Chapter 6

The 1970s: Living with an Energy Crisis

Historical review of FSEC programs from 1976 through 1979 is best presented from two perspectives – the thoughts of FSEC employees, and a discussion of FSEC research and programs conducted as part of its state activities and as funded by the federal government.

Jerry Lowery, Marvin Yarosh and Howard Harrenstien, during Jimmy Carter's visit to FSEC in 1976

1977 Annual Report Foreword [Reference 13] – Dr. Ross McCluney, Research Associate

FSEC Annual Reports from 1977 on began with a foreword written by a key staff member. The director's message followed. Abbreviated versions of these statements offer insights on the thoughts of these individuals at the time.

Centuries ago, civilization was easily within its daily budget of energy from the sun. Solar power "fueled" a vast variety of natural processes which provided man with all his needs. The demands of a growing human population coupled with increased societal demands and technological achievements soon exceeded the ability of these solar-driven natural processes to provide all of the energy needed by man. Faced with this problem, mankind turned to abundant and easily obtained fossil fuels to meet a burgeoning demand for supplemental energy. At the time, these fuels seemed to represent an unlimited supply of relatively inexpensive energy.

It is now evident that we cannot continue burning up these valuable fossil resources in clouds of polluting gases. We need the complex molecules contained in coal, petroleum and natural gas for other, more durable uses such as in plastics, paints, chemicals, lubricants and clothing. It would take prodigious amounts of energy to synthesize these complex molecules artificially.

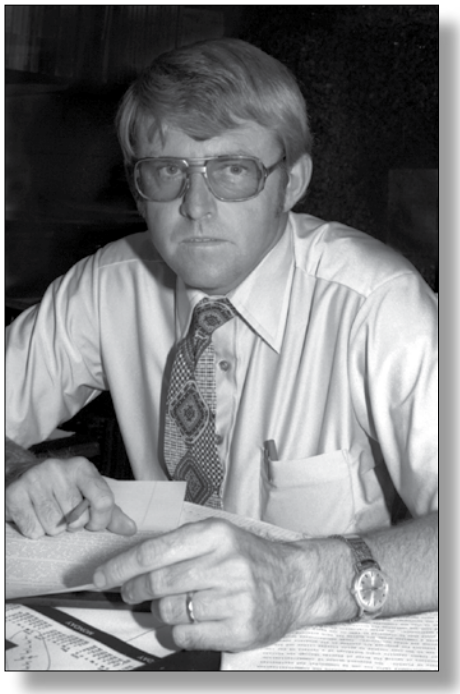
Ross McCluney (April 1978)

A considerable amount of creative work will be required to realize the great promise of essentially endless energy that the sun provides. The sun is ultimately the source of all life on earth -- we must reassert that fundamental fact and take advantage of the innovations that inevitably result when active groups of talented engineers and scientists work together toward exciting and challenging goals.

1977 Director's Report – Dr. David Block, Director

The impact of today's energy problems has no exceptions. Every person, institution, and industry has felt the effects of dwindling non-renewable fossil fuel sources and soaring consumption. Energy is and will be the most significant technological, social, political, and economic issue ever faced by the world.

Florida's energy problem is of greater concern than that of most states due to its overwhelming dependence upon fossil fuels. Today, Florida obtains 90 percent of its energy from oil and gas and produces only 15 percent of its own energy needs. This dependence upon external energy sources dictates that Florida seek rapid development of and conversion to alternative energy sources.



David Block (April 1978)

1978 Annual Report Foreword [Reference 14] – Dr. Subrato Chandra, Senior Systems Analyst

Subrato Chandra (April 1978)

The solar age finally dawned upon America on "Sun Day," May 3, 1978, as millions of citizens, young and old, from Maine to Hawaii, joined in a celebration of the sun. It was a great day for solar energy. These activities won national media coverage as President Carter announced the domestic policy review and a $100 million boost in the federal solar budget. Then in October, after 18 months of protracted action, Congress finally passed an energy bill providing tax credits of up to $2,200 on solar purchases.

Meanwhile, state legislatures were taking strong pro-solar actions: California approved a solar credit of 55 percent on its state income tax, and Florida led the nation in number of solar laws enacted. We at FSEC are proud and honored to be a part of the solar movement and will continue working to put solar collectors on the roofs of all Florida homes.

Phil Goree, David Block, UCF President Trevor Colbourn (September 1979)

UCF President Trevor Colbourn, David Block and BOR member Betty Ann Staton in Solar Water Heating Lab (September 1979)

1978 Director's Report
– Dr. David Block, Director

Since the early 1920s, the United States has supplied subsidies to encourage the use of oil, natural gas, coal, and nuclear energies in the amount of some $140 billion. Of that figure, oil has received $80 billion, most of it in the last five years. On the other hand, federal subsidies through 1978 to stimulate use of solar energy amounted to less than a billion dollars with 90 percent of that help occurring in the last three years.

There is agreement within the solar energy field that if solar had enjoyed support equal to even the least-helped of the above energies, it would be in wide use today. Solar still competes today largely on its own, with nowhere near the benefits directed to traditional forms of energy – an unfortunate disparity for a nation ridden by energy anxieties.

Solar energy can and must play a lead role in solving our energy problem. It offers a uniquely attractive solution because it is clean, it is renewable, its supply cannot be affected by foreign nations, and it is free. This nation must significantly utilize its solar resource, and in time solar must become our number one energy priority. The federal government must provide leadership at the national level.

1979 Annual Report Foreword [Reference 15] – Dr. Omar G. Hancock, Research Engineer

World gas and oil reserves continue to decline, and suitable alternative energy sources have not yet become available. I am pleased that Americans everywhere are really conserving energy, but that is not enough. Not only may we eventually exhaust these reserves, but also recent experiences with foreign sources of oil certainly have shown that the United States must become energy-independent of other nations, not relying on friend or foe for this precious commodity.

There are many ways of using solar energy that we know work and some ways that we think will work. Much remains to be done to prove these concepts and to reduce the cost of solar systems to an affordable level. I am confident that the American ingenuity and winning spirit that have characterized our past successes will lead us to victory on the energy front. Let's get on with the task.

Solar air conditioning dedication – – Omar Hancock, project engineer (June 1979)

1979 Director's Report – Dr. David Block, Director

President Carter, in his June 20, 1979, address to the nation, set a goal of achieving 20 percent of the nation's energy by solar by the year 2000. That goal means that the United States must produce by solar 19 of the 95 quads of energy it is projected the nation will need by the year 2000. It is estimated this goal would require:

- *Solar installation on one of every two residential and commercial buildings*
- *Solar industrial process heat application in one of every seven factories*
- *Solar generation of 20 percent of the nation's electricity*
- *Successful deployment of most solar technologies presently in the research and early development stages*
- *Capital investment equal to approximately one-third of the nation's total for the next 20 years.*

The solution to the energy problem will be reached only by all of us working together.

These messages set the tone for the policy and programs of the '70s. The irony of these comments is that little has changed, except for the dates at the end of each of them.

FSEC Programs of the 1970s

Both federal and state actions directly influenced FSEC programs in the '70s. Federal direction came through research supported by the U.S. Energy Research and Development Administration (ERDA). State direction came through efforts to increase the use of solar energy in Florida. FSEC developed technology programs based on these two influences.

Visit of Bob Mann (Chairman, Florida Public Service Commission), with David Block (October 1979)

Solar water heating was strongly supported in both the federal and state realms. So, FSEC's main program efforts in the early days were in solar water heating and the state-mandated solar testing and certification program.

Solar Water Heating Technology Activities

Solar water heating has had a long history in Florida. Until approximately 1950, electricity was an expensive commodity in the state. This made solar water heating popular, particularly in the burgeoning Miami area. According to Florida Power & Light Company studies in the '70s, the number of operating residential solar water heating systems in the state peaked at between 30,000 and 60,000 units around 1950. With the decline of electricity prices, installation of new solar systems in Florida had almost ceased after 1950. The number of functional systems then declined, year by year, over the next two decades, as residences were remodeled, and solar water heating systems were replaced by electric water heaters.

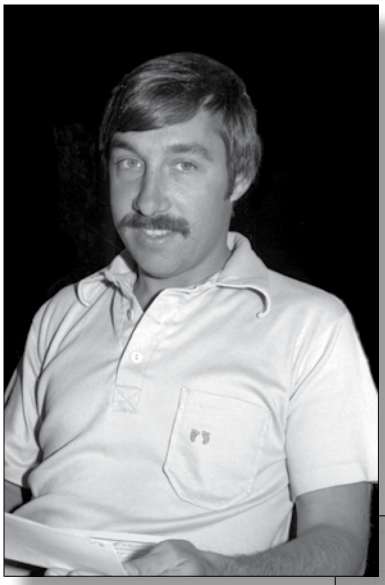
FSEC's most significant effort during the '70s was the Solar Water Heating Initiative sponsored by the U.S. Department of Housing and Urban Development (HUD). It was the state's largest federally funded solar effort, and it initiated both FSEC's solar hot water program and the nation's and state's solar industry.

The HUD program involved disbursement of 1,650 grants of $400 each to single-family homeowners and builders. The grants were used to purchase and install solar domestic water heating systems. The program began on April 28, 1977, with a $735,000 award from HUD to FSEC. Of that amount, FSEC would administer distribution of $660,000 to homeowners through individual grants of $400.

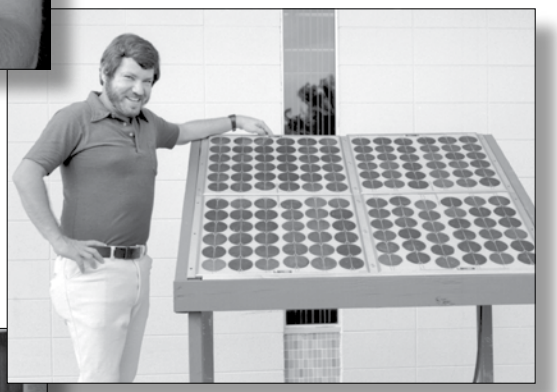
FSEC staff members who developed the procedures and operated the program were Dr. Ross McCluney, Mr. Tom Hill, Mr. Art Litka, Dr. Stuart Gleman, Mr. Stan Starr and Mr. Tim Merrigan. Of the group, Ross McCluney is the only one still at FSEC.

Visit of Dr. Marvin (ERDA Solar Head): Marvin Yarosh, Chuck Beach, Dr. Marvin, DOE representative, and David Block (September 1977)

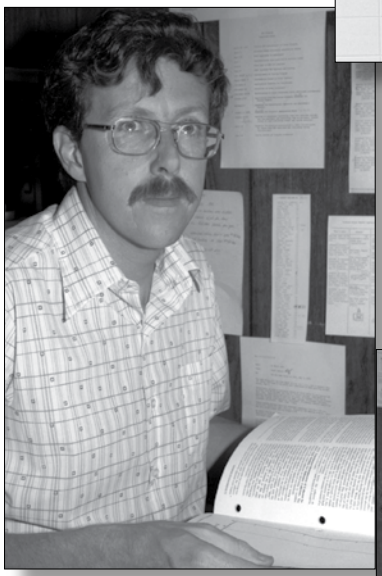
David Block and Joan Morin (September 1979)



Tom Hill (April 1978)



Art Litka (September 1979)



Stuart Gleman (April 1978)

Stan Starr (April 1978)

The goals of the HUD program were to encourage the solar industry to increase its capabilities in manufacturing, distribution, installation and service, and to stimulate public awareness of commercially available solar energy systems for new and retrofit residential applications. Growth of the solar industry was an additional benefit.

Another program goal was to demonstrate the use and feasibility of solar water heating throughout Florida. Grants were allocated to Florida districts based on population to ensure uniform geographic distribution. In addition, the program offered unique opportunities for education of homeowners, building inspectors, community action personnel, and lending and insurance institutions on use of solar equipment that met HUD standards.

FSEC received a second award of $212,000 from HUD in September 1979, again to fund grants to homeowners for the purchase of solar equipment. The second award resulted in 500 grants of $400 each. The HUD project was completed when all the grants were finally awarded.

The HUD program required that the solar collectors for each solar system be certified before grants would be made. This requirement initially strained FSEC's testing and certification abilities. The testing group had to rapidly develop the collector testing and certification program. In retrospect, the HUD program was key to creating a new solar industry and was one of the most successful government solar programs. [Reference 16]

Testing and Certification Program

Florida Statute 377.705, which created the solar equipment standards and testing program, made testing the on-site technical effort of the time. By January 1977, staff had constructed test stands and completed the first 10 tests to determine solar collector efficiency. They also developed a program to identify problems associated with collector performance and reliability. By the beginning of 1978, more than 40 collectors had been submitted by manufacturers and were scheduled for testing.

Enactment of the 30 percent federal tax credit in 1977 also spurred solar collector testing and certification efforts. This tax credit, which remained in effect until January 1, 1986, had the effect of building the early industry.

But the timing of both the grant program and initiation of the tax credit strained the industry's capabilities. The programs were announced six to nine months before they could be implemented, resulting in a gap between manufacturing and sales that created monetary problems for the solar industry.

Through the HUD program and solar tax credits, solar collector certification became very important to the national and state solar industry. By 1978, more than 80 solar collector models had been certified as meeting the standards established by FSEC. That number grew to more than 150 by the end of 1979.

These certifications provided assurance about product performance and durability to both consumers and manufacturers. Approximately 10 percent of the units tested failed to meet the standards criteria and were not certified. Other states recognized and accepted FSEC's test program, which was an important consideration to national manufacturers located in Florida.

Collector Test Area

In FSEC's testing facility, six automatic tracking stands could test an array of solar collectors simultaneously. It also included a test facility for swimming pool collectors, a test facility for solar water heating systems and a complete weather station.

Jim Huggins at test site (October 1978)

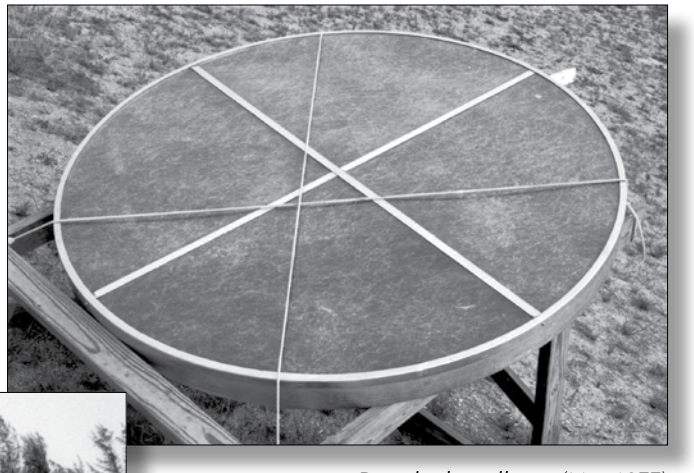
Collector test area showing instrumentation

FSEC collector testing area

The importance of the testing and standards functions led to an administrative change in1979. Testing was separated from the RD&D Division and moved into the newly formed Testing and Laboratories (T&L) Division. The Testing and Laboratories Division was also given the responsibility of providing shop and computer support to all other FSEC divisions, and all technicians were assigned to T&L Division Director, James Roland.

In November 1982, the division name was changed to the Testing and Operations Division. Roland, one of the seven original staff members in 1975, continuously held the division director position until his retirement on June 30, 2003.

Collector testing and other R&D efforts spurred the development of one of the T&O Division's (and FSEC's) most important future capabilities – its computer system capability. A PDP 11-34 mini-computer was the early computer used for in-house solar system testing and data analysis. Its original configuration allowed only one user at a time and provided limited memory space. It quickly became apparent that the computer requirements of new research projects and additional testing activities would surpass the capabilities of this machine.



Round solar collector (May 1977)

Owens-Corning evacuated tube collector test (April 1978)

In the mid-'80s, FSEC purchased the very popular VAX 11-750 mini-computer to run a VMS operating system. The VAX had 2 MB RAM and a disk drive with 456 MB storage, and it allowed multi-user access to the system through terminals – a remarkable feat in the mid-'80s. Multiple researchers at FSEC could now use simulation software developed by others and could engage in the development of FSEC simulation software. Major software development was conducted in two areas – data acquisition and analysis of the thermal behavior of buildings in Florida's hot, humid environment.

Other Federal Solar Hot Water Projects

The HUD grants program, plus Florida's solar equipment testing and certification requirements, led to additional federally funded efforts. One was the Evaluation of Intermediate Standards for Solar DHW Systems used in the HUD Initiative. The National Bureau of Standards (NBS) was responsible for developing the standards used for the HUD initiative. These standards covered the design and installation of solar water heating components and systems. States participating in the initiative used these as the basis for evaluating systems acceptable for use in the program. Because of its experience with the standards and their use during the HUD program, the Center was asked to evaluate the NBS standards, which included coordination with the manufacturers whose systems had to comply with the standards. [Reference 17]

NBS also funded the Experimental and Analytical Performance Predictions of Solar Domestic Water Heating Systems to evaluate the actual performance of solar hot water systems installed through the HUD initiative. Through this project, FSEC monitored the performance of 30 solar water heaters in the homes of Brevard County grant recipients. In its first-ever monitoring project, FSEC installed kilowatt-hour meters and accumulated data from water flow meters in the 30 homes to perform the evaluation. Over the years, performance evaluation of field systems has become an FSEC trademark and one of the Center's strongest assets. This project was also important to FSEC in that it was partially funded by Florida Power & Light Company, making it the Center's first utility company sponsored effort.

Computer room (1981)

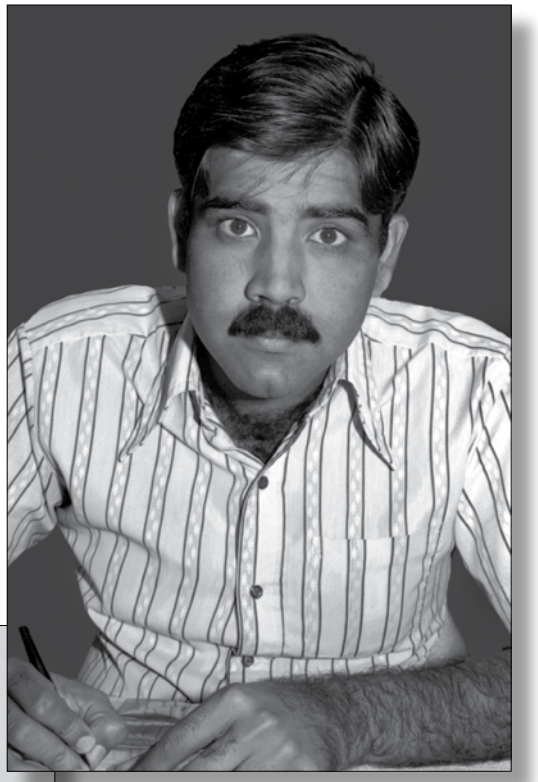
NBS next funded a $149,000 project called the Solar Collector Reliability Test Program. Beginning in August 1978, FSEC conducted an extensive series of solar water heating tests using four sets of eight different collectors (32 in all). All the collectors were tested several times over a two-year period to determine stability of thermal performance after varying periods of exposure.

The tests employed four different exposure methods. One series of collectors were exposure-tested dry; a second series wet; the third with continuous fluid flow; and the fourth with additional solar radiation through the use of reflector panels. The results were then used to set the national standards for collector testing and reliability. [Reference 18]

FSEC's experience and abilities in collector testing next led to a project in the late '70s in which FSEC performed solar system tests in its auditorium. The Tennessee Valley Authority funded the project, and Stuart Gleman was principal investigator for these system tests. The project tested whole solar systems, including the collectors, in an indoor environment. Conducting the tests in a controlled environment allowed for measurement of total heat loss from the systems. [Reference 19]

Bird's nest in collector test stands (June 1979)

The solar water heating and HUD programs led to an early Federal Energy Agency (FEA) project — Development of Solar Energy Consumer Protection Systems. FEA funded the $124,362 project on September 10, 1977. The principal investigators were Marvin Yarosh and Rajesh Talwar, with significant support provided by Colleen Kettles and Art Litka.



Raj Talwar, Consumer Protection Project (April 1978)

Colleen Kettles, Consumer Protection Project (January 1979)

The study considered potential consumer issues that could arise with increasing use of solar energy. It examined the solar energy market and industry, and used contact groups to make recommendations. The recommendations attempted to address consumer issues through existing institutional mechanisms and resources wherever possible. The Department of Energy (DOE) continued this project through 1979.

The consumer protection project was FSEC's initial entry into the area of policy and regulations. It led to the addition of many FSEC staff members. [Reference 20]

FSEC's experience in developing collector standards and evaluating systems for the HUD Residential Solar Water Heating Initiative also led to the investigation and development of a Model Solar Building Code. This project determined the criteria to be used by building officials for issuing permits for solar water heater installations and for inspecting the installations. The results helped in establishing a national building code.

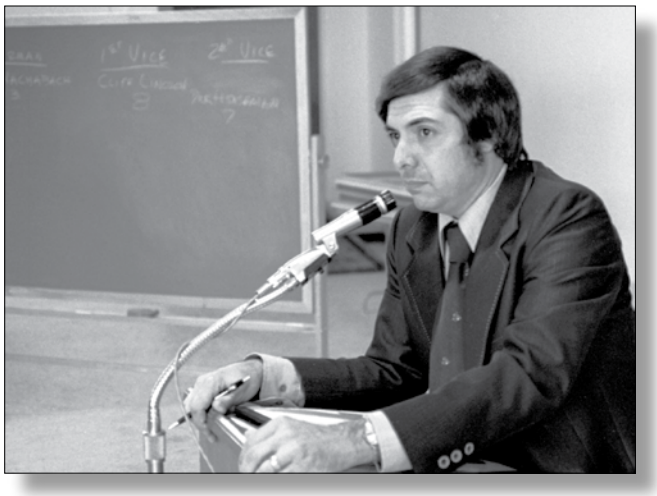
During this time frame, FSEC began an important national effort to create the Solar Public Interest Coordination Committee, which led to the development of the Interstate Solar Coordination Council. Recognizing that a variety of state and industry standards were being developed, DOE project manager David Pellish selected FSEC to develop the national committee as a forum for discussion and orderly implementation of state certification activities and programs. The committee's initial objectives were to establish a mechanism for voluntary exchange of information, coordinate solar testing and certification programs, and develop reciprocity agreements. Initial efforts focused on testing, standards and certification of solar collectors and systems. In 1979, the project was funded at $61,200.

Art Litka at Consumer Protection Study site visit (May 1979)

Educational Activities

In 1976, ERDA provided $39,210 for FSEC to conduct the Flat-plate Solar Collector Conference and Workshop as a forum for presentations and discussions on new concepts in the technology. Held in Orlando, Florida, from February 28 to March 2, 1977, the conference drew 425 participants. This project was the second federally funded project that FSEC coordinated. This first-ever national workshop resulted in publication of technical proceedings that included invited presentations as well as workshop reports summarizing the state-of-solar-collector technology in topical categories. [Reference 21]

Stan Starr, Rodney Boyd at DWH Workshop (September 1978)



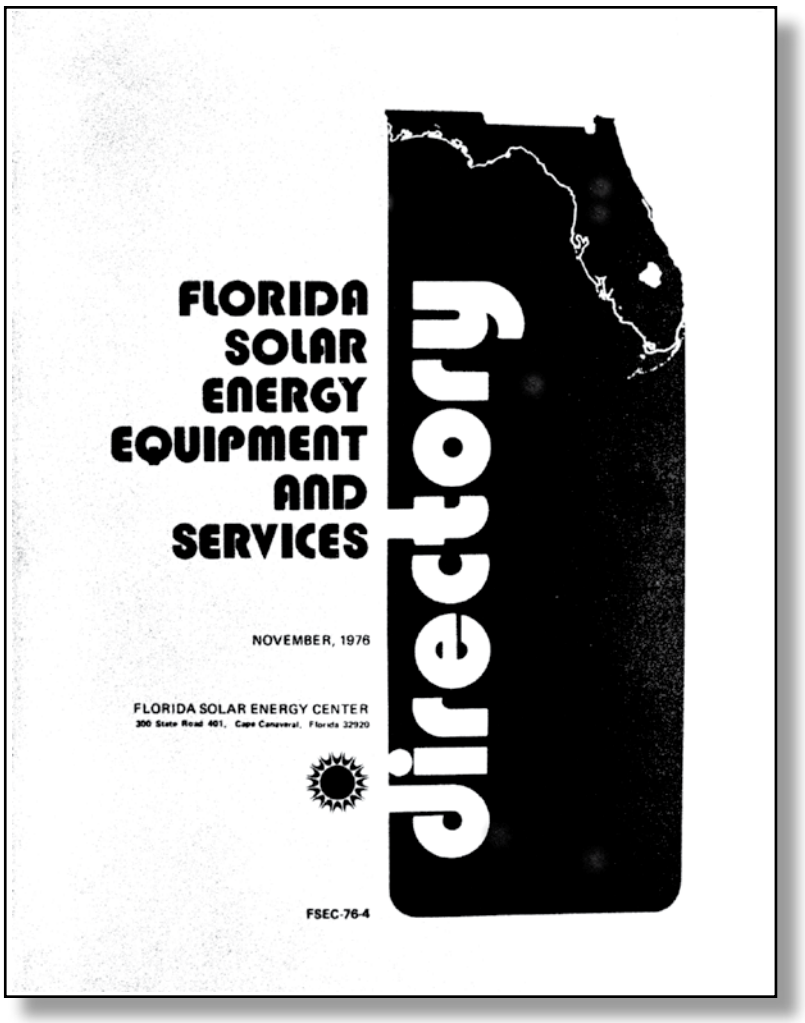
Ron Yachabach, workshop presentation (March 1977)

The Solar Energy Task Inventory for Florida was another of FSEC's initial educational efforts. Funded by the Florida Department of Education's Division of Vocational Education, FSEC inventoried the skills and knowledge required by engineers, technicians and mechanics in the field of solar energy. The inventory gave direction to solar educational programs, especially in vocational training.

Using a questionnaire they devised, FSEC staff collected information from the industry on competency levels needed to design, size, analyze, install, maintain and repair solar thermal systems. Based on the study's results, the Division of Vocational Education in 1980 funded a short course for 20 to 30 selected vocational-technical faculty members to expand solar training capabilities within the state. [Reference 22]

In addition to this externally funded work, FSEC conducted a variety of state-supported solar hot water activities. In one, staff surveyed and published a 100-page directory of the 77 solar energy equipment and service companies operating at the time in Florida. Another resulted in publication of a solar water heating guide entitled "System Sizing and Economics of Solar Water Heating in Florida Residences." These two documents helped initiate FSEC's continuing role as a publisher of industry and technical information.

In 1976, the Center was instrumental in the formation of the Florida Solar Energy Industry Association (FlaSEIA). FSEC supported FlaSEIA's introduction of 17 solar-related bills during the1977 Legislative session.



Solar Directory Publication (November 1976)

Honeywell Solar air conditioning laboratory display (January 1977)

SunDay - Solar water heating demo by Art Litka (April 1979)

SunDay - Jim Gorman back to camera (April 1979)

The period also produced the first of the Center's education workshops. FSEC initiated its long history of professional training in 1976 with a one-day seminar in Tampa for architects, engineers and building owners. In early 1977, the Center hosted a comprehensive, 10-day public information program, display and workshop. Sponsored by ERDA, the display featured a solar air-conditioned trailer (see photo above).

In April 1979, FSEC held its first "SunDay" open house. This became a very successful annual springtime event for the Center while it was headquartered at Cape Canaveral. Hundreds of members of the general public attended the Saturday events to learn about solar technologies, equipment and concepts.

Solar Heating and Air Conditioning Projects

In addition to supporting solar water heating, ERDA provided significant support for research on solar heating and air conditioning of buildings. Review of the early federal solar budgets shows that solar buildings (heating and air conditioning) received more dollars than photovoltaics. Solar building R&D is now one of the lowest funded federal activities.

For obvious reasons, ERDA selected Florida as a location for an initial demonstration of solar air conditioning technologies. On March 15, 1976, FSEC received its first externally funded contract for the Solar Energy Space Heating and Cooling Demonstration at the Interstate 95 Welcome Station. Omar Hancock was the engineer and principal investigator for the $280,000 project.

Marvin Yarosh, David Block and Jim Roland at burial of time capsule during SunDay event in May 1984.

I-95 Welcome Station, 1978

I-95 Welcome Station Solar Air Conditioning Project, under construction (1978)

The project's objective was to use a solar energy system to heat and cool the Florida Welcome Station adjacent to Interstate Highway 95 north of Jacksonville. The Welcome Station that opened in December 1975 was an ideal choice for a "sun power" demonstration given its exposure to approximately one-half million visitors annually.

Key system components of the air conditioning demonstration were an Arkla WF-300 water chiller, a field of Northrup concentrating collectors, two 6,000-gallon hot-water storage tanks, and a cooling tower to provide condensing water. The system was designed to provide sufficient thermal energy to meet approximately 88 percent of the annual cooling load and 99 percent of the annual heating load. In 1977, an interpretive center was added to the Welcome Station to provide visitors with information on the demonstration. The demonstration never proved to be a success, partly because of its complexity and partly because skilled technicians were not provided to support and maintain it. [Reference 23]

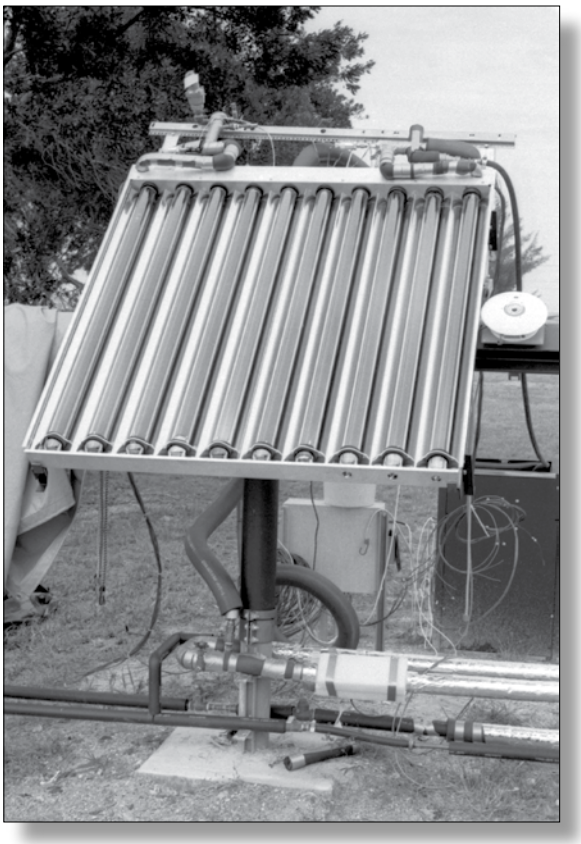
Winter Springs was the site of Florida's second solar heating and cooling demonstration. HUD funded the project through Florida Gas Company, which subcontracted FSEC for $7,129 of the work. Omar Hancock was again the principal investigator.

Florida Gas Company's subsidiary, Florida Land Company, constructed the demonstration home in the Highlands complex north of Orlando. It featured solar space heating, air conditioning and water heating. The system used stainless steel solar collectors and a lithium bromide, absorption-type air conditioning unit developed by Chrysler Corporation. Chrysler furnished the modified-and-tested Arkla Industries three-ton air conditioner because of the company's interest in solar energy research.

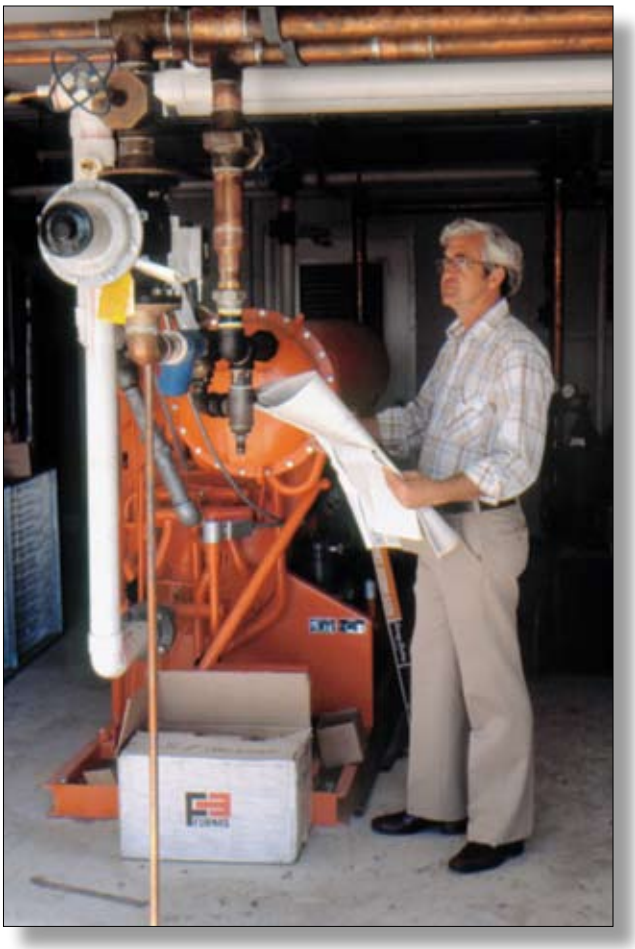
The home was completed in January 1978 and was sold after a brief demonstration period. FSEC was to collect data on the solar system's efficiency, cost savings, operating characteristics, equipment life and maintenance needs for five years. Unfortunately, system problems prevented that data collection, and the project was discontinued after the home was sold. [Reference 24]

The FSEC complex was the site of ERDA's third and most-aggressive solar heating and cooling project. ERDA provided $192,000 for the project on September 20, 1977. Omar Hancock and Charles Beach were principal investigators.

HUD residential solar air-conditioning demonstration project (1977)



Evacuated-tube collector being tested (November 1976)



Solar air conditioning project R&D Building Arkla chiller - Jim Roland (February 1979)

For this demonstration project, FSEC designed a solar heating and cooling system to cool its 4,500-square-foot RD&D office and laboratory building and to provide heat for that building, along with the other three buildings that made up the FSEC complex. The installed system comprised 1,780 square feet of evacuated tube collectors manufactured by General Electric Corporation and an Arkla WFB-300 25-ton absorption chiller. The installation was expected to meet about 70 percent of the building's air conditioning requirements and about 50 percent of the complex's space heating needs. The system incorporated both hot and chilled water storage to provide for maximum solar energy use and high-efficiency operation of the absorption chiller. [Reference 25]

Solar air conditioning project R&D Building - evacuated tube collectors (February 1979)

Solar air conditioning project R&D Building - Omar Hancock (left) explaining to a visitor (February 1979)

David Block, Omi Walden (DOE Assistant Secretary) and State Senator Clark Maxwell cut the ribbon at FSEC air conditioning dedication (June 1979)

State Senator Clark Maxwell, DOE Assistant Secretary Omi Walden, State Senator John Vogt and David Block at FSEC Solar air conditioning dedication (June 1979)

Using evacuated glass tubes in the flat-plate collector configuration provided a unique opportunity to compare this system's performance with that of the somewhat similar focusing-collector system at the Florida I-95 Welcome Station. Completed in April 1979, the FSEC system operated for several years. However, the evacuated tube collectors presented significant problems – at least twice, more than 200 tubes shattered after being cold-started on a hot day. The copper tubes inside the glass tube covers also developed internal corrosion problems, which FSEC investigated for DOE under a separate contract.

Sadly, while solar heating and air conditioning is still one of the nation's major research needs, DOE today supports no activity in this area. Solar cooling was very high on ERDA's research priority list, but DOE most likely dropped it from the national research agenda because the demonstration projects showed poor performance and reliability. Failure of these demonstrations illustrates the need for continuing research and development before demonstrating the technology – then and now.

Roger Messenger and Jerry Ventre at air conditioning dedication (June 1979)

GE evacuated tube collector field for FSEC solar air conditioning project (1979)

Solar Electric Technologies

FSEC made small but important forays into the technology of photovoltaics in the late '70s. The first was the Southeast Regional Assessment Study for Deployment of Solar Electric Generation Options. DOE awarded project funds to Stone and Webster Engineering Corporation of Boston, Massachusetts, on September 20, 1977. Stone and Webster subcontracted FSEC for $80,000 to evaluate the potential for solar electric in the Southeast. Ross McCluney and Marvin Yarosh served as principal investigators.

The project assessed the potential of available solar electric options for generating power in the Southeast. The options were solar thermal electric, ocean thermal energy conversion (OTEC), photovoltaics (PV), biomass conversion and wind power systems. FSEC's region in the nationwide study covered Mississippi, Alabama, Georgia, Florida, North Carolina, South Carolina, Tennessee, Virginia, Maryland, Delaware and Puerto Rico. [Reference 26]

Carolyn Burby at FSEC's first 40-watt PV system, used to power typewriter (October 1978)

FSEC windmill (1979)

PV House

The Center's first major PV project started in 1979 when staff began planning for the PV-Powered Experimental House. This bold move into the PV area is discussed in detail in the next chapter. In December 1979, plans were finalized for construction of a 1,300-square-foot experimental house to be powered by photovoltaic cells. Construction of the three-bedroom, two-bath structure was set for spring of 1980 at the FSEC facility. Scheduled to become fully operational by summer, the building's roof would be equipped with about 560 square feet of PV modules to provide four kilowatts of power.

FSEC purchased the panelized wood-frame house from Nobel Homes Corporation of Orlando and the PV cells from Arco Solar Corporation of California. Long-term experiments on the house were to show what some experts foresaw by the end of the 1980s – a PV-powered house tied into the local electric utility grid with the utility "buying" any surplus power produced. The house would be unoccupied, other than for experimental work, but it would be furnished with conventional household appliances so that the house would impose realistic energy loads on the PV system.

During this time frame, PV had moved to the top of the federal solar energy budget, and DOE programs were aimed at reducing PV costs. DOE said that dramatic cost cuts had been achieved in recent years, but the cells still were prohibitively priced for wide use. In 1979, PV cell costs were in the $7 to $10 per-watt range and, by the mid-1980s, were projected to cost $0.50 to $1 per watt. Today, the price of PV cells is approximately $3.50 to $4 per watt. The $1 per watt number is now a goal for 2010.

PV house site ground breaking – – Leroy Nash, David Block, Subrato Chandra (January 1980)

Buildings Research

FSEC began its buildings research program in 1979 with its first Passive Solar Residential Design Competition. The competition's goal was to stimulate the design of passive solar homes appropriate for Florida's hot, humid climate. More than 70 designers registered for the competition, and a panel of experts judged the 40 designs that were submitted. FSEC published a portfolio of the outstanding designs with descriptions of their specific cooling techniques for Florida homes. Chris Beck led this effort. Chris left FSEC and worked for a utility company for more than 20 years until her untimely death on December 6, 2003. [Reference 27]

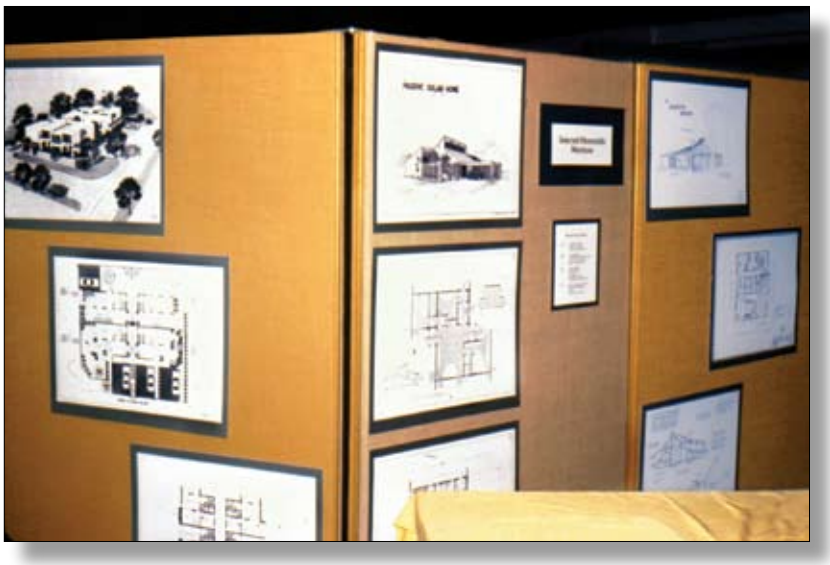
Partially completed FSEC PV house (1980)

University-sponsored Research

From its very beginnings as the brainchild of the Florida Energy Committee, the Solar Center was to support solar energy research at Florida universities. FSEC made its initial $262,712 worth of R&D grants between July 1975 and December 1976. Five grants of $2,400 to $100,000 went to five universities – University of Central Florida (UCF), University of Florida (UF), University of South Florida, University of Miami (UM) and Florida Institute of Technology (FIT). UF's Solar Energy and Energy Conversion Laboratory received the largest grants of $100,000 in 1975 and $80,000 in 1976.

The Center's second series of grants in 1976-77 totaled $120,567. Funds went to UCF, UF, UM, University of West Florida and Chippola Junior College. In addition, UF received $80,000 in 1977. In 1979, three universities received a total of $234,000; $24,000 went to UCF, $60,000 to FIT and $150,000 to UF.

First Passive Design Contest awards - David Block and Chris Beck (center) (November 1979)



First Passive Design Contest (November 1979)

From 1979 forward, FSEC directed its university grants entirely to UF and FIT. In 1979 or 1980, the Florida Legislature determined the amount of funds to be allocated to these universities – $150,000 to UF and $200,000 (includes $120,000 for joint research) to FIT. These funding levels remained relatively constant over the years until the FIT joint research funding was reduced by 50 percent and the total amount of funds was reduced in fiscal year 1991-92 because of UCF budget cuts to FSEC. For 2003-2004, UF received $122,226 and FIT received $106,950 in FSEC funds.

Solar hot water system demonstration project on roof of UCF Engineering Building in 1974-75. This UCF project was under the direction of Dr. Bruce Nimmo, who later became an FSEC employee and Director of the Advanced Technologies Division.

Conclusion

FSEC established its testing, R&D and educational direction and reputation in just five years – from its creation in 1975 to the end of the decade. Notable achievements included:

- *Development of the mandatory solar equipment certification program*
- *Establishment of a Florida solar energy industry and institutional infrastructure*
- *Development of FSEC's solar collector testing capability and certification programs*
- *Initiation of FSEC's educational and publishing activities*
- *Demonstration of the need for further R&D on solar space heating and cooling technologies*
- *Initiation of PV and building energy programs*
- *Stabilization of FSEC's administration and state relations.*

These first productive years set the stage for growth and expansion through the '80s and '90s.