negotiate an easement with an adjoining owner for the purpose of maintaining solar access (Sec. 704.07, F.S.)

- Florida Energy Efficiency and Conservation Act: In an effort to reduce and control energy consumption growth rate and peak demand, the Florida Public Service Commission is directed to establish goals for energy conservation; requires Florida's electric and gas utilities to adopt plans and programs to meet those goals (Sec. 366.80, F.S.)
- Florida Thermal Efficiency Code: Authorizes the Department of Community Affairs to adopt statewide uniform standards for energy-efficient building designs (Sec. 553.900, et. seq., F.S.)
- Energy Conservation in Buildings: Encourages the use of solar energy and energy conservation in state buildings when life-cycle costs indicate they are economically feasible (Sec. 255.251, et. seq., F.S.)
- Solar in Educational Facilities: Requires the use of solar energy systems and building designs in state educational facilities, when technically and economically feasible (Sec. 235.011, .212, F.S.)

Tax Incentives: At one time, solar energy equipment enjoyed favorable tax treatment at the federal, state and local level. Tax credits and exemptions were available until the mid 1980s, when they were either repealed or allowed to expire.

The net effect of these policies has been the development of a mature solar industry. However, the market for solar energy equipment still remains in relative infancy compared to market potential. The challenge facing the industry today is to overcome the barriers that stand in the way of its long-term success and allow Florida to lead the way to a sustainable energy future.

In the 1993, the Florida Legislature directed two agencies to undertake additional efforts to promote the use of solar energy in Florida. The Department of Commerce was directed to assist in the expansion of the solar energy industry by conducting promotional and educational programs on the benefits of solar energy, targeting the business sector and the export market. The Department of Community Affairs was directed to promote the development and use of renewable energy resources by establishing goals and strategies for increasing the use of solar energy and by aiding and promoting the commercialization of solar energy technology.

The Legislature further directed the Department of Community Affairs to identify the barriers to greater use of solar energy and to develop recommendations for overcoming those barriers, reporting its findings to the Legislature annually. The Department has requested that the Florida Solar Energy Center assist in developing this, the final report of the initial project, in response to the barriers legislation. The Florida Solar Energy Industries Association has also participated in this effort.

METHODOLOGY

A list of barriers was developed by FSEC, along with a range of actions which would serve to overcome the barriers. Input was then sought from the industry as well as the Department. The first report of the study, "Solar Energy Development in Florida," FSEC-CR-696-94 [Reference 1], was completed on January 20, 1994, and was presented to the DCA Energy Policy Advisory Committee meeting on February 2, 1994.

A number of references were then reviewed and analyzed in the course of assessing current barriers. These included several market surveys and barrier studies conducted over the last 15 years. Details from this review were presented as the second interim report, "Barriers, Goals and Actions for Solar Water Heating and Photovoltaics," FSEC-CR-708-94 [Reference 2], and at the Florida Solar Energy Industries Association Board of Directors meeting on April 24, 1994. While it was recognized that some of these references in the second interim report were dated or had a narrow focus, it was agreed that those references captured the essence of problems confronting the industry today. Future studies should periodically update these surveys to fully explore current attitudes of key decision-makers, including the range of end users in the public and private sector.

The following sections detail, by solar technology, the barriers and actions to overcome the barriers. The presented actions are extensive and inclusive, and are not screened in any manner.

SOLAR THERMAL INDUSTRY

I. Barriers

The primary issue, or problem statement, used to focus discussion of the barriers is:

Technologically feasible solar thermal applications have not achieved significant market penetration in any end-use sector.

Three primary barriers have been identified which are hindering the successful commercialization of solar energy. These three barriers have substantial consequences:

Barrier 1: Solar thermal systems have a high initial cost when compared to competing technologies.

Consequences:

- The current solar market is comprised of a limited base of customers with access to cash or select financing opportunities.
- Solar water and pool heaters are characterized as high-end, luxury or non-essential items.
- There is a lack of new home market penetration.
- There is a lack of commercial and industrial market penetration.

Barrier 2: There is a general lack of awareness by all sectors of solar energy system characteristics, including appropriate end uses and their corresponding benefits.

Consequences:

- The tendency to reject that which is unknown has greatly inhibited the promotion and use of solar energy.
- End users perceive solar as "technology under development," with little direct application to their needs.
- Credibility problems arise due to dissemination of inaccurate information by a variety of organizations with a presumption of credibility.
- Delivery of solar water and pool heaters through traditional means, as compared to other household appliances, has not developed.
- There is a lack of residential market penetration.
- There is a lack of non-residential market penetration.

Barrier 3: Current institutional frameworks and resulting built-in inertia act to inhibit and preclude the use of solar energy.

Consequences:

- There is an inherent bias against solar in the legal and regulatory infrastructure.
- There is a lack of building code uniformity among the various code and enforcement entities.
- There is a lack of promotion of solar applications by the architectural, engineering and building construction industry.
- There is a lack of utility industry support for solar water and pool heating systems because of significant lost revenue to electric utilities.
- There is a lack of consistent and continuing government sector use of solar energy.
- Agency implementation of legislation has been ineffective in promoting the use of solar energy as intended.

II. Actions

A series of actions, stated as objectives, have been identified which can serve to overcome the barriers identified in this study. Some are more feasible than others. Some will require a commitment of public or private resources. Others will just require commitment. The actions have not been screened in any manner.

Objective 1: Make solar systems cost competitive with conventional water and pool heating systems.

- A. Develop financing programs with the objective of setting monthly payments which are less than or equal to monthly savings.

- Create state-assisted solar bank for use by the public and private sector.
- Create private or utility-sponsored loan programs through statewide lending organizations or other appropriate organizations.
- Encourage financial institutions to recognize the benefits of solar energy in loan programs.

B. Increase the cost of conventional water and pool heaters.

- Tax conventional electric and gas appliances that do not use solar energy as a primary source.
- Establish electric rates which impose a surcharge for electrical resistance as the primary source for water heating.
- Develop a permit fee structure for all water and pool heating appliances which declines as energy efficiency increases.

C. Provide tax incentives.

- Reenact the state sales tax exemption.
- Reenact the local property tax exemption.
- Enact corporate tax credits for businesses that provide or use solar energy equipment.

D. Provide financial incentives

- Solve the lost revenue problem for utilities in order that they could offer financial incentives for solar energy purchases by their customers.
- Develop grant programs for government, business and industry to help defray the cost of solar energy investments.

Objective 2: Increase awareness and acceptance of solar applications.

A. Provide market development assistance.

- Develop databases and information services on solar technologies.
- Identify appropriate solar technologies for each market segment (i.e., export market, government sector, residential, commercial, industrial, utility, agricultural, etc.).
- Develop and implement a demonstration program for each market segment.
- Develop and disseminate informational and promotional material for each market segment.
- Develop formal and informal educational programs for the general public, the government sector, public and private educational institutions, and the business/industrial sector.

B. Establish and implement initiatives for the sectors which influence the use of solar energy applications.

- Develop solar programs for the government sector, including public buildings, subsidized housing and tax-supported institutional facilities.
- Require the use of solar on all state facilities, low-income housing units and tax-supported institutional facilities.
- Require disclosure of building energy-efficiency ratings on all residential and commercial buildings.
- Require disclosure of pool heating energy-efficiency ratings for all pool heating equipment.

Objective 3: Achieve uniformity in building codes and permitting requirements for water and pool heating appliances.

A. Develop and implement consistent statewide provisions for solar energy in building codes

- Establish a task force to develop a standard state solar code which preempts local regulation.
- Develop provisions within existing building and development regulations which act as incentives for builders, planners and developers to incorporate solar in new construction. For example, in the Florida Energy Efficiency Code for Building Construction, make solar water heating systems the baseline hot water system to which the energy consumption of all other water heaters must be compared.
- Maintain standards for all market-ready solar applications.
- Require the use of solar energy as a primary source of pool heating.
- Provide regular training for building officials.

B. Standardize energy ratings for all water and pool heating appliances.

- Establish and publish standards and energy-efficiency ratings for all water and pool heating appliances.
- Require disclosure of uniform energy ratings to consumers.

Objective 4: Increase the potential for solar energy utilization in the electric utility sector.

A. Establish by PSC rule (under Florida Energy Efficiency and Conservation Act) an effective strategy for utilities to promote solar.

- Establish incentives and remove disincentives for utility use of solar thermal as a supply and demand-side option by making

utility investments in solar at least as profitable as investments in other energy resources; establishing set-asides for utility investment in solar; instituting "green pricing" programs for customers willing to invest in solar energy; and/or instituting a surcharge on electrical resistance water and electric pool heating appliances.

- Quantify the external costs and benefits of energy generation, transmission and distribution, and require that they be factored into integrated resource planning.
- Establish numeric goals for utility use of solar.
- Identify appropriate methods of utility promotion and utilization of solar.

Objective 5: Develop a funding mechanism to support long-term growth and development of solar energy in Florida.

A. Develop a plan, with participation of all interested parties, for assuring the best use of remaining oil overcharge funds.

B. Develop a new source of funding to support a Solar Energy Trust Fund.

- Impose a surcharge on the gross receipts tax on sales of electricity and gas by public utilities.
- Levy a tax or surcharge on electric and gas appliances based upon energy efficiency.
- Establish environmental impact fees on conventional energy appliances.
- Other appropriate means.

PHOTOVOLTAIC INDUSTRY

I. Barriers

The primary issue, or problem statement, used to focus discussion of the barriers to greater use of photovoltaics is:

Photovoltaic systems have both near- and long-term application, yet face significant technical, economic and institutional challenges.

The four primary barriers identified are similar to those of solar thermal applications and are as follows:

Barrier 1: Photovoltaic systems have a high initial cost when compared to conventional electrical generating options.

Barrier 2: There is a general lack of awareness of the status and medium- and long-term potential of PV technology, including both technical and economic characteristics.

Barrier 3: Current institutional frameworks act to inhibit and preclude the current and future development of PV applications.

II. Actions

Objectives to overcome the PV barriers are as follows:

Objective 1: Increase the cost effectiveness of PV applications.

- A. Establish a pilot plant for scale-up of PV technologies developed in Florida laboratories and demonstration of feasibility for large-scale manufacturing facility.
- B. Develop PV applications and/or technology developments that have the potential to lower costs or increase effectiveness.
- C. Provide legislative incentives to establish a PV manufacturing facility in Florida.
- D. Support "green-pricing" initiatives under the sponsorship of Florida's electric utilities.

Objective 2: Increase awareness and acceptance of PV applications.

- A. Demonstrate utility scale technologies that are optimally designed with streamlined and standardized installation procedures.
- B. Disseminate results from PV installations and establish a Florida interface with national groups working toward PV goals.
- C. Identify, develop, demonstrate and test high-value PV applications in utility industrial, commercial, transportation, and residential sectors.
- D. Identify niche markets for PV products.
- E. Develop a PV database and clearinghouse on manufacturers, dealers, installers, individuals and agencies interested in PV as commercial products.
- F. Establish an export program for PV products in the Latin American and Caribbean region.

Objective 3: Provide education and training opportunities on PV performance, operation and maintenance.

- A. Continue and/or increase the general knowledge of architects, engineers, designers and contractors to assure proper design, installation, operation and maintenance of PV systems.
- B. Develop a state policy which encourages the demonstration and use of cost-effective PV applications.

Objective 4: Establish a uniform code for PV applications.

- A. Develop standards for PV systems in use in Florida.
- B. Establish a pre-emptive state-wide code for PV installations.
- C. Provide training opportunities for building officials.

SPECIFIC ACTIONS

This section takes the previous input and separates the actions by organizational framework -- legislative and agencies.

I. Legislative

A. Finance and Tax

- Tax conventional electric and gas appliances that do not use solar energy as a primary source.
- Reenact the state sales tax exemption.
- Reenact the local property tax exemption.
- Enact corporate tax credits for businesses that provide or use solar energy equipment.
- Establish a Solar Energy Development Trust Fund to be funded by (i) a tax or surcharge on electric and gas appliances based upon energy efficiency; (ii) an environmental impact fee on conventional energy appliances; (iii) a surcharge on the gross receipts tax on sales of electricity and gas by public utilities; and/or (iv) any other appropriate means.
- Provide legislative incentives to establish a PV manufacturing facility in Florida.

B. Utility Regulation

- Authorize electric rates which impose a surcharge for electrical resistance as the primary source of water heating.
- Establish numeric goals for increased use of solar technologies.

- Authorize the use of incentives for utility use of solar thermal as a supply and demand-side option.
- Require quantification of the external costs and benefits of energy generation, transmission and distribution, and require that they be factors in integrated resource planning.
- Encourage utilities and utility regulators to develop consistent and long-term policies on acquisition and promotion of PV systems.
- Develop a state policy which encourages the demonstration and use of cost-effective PV applications.

C. Government Operations

- Require the use of solar on all state facilities, subsidized housing units and tax-supported institutional facilities.

D. Planning and Development/Community Affairs

- Require disclosure of building energy-efficiency ratings prior to the sale of all residential and commercial buildings.
- Require that building and development regulations provide incentives for builders, planners and developers to incorporate solar in new construction.
- Require the use of solar energy as a primary source of pool heating.
- Require standards and energy-efficiency ratings for all water and pool heating appliances, with disclosure of energy ratings to consumers.
- Authorize a permit fee structure for all water and pool heating appliances which declines as energy efficiency increases.

II. Department of Community Affairs

- Continue solar installation and evaluation projects in SWAP and other low-income housing programs which have the stated goal of using low-cost solar systems. Disseminate the results from these programs to show the potential of smaller and lower-cost systems.
- Continue support of the Solar Information Program.
- Develop a comprehensive database, clearinghouse and information service for residential, commercial and industrial solar water, pool heating and PV applications. Database to include information on equipment, certification, performance, installation, manufacturers, dealers and installers, as well as key contacts in the public and private sector. Include opportunities in the Caribbean and Latin America to enhance the export potential of Florida solar products.
- For utility company acceptance, conduct statistically significant performance evaluation of SWH in order to provide confidence in SWH time-of-day performance as applied to utility demand. A part of this effort would be to establish reliability, operation and maintenance data for SWH.
- Require use of solar water heating through building energy ratings and energy-efficiency mortgage programs. Efforts would involve coordination

with national HERS efforts and development of uniform rating methodologies for all types of water heaters.

- Provide support for Department of Commerce initiatives, including a program to encourage a photovoltaic manufacturer to locate in Florida, an inventory of in-state and export markets, and identification of appropriate technologies for each market.
- Require disclosure of building energy-efficiency ratings on all residential and commercial buildings.
- Create state-assisted solar bank for use by the public and private sector or create a private loan program through statewide lending organizations.
- Inventory public assistance housing, subsidized housing and tax-supported institutional facilities for solar applications. Require design review and inspection of systems installed on government facilities. Promote these installations to demonstrate commercial sector potential.
- Develop provisions within existing building and development regulations which act as incentives for builders, planners and developers to incorporate solar in new construction.
- Provide certified training for building officials, building designers and other professionals.
- Establish a task force to develop a state solar code which preempts local regulation.
- Adopt and publish standards and energy-efficiency ratings for all water and pool heating appliances, with a means for disclosure of energy ratings to consumers. A solar simulator would be required to develop these standards and ratings.
- Develop a permit fee structure for all water and pool heating appliances which declines as energy efficiency increases.
- Provide funds for establishing a pilot plant for scale-up of PV technologies developed at Florida laboratories and for demonstration of feasibility for large-scale PV manufacturing.
- Establish a pre-emptive statewide code for PV installations.
- Identify and promote demonstration of niche or high-value PV applications.
- Develop PV applications and/or technology developments that have the potential to lower costs or increase effectiveness.
- Demonstrate utility scale technologies that are optimally designed with streamlined and standardized installation procedures.
- Develop a plan, with participation of all interested parties, for assuring the best use of remaining oil overcharge funds.

III. Public Service Commission

- Create effective utility loan programs for solar thermal applications.
- Establish electric rates which impose a surcharge for electrical resistance as the primary source of water heating.
- Solve the lost revenue problem for utilities in order that they could offer financial incentives for solar energy purchases by their customers.
- Establish numeric goals for utility promotion of solar.

- Make utility investments in solar at least as profitable as investments in other energy resources (through decoupling and other methods).
- Establish set-asides for utility investment in solar.
- Institute "green pricing" programs.
- Institute a surcharge on electric water and pool heating appliances.
- Explore the technical potential of solar thermal as a supply and demand-side measure. This measure requires the conducting of a statistically significant performance evaluation of SWH in order to provide confidence in SWH time-of-day performance as applied to utility demand.
- Quantify the external costs and benefits of energy generation, transmission and distribution, and require that they be factored into integrated resource planning.
- Establish numeric goals for utility use of solar.
- Identify appropriate methods of utility promotion and utilization of solar.
- Encourage collaboration of utilities and the solar industry.

IV. Florida Solar Energy Center

- Evaluate existing standards and testing regulations for simplification and better understanding by government and public sectors.
- Maintain standards for all market-ready solar applications.
- Develop standards for PV systems in use in Florida.
- Develop a best-practice solar hot water system for each climate region for commercial applications.
- Disseminate results from PV installations and establish a Florida interface with national groups working toward PV goals.

V. Department of Commerce

- Conduct programs to encourage a PV manufacturer to locate in Florida.
- Identify appropriate export markets for solar technologies.
- Develop and disseminate informational and promotional material for export markets.
- Establish an export program for solar water heating, pool heating and PV products.

MARKET POTENTIAL

I. Solar Water Heating

Building permit data from the University of Florida [Reference 3] for residential construction show that there were 83,747 single-family units and 18,317 multi-family units constructed in Florida during 1992. These units represent an estimated annual residential construction value of \$8.96 billion [Reference 4]. Housing data from the 1993 Florida Statistical Abstract [Reference 5] show a cumulative Florida housing stock total of 2,368,437 single-family units, 383,609 multi-family units and 475,618 mobile homes.

The annual installation of solar water heating systems is currently estimated at 15,000 per year, and the total number of installed solar heating systems in Florida is estimated to be 375,000 [Reference 6]. With 3.2 million existing residential units available and 102,000 new units being built each year, a large potential market exists for residential solar water heating.

The market for solar water heating in the new home sector is reported to be almost untouched. According to a recent survey [Reference 7], 25% of homebuyers want solar, but only 2% of builders offer it.

Another opportunity for solar water heating applications is in low-income housing assistance programs. Data from Reference 4 show that in 1992, the State of Florida received \$376 million from the federal government for public housing, agency housing projects and college housing.

Florida's non-residential and state government sectors also represent significant markets. The State's 1992 non-residential construction value total was \$4.67 billion, disaggregated as industry facilities at \$144 million, offices at \$287 million and commercial structures at \$790 million [Reference 4]. As examples of State agency values, the Department of Education fiscal year 1993-94 construction budget is \$863 million, and the Department of Corrections' construction budget is \$125 million. Current use of solar in the public and commercial/industrial sectors is so small as to be virtually nonexistent, indicating an as-yet-untapped, huge potential market.

II. Solar Pool Heating

Data from the National Spa and Pool Institute [Reference 8] show that 30,000 in-ground and 6,000 above-ground pools were constructed in Florida in 1991. The same source gives cumulative totals for Florida of 593,000 in-ground and 96,000 above-ground pools. FSEC estimates that 30% of these pools are heated, representing a cumulative total of 207,000 existing heated pools and an additional 10,800 new heated pools each year. The 20,000 solar pool heaters installed each year [Reference 6] are primarily found in the retrofit market, where solar replaces both natural gas and electric heat pumps. The new pool market presents excellent potential, as does increasing the solar share of the retrofit market.

III. Photovoltaics

Florida's power generation by fuel type breaks down to 42% coal, 28% oil, 18% nuclear, and 13% gas. Existing utility generating capacity is 37,000 megawatts [Reference 9], with 500 to 700 megawatts to be added each year over the next five years [Reference 10]. In terms of kWh generation, Florida utility companies produced a total of 140,000 GWh in 1992 [Reference 9]. The addition of 500 megawatts of new power will provide an additional 2.9 billion kWh/year. Thus, the utility market potential for PV is, for all practical purposes, unlimited.

However, there is a perception on the part of regulators that PV is not ready for widespread use on the grid. Reverence 11 reports a survey of 49 utility commissions (including Florida's) to assess obstacles to further use of renewable technologies for power production. The survey results showed that the majority of respondents (64%) believe that cost is the single largest impediment to PV's use as a utility power generation technology. Almost half (42%) also said that PV is still too immature as a technology, again indicating a financial concern about investment security.

Stand-alone (non-utility-connected) PV applications represent the best present PV market. Power for remote communications and transportation applications are two examples. The export market in regions serviced by Florida has excellent potential, as Caribbean and Latin American economies begin to grow.

GOALS

Achievement of increased usage of solar energy technologies will result in increased installation of solar systems. The following section gives goals by which success of the barriers and objectives can be measured.

- Increase use of solar water heating on new homes to an annual installation rate of 15,000 by the year 2000. (This represents 10% of the new home-market.)
- Increase the use of solar water heating in existing homes to an annual installation rate of 80,000 by the year 2000. (This represents 2% of Florida's housing stock.)
- Increase the use of solar pool heating to a level of 50,000 residential installations per year by the year 2000. (This represents 20% of the pools heated in Florida.)
- Increase the use of solar water and pool heating applications to an annual rate of 2,000 in the commercial, industrial sector by the year 2000. (This represents 2% of the annual construction value in this sector.)
- Increase the use of solar water and pool heating to a level of 500 systems per year in the government sector by the year 2000. (This represents 2.5% of the total value of space owned or leased by the state.)
- Increase the export market for solar energy to an annual rate of 1.5 million square feet of solar water and pool collectors by the year 2000. (This represents 1% of Florida's annual consumption of petroleum imports.)
- Install 20 megawatts of PV generating capacity in Florida by the year 2000.

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