

# State Energy Program Case Studies

## Florida Sunshine — Natural Source for Heating Water



*A municipal utility in central Florida provides its customers with an option of solar domestic hot water. The utility installs and maintains the systems, charging customers only for hot water delivered to the faucet. It is the first utility-run “pay-for-energy” service in the country.*

Once known as the world’s citrus center, Lakeland, Florida, is making a new name for itself as home to solar energy. The city’s municipally owned utility, Lakeland Electric, over the last two years has installed solar water heaters in the homes of around 60 of its solar-savvy customers. The project received financial support from the Florida Energy Office and the U.S. Department of Energy (DOE) and technical assistance from the Florida Solar Energy Center (FSEC) that proved to be pivotal contributions to getting the project going in its early phases.

Lakeland Electric has become the nation’s first utility to offer solar-heated domestic hot water on a “pay-for-energy” basis. Under this arrangement, customers pay for the hot water they use, not the system hardware. The program finances itself on an ongoing basis and, because the utility owns the hardware, takes system maintenance out of the hands of homeowners and places it in the hands of utility professionals.

Lakeland Electric’s Jeff Curry describes the solar program as its green offering. “Unlike the green pricing offerings of other utilities that charge a premium,” he says, “Lakeland Electric’s customers don’t pay an extra dime for their solar-generated domestic hot water.”

### Getting Started

Lakeland Electric first became involved in solar water heating when the Florida Energy Office issued a call through FSEC in 1997 for proposals for utility-sponsored solar programs. State funding originated from Petroleum Violation Escrow or oil-overcharge funds administered by DOE through its State Energy Program (SEP).

Lakeland Electric and FSEC teamed up to install a pilot system to test the concept. A small group of supporters from each organization were able to convince their respective managements to get involved, inaugurate the program, and pass it off to today’s project team. The Florida Energy Office played a key role in getting the project started by funding a staff position in Lakeland Electric Company for the first year. Says Energy Office project leader Jim Tatum, “We don’t normally fund staff positions for other organizations. In this case, however, there was an innovative idea, a good project team, and support from utility customers.” Having the position covered allowed the utility to develop the innovative financing package and with FSEC’s help, design a hardware system to meet requirements.



*Jim Tatum of the Florida Energy Office (left) and Jeff Curry of Lakeland Electric company (right) stand in front of one of the utility’s roof-top solar hot water installations.*

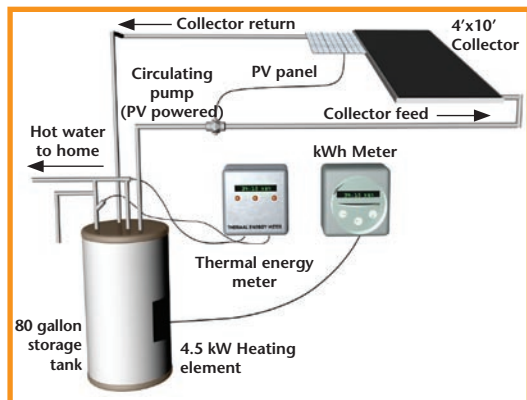
Credit: Carlos Colen, Florida Solar Energy Center



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*To measure energy delivered to the customer for domestic hot water, Lakeland Electric uses two meters. The first measures flow and temperature in the water pipe. The second measures electricity use of the electric heating coil inside the hot water tank.*

Lakeland's first step was to survey its customers to measure potential interest and, with support from DOE's National Renewable Energy Laboratory, develop a business plan for the project to be economically self-sustaining. Customer response to the survey showed support and also identified key concerns with solar hot-water systems—initial cost and maintenance. Based on this feedback, project leaders decided on utility ownership and responsibility for

maintenance of the hardware. In mid-1998, the utility announced its new program to its 90,000 residential customers through a "bill-stuffer." When more than 500 customers responded, the utility had to establish a selection criteria that included roof condition, orientation, and exposure to the sun. Solar exposure was important at first because the utility didn't want to get involved with tree trimming. Says FSEC project manager Carlos Colon, "You know, we Floridians have a love affair with our trees. Even trimming branches from an old tree is an emotional issue for some of us." As a result, the first installations were in a relatively new subdivision where there were no trees to block sunrays from reaching the rooftop solar panels. By September 1999, the utility had installed 29 solar hot water systems and in December began billing customers separately for hot water. The program has remained popular since its beginning. According to Jeff Curry, the waiting list for solar hot water systems is growing today through word-of-mouth and has not required additional promotion by Lakeland Electric.

## System Design

In order to put the new billing procedure into place, the project team had to design a metering scheme and purchase accompanying hardware. This phase of the project was more difficult than anticipated, and it was here that the technical expertise of FSEC proved valuable.

In order to bill separately for hot water, it is necessary to measure hot water usage separately from the primary electricity meter that measures all electricity delivered to the house. The design scheme they settled on uses two additional meters. One measures hot water usage, and the second measures electricity provided by the backup electric heating element inside the domestic hot water heater (see diagram). This standard heating element is rated at 4.5 kilowatts (kW) and kicks in when the household's water needs exceed the output of the solar collector.

The unexpected challenge was getting the right metering equipment. The solar thermal meter that the specifications originally called for became too expensive, even when purchased in bulk. After months of searching, Colon and Curry located a suitable and affordable meter from a Swedish company that quantifies all of the heat delivered to the tank and reports energy usage in kilowatt-hours (kWh) rather than in Btus. The result is the utility has an easy way to bill for hot water and customers have the capability of monitoring their hot water usage by reading the meters themselves.

The utility collected data from 27 customers between September 1999 and August 2001 and established a performance benchmark for what to expect in the future. For the one-year period ending August 2001, the average solar contribution was 5.3 kWh per day.

Today, the project is very close to being economically sustainable, according to Curry. His accounting

shows the program generates a 7% annual rate of return on investment for the utility. He says that meter reading and billing have become routine, and the utility plans to expand the number of households participating using its own financing. "Of course the program has to compete for funding with many other qualified programs," he adds. He believes that by Summer 2002, Lakeland Electric could be in a position to put a new system on-line each month with the revenue generated by existing solar hot water systems.

### The Benefits

The benefits of this solar water heating program reach the customers, the utility, and the environment.

**For homeowners**, this program has the advantage of allowing them to use solar energy with no financial risk. In the past, many homeowners were reluctant to install solar hot water systems because of the high initial cost and concerns about upkeep of equipment they are not familiar with.

Lakeland Electric's program eliminates these worries. The utility monitors and maintains installations, so the homeowner does not wonder if the solar thermal system is performing as specified. Without meters, it is sometimes difficult to tell. The utility detects when a system requires maintenance from monitoring system output on monthly bills and can send staff out to fix problems. Participating customers get a brand new water heater with a larger capacity, which is attractive for some.

Furthermore, they no longer pay for standby losses from the water tank when the system is not in use. These losses typically amount to 15% of the energy consumption of a hot water heater. As a result, participating customers pay less than their neighbors who have electric water heaters.

**For the utility**, this program reduces demand on its generation and transmission system, diversifies its resource base, and represents a

business opportunity by opening doors to new arrangements with its customers.

Reduced demand can be very important during periods of peak demand when the utility's system is straining to deliver maximum power. For example, during a month of scorching Florida heat in the summer of 1998, the residential solar systems decreased the homeowners' requirements for grid-generated electricity for water heating to almost zero between noon

and 9:00 p.m., which is the period of highest demand for electricity on Lakeland's grid. The utility estimates that each solar system reduces demand by 0.2 kW on the summer system peak, and by 0.7 kW on the winter system peak. (Lakeland Electric is a wintertime peaking utility.) Lakeland Electric estimates the value of this demand reduction at \$1.40 per month for each household. Because the solar hot water program provides energy generated at the home itself, the utility benefits by reducing the requirements for transmission, distribution, and service equipment. There are no power losses in transmission lines, which are sometimes calculated at roughly 10% of total generation (on a large system). And by adding solar energy to its mix of energy supply, Lakeland Electric diversifies its supply of resources and reduces its exposure to risk of supply interruption or sudden increase in fuel prices.

Finally, because the utility is supplying a new service to its customers, it benefits from the potential business opportunities from that new relationship. The majority of its customers approve of its "green programs," so the utility also benefits from good public relations.



*After moving aside pool toys, Jeff Curry explains operation of the utility's meters for domestic hot water on the home of Maureen Roe. Ms. Roe was the first customer to receive a solar hot-water installation from the Lakeland Electric Company.*

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**For the environment**, solar systems reduce generation of electricity in power plants fired by fossil fuels and its corresponding emissions. The utility estimates the reduction of electricity consumption at 1,570 kWh per household. Based on Lakeland's mix of generation, the average annual emissions reduction per household is:

Carbon Dioxide (CO<sub>2</sub>) 1,392 kilograms (kg)  
Sulfur Dioxide (SO<sub>2</sub>) 5 kg  
Nitrogen Oxides (NO<sub>x</sub>) 4 kg

Looking to the future, Tatum, the Florida Energy Office, and FSEC are working with the Florida Municipal Electric Association to interest other utilities in starting their own solar water heating programs. He says, "It's a great idea because it is a turnkey operation for the homeowner. They have a waiting list in Lakeland, so we know the program is very popular."

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