

Innovative Solar Solutions: Progress Energy Florida's Renewable Energy Program

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ABSTRACT

In 2007, Progress Energy Florida (PEF) launched an innovative renewable energy program designed to provide an incentive for customers to invest in renewable energy technology which is used in conjunction with EnergyWise, PEF's direct load control program. The renewable energy technology supplements a portion of consumer demand, while peak demand is reduced by interrupting service to selected electrical equipment on the customer's premises.

The program includes two separate renewable measures. The first of these encourages residential customers to make an investment to install a solar thermal water heating system. This system will save customers money by harnessing solar energy to heat water in their homes. In order to qualify for the incentive, customers must also be signed up on the EnergyWise program.

The second measure is called SolarWise™ for Schools and promotes environmental stewardship and renewable energy education through the installation of solar energy systems at schools within PEF's service territory. Customers participating in the EnergyWise program can elect to donate their monthly credits toward the SolarWise™ for Schools program which uses the credits to purchase solar photovoltaic systems and provide educational opportunities for these schools.

The renewable energy program represents an innovative solar solution by combining demand side energy savings with renewable energy sources and encourages our customers to help the environment by implementing renewable-energy technologies in their homes in a cost effective manner.

This initiative is part of Progress Energy's balanced approach to meeting future energy needs. It expands our existing portfolio of energy-efficiency offerings into evolving renewable technologies.

Introduction

Progress Energy, headquartered in Raleigh, N.C., is a Fortune 250 energy company with more than 21,000 megawatts of generation capacity and \$10 billion in annual revenues. The company includes two major utilities that serve more than 3.1 million customers in the Carolinas and Florida which are two fast-growing areas of the country. The company is pursuing a balanced approach to meeting the future energy needs of each region. That balance includes increased energy efficiency programs, investments in renewable energy technologies and a state-of-the-art electricity system.

Progress Energy's retail service area in Florida spans about 20,000 square miles in central Florida, including metropolitan St. Petersburg, Clearwater and the greater Orlando area. In Florida, the company maintains more than 43,600 miles of distribution and transmission lines in serving 1.5 million customers and a population of more than 5 million people.

Progress Energy Florida has been helping customers use energy more efficiently since 1981. PEF has a comprehensive mix of residential, commercial and dispatchable programs along with an extensive list of alternative energy research projects that include solar, hydrogen and biomass technologies. PEF's energy-efficiency programs have achieved total reductions of over 11.1 billion kWh, saved customers nearly \$870 million and removed 7.5 million tons of carbon dioxide from the environment.

Table 1. Progress Energy Florida’s Energy Efficiency Impacts

Reduced Energy Use		<ul style="list-style-type: none">❖ Power the city of Orlando for over 2 years❖ Customers have saved almost \$870 Million since 1981❖ Annual savings potential of \$504 for average home
Reduced Energy Demand		<ul style="list-style-type: none">❖ Since 1981, over 1,500 MW demand reduction❖ Eliminates the need for 17 peaking power plants❖ Residential Load Management credit of up to \$147¹ annually
Reduced Emissions		<ul style="list-style-type: none">❖ Reduced carbon dioxide by 7,500,000 tons❖ Or equal to removing almost 1,900,000 cars off roads²❖ Or equal to planting over 1,900,000 acres of trees

On July 12 and 13, 2007, Governor Charlie Crist hosted “Serve to Preserve: A Florida Summit on Global Climate Change.” The summit brought together leaders of business, government, science and advocacy to examine the risks of global climate change to Florida and the nation, and to explore the business opportunities that can come from aggressive response to climate change. At the conclusion of the summit in Miami, Governor Crist signed three Executive Orders and two international partnership agreements, vaulting Florida to the vanguard of states actively working to address global climate change.¹

As an energy source that is native to Florida, solar energy will continue to have a strong role in both research and implementation of cost-effective systems to meet Florida’s growing consumer demand. The Florida Global Climate Action Team, established as part of the Executive Orders, recommends that the state of Florida adopt policies and continue funding which accelerates research, new job creation, development, and expansion of renewable resource electric production technologies such as solar.

Types of Solar Systems

Solar energy technologies harness the sun's energy for practical ends. These technologies date from the time of the early Greeks, Native Americans and Chinese, who warmed their buildings by orienting them toward the sun. Modern solar technologies provide heating, lighting, electricity and even flight.² Two of the more common technologies involve either a solar thermal system or photovoltaics (PV) system.

Solar Thermal System

Solar thermal technologies use the sun to heat water which is then generally either used directly for domestic water heating applications or indirectly for space heating. In some larger process applications, the steam created is sent through a turbine which then turns a generator to create electricity. Water heating

¹ Florida’s Energy and Climate Change Action Plan: 2007 (11/1/07)

² http://en.wikipedia.org/wiki/Solar_energy

technologies have relatively high efficiencies as compared to other solar technologies. The most common types of solar water heaters are batch systems, flat plate collectors and evacuated tube collectors.

Photovoltaic System

Sunlight is composed of photons, or particles of solar energy. These photons contain various amounts of energy corresponding to different wavelengths of the solar spectrum. A solar cell or photovoltaic cell (PV) is a device that converts light into electricity using the photoelectric effect. They are made of semi-conducting materials similar to those used in computer chips. When sunlight is absorbed by these materials, the solar energy knocks electrons loose from their atoms, allowing the electrons to flow through the material to produce electricity. Regardless of size, a typical silicon PV cell produces about 0.5 – 0.6 volt DC under open-circuit, no-load conditions. The current (and power) output of a PV cell depends on its efficiency and size (surface area).

The photovoltaic cells are connected electrically in series and/or parallel circuits to produce higher voltages, currents and power levels. The direct current (DC) electricity is put into an inverter which converts it from DC to alternating current (AC) which is more widely used. The power generated goes to the electrical service and helps feed the demand for electricity either on a distributed basis serving an individual customer or application or linked back into a larger electrical grid.

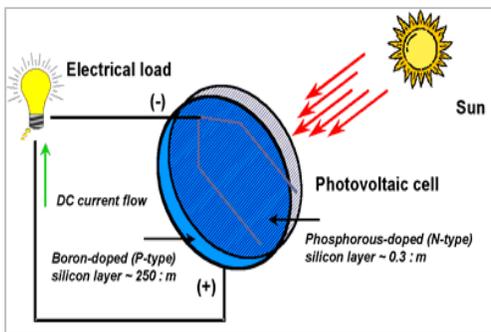


Figure 1

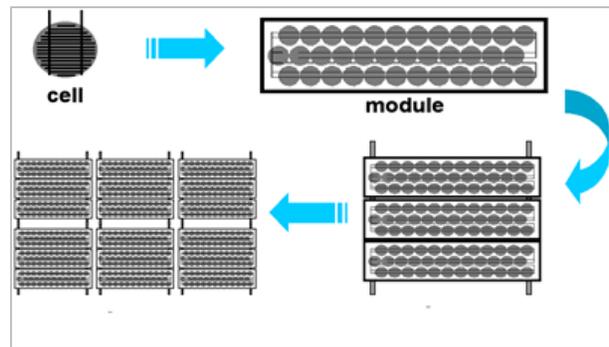


Figure 2

Progress Energy Florida’s Renewable Energy Program

In 2007, Progress Energy Florida (PEF) launched an innovative Renewable Energy Program which is designed to not only provide an incentive for customers to invest in renewable energy technology, but also addresses peak demand since each measure must be used in conjunction with EnergyWise, PEF’s direct load control program. The renewable energy technology supplements a portion of consumer demand, while peak demand is reduced by interrupting service to selected electrical equipment with radio-controlled switches installed on the customer’s premises.

EnergyWise Program

This is a voluntary load management program in which PEF reduces winter and summer peak demand by interrupting electric service to water heaters, central electric cooling and heating units, and pool pumps. It allows the company to temporarily cycle off power for brief durations during peak periods of community electrical demand. This is only done when all of the customers combined are using an extreme amount of energy at the same time, and the system needs to reduce the total demand. The cycling of power is usually not even noticed as it occurs infrequently and lasts for only minutes at a time.

The program is offered during winter months (November through March) and during summer months (April through October). Even though the EnergyWise program is a voluntary residential load control program, participation is required to take advantage of either of the two renewable energy program measures.

Solar Water Heater with EnergyWise

This renewable energy measure, launched in February 2007, offers incentives for residential customers to install a solar thermal water heating system. Solar thermal is one of the most cost-effective renewable technologies. This system saves customers money by harnessing solar energy to heat water in their homes. In order to qualify for the incentive, customers must also be signed up on the EnergyWise program. Participating customers are then eligible for an up-front \$450 incentive and on going credits for their EnergyWise program participation of up to \$60 each year. Additionally, there is a \$500 rebate from the state of Florida and a Federal tax credit of 30% of the cost of the system up to \$2,000.

Objectives. The main objectives of this program measure is to increase renewable energy generation on Progress Energy Florida's grid, increase awareness of renewable energy generation and their capabilities with customers and contractors and to increase participation in PEF's EnergyWise program.

Benefits. In addition to the up-front incentives and monthly credits, customers will reduce their energy bills. The Florida Solar Energy Center (FSEC) indicates a savings potential of up to 85% of the water heating needs. Typically, water heating accounts for 17% of a customer's energy bill. A solar thermal system can deliver hot water even during long power outages through the use of backup solar power for the circulation pump. Customers will also be helping the environment through the reduction of greenhouse gas emissions associated with typical electric generation.

For the company, PEF gains valuable knowledge on operation and performance of solar thermal systems. The solar thermal energy can be metered using the existing AMR meters to determine kWh delivered.

System. A solar water heater uses the sun's energy to heat water reducing the amount of electricity needed to perform this task. The solar collector is the main component of the solar system. It is usually a metal box with insulation and a black absorber plate that collects solar radiation to heat the water. The solar panel is typically located on the roof of a residence. Piping then transfers the heated water to the tank for storage until it is needed.

These systems still have an electric element to use during extended periods of cloudy days or when the demand for water heating needs are high to ensure a constant supply of hot water. There are many variations of solar thermal systems for hot water production. The most commonly used in Florida are direct active systems and passive systems. Direct active systems (50% - 90% effective) use a pump to circulate water through a low volume solar collector thereby directly heating the water in a customers water heater tank. Passive systems (30% - 50% effective) are integrated collector and storage systems (ICS).

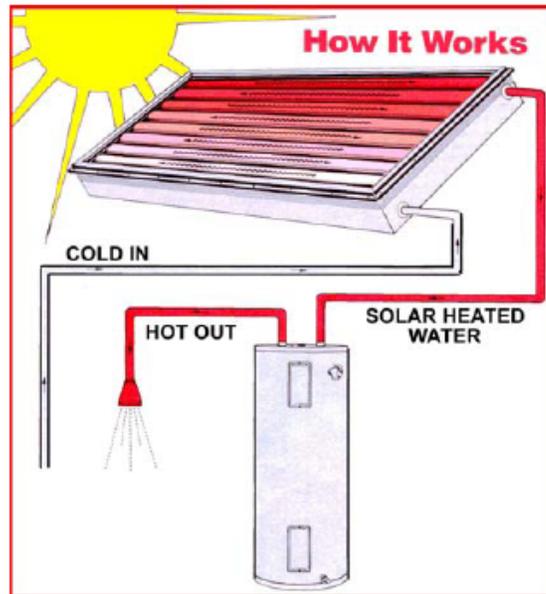
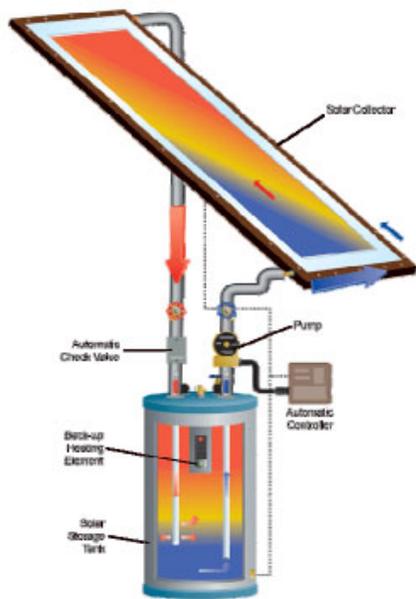


Figure 3 – Direct Solar Thermal System Figure 4 – Integrated Collector (Passive System)

Installation: Customers should use a licensed solar water heating contractor to ensure a proper installation of the systems and their components.



Figure 5 - Solar Collector



Figure 6

Participation: Since the kick-off of the program on February 26th, over 350 orders for new solar water heaters have been received with over 200 installations completed and rebated processed.

Additionally, Rusaw Homes, a new construction builder in Citrus County, has committed to installing a solar water heater with EnergyWise as a standard feature on each of their new homes with an anticipated 100-150 installation per year. Mercedes Homes is offering the solar water heater as an available option for installation in their new homes as well.

SolarWise™ for Schools

This renewable energy measure, rolled out in August 2007, promotes environmental stewardship and renewable energy education through the installation of solar energy systems at schools within Progress Energy Florida's 35-county service territory. Customers participating in the EnergyWise program can elect to donate their monthly credit toward the SolarWise™ for Schools escrow fund. All proceeds collected from the participating customers, and their associated monthly credits, are then used to purchase solar photovoltaic systems and provide educational opportunities for these schools.

In addition to the benefit of the solar power generated, approximately 5,840 kWh annually for a 4-kW system, the program promotes environmental stewardship and renewable energy education. Teachers are provided with a valuable, interactive teaching tool, allowing students an exciting hands-on approach to explore solar energy. The funds will be used to administer a correlating student curriculum and a state-wide database that will monitor the energy produced by the photovoltaic systems.

Progress Energy Florida has already partnered with the Florida Department of Environmental Protection (FDEP) and the Florida Solar Energy Center (FSEC) to install PV systems at 11 schools throughout the company's service territory as part of the SunSmart Schools program. The SunSmart program is a state-run program administered by FSEC. It costs approximately \$11 per watt to install a 4 kW photovoltaic system. State funding through the SunSmart program is \$4 per watt, leaving a shortfall of \$7 per watt or approximately \$28,000 per school. The new SolarWise™ for Schools program will significantly accelerate the rate at which new PV systems can be installed at schools to expand the use of renewable energy in Florida. It takes approximately 200 participants to fund a system for a school. PEF will perform a random lottery from schools throughout the service territory that do not have an existing system to determine the order of schools for installation.

"SolarWise for Schools is a great way for our customers to help educate young minds about the potential of renewable energy sources – like solar – and, at the same time, manage energy wisely," said Jeff Lyash, president and chief executive officer of Progress Energy Florida. "Through this program, we hope to install a photovoltaic system at every school in our service territory. Informing students about the potential of solar energy is part of our ongoing commitment to renewable resources while meeting the future energy needs of our customers."

Participation: Even in such a short amount of time, 106 participants have signed up to donate their credits. This new program was also promoted by PEF employees while participating in the Great American Teach-In held in November. The project team has already identified St. Petersburg High School as the first school to benefit from this program with the installation of a PV system.



Figure 7



Figure 8

Progress Energy Florida's Solar Energy Research

Progress Energy Florida has been involved in solar energy research since 1988 and has recently expanded the number of projects as part of its alternative energy strategy. In addition to the recently implemented Renewable Energy Program which includes the Solar Water Heating Program and SolarWise™, PEF has a number of active research projects and initiatives which include demonstrating and testing solar thermal, photovoltaic and lighting technologies. The photovoltaic projects alone represent over 455 kW and 665,000 kWh of present and future generation located throughout PEF's service territory.

Photovoltaic Projects

- **Manufactured Housing Photovoltaic (PV) Pilot Project:** This project was nationally recognized with the Interstate Renewable Energy Council's (IREC) 2002 Innovation Award. Additionally, this project received the 2003 Florida Sustainable Energy Award and was recognized by Governor Jeb Bush and his Cabinet with a resolution ceremony at the Capitol in Tallahassee on September 30, 2003.
- **British Petroleum Amoco "BP":** British Petroleum Amoco (BP) has worked with Progress Energy to interconnect 16 stores with gas-pump canopies outfitted with power generating photovoltaic systems throughout Progress Energy's service area and partnered to monitor and evaluate the photovoltaic (PV) production from a sampling of the sites.
- **Progress Energy's Econlockhatchee Photovoltaic (PV) Array:** The PV Array was originally commissioned in August 1988 at the Econlockhatchee substation in Orlando, Florida. The PV array consisted of 640 Siemens G4000 thin-film amorphous silicon modules and was nominally rated at 15-peak kilowatt (kWp). The PV system was designed to research power generating technologies that could generate electric power to be delivered directly into the electric grid. In 2006, two new PV technologies were added. The three technologies have identical interconnections and will be used to compare and evaluate the most efficient and cost effective performance.
- **The Nature Conservancy at the Disney Wilderness Preserve:** This project features two grid connected PV systems. The two 6.5 kW systems were installed to promote renewable energy technologies at the Disney Nature Conservancy conservation and learning center located in Kissimmee, Florida. The buildings were officially opened to the public in October 1999.
- **The SunSmart School Program:** PEF partnered with the Florida Department of Environmental Protection (FDEP) and the Florida Solar Energy Center (FSEC) to demonstrate PV systems at eleven schools throughout the company's service territory. This program is a collaborative initiative that provides students with interactive learning opportunities to explore alternative energy sources. The five-year project was launched in 2003 with the installation of 4-kilowatt (kW) PV systems at five schools. An additional school with a 2 kW system was added in 2005, two more 2 kW systems in 2006, and three additional 2 kW systems in 2007. Students can track energy production from the PV system mounted on a school's roof, even if they do not attend that school. Students work within their individual classrooms to conduct scientific experiments and mathematical computations based upon the PV system's energy production. Approximately 265 tons per year of CO₂ emissions are avoided from these installations.

- **Homosassa Springs State Wildlife Park — Hydrogen Production and Fuel Cell Project:** PEF and the FDEP teamed up to develop a sustainable hydrogen generator and fuel cell for the wildlife park in Citrus County, Florida. The hydrogen fuel cell and 5 KW PV systems demonstrate sustainable energy, requiring only sunlight and water as a fuel source. The PV cells convert sunlight into electricity, which operates an electrolyzer to produce hydrogen and oxygen from water. The oxygen is released harmlessly into the atmosphere, while the hydrogen is used inside a fuel cell, which is similar to a battery, to generate electricity for the park's Wildlife Encounter Pavilion.
- **Additional Customer Owned and Operated Interconnected Photovoltaic (PV) Systems:** PEF has worked with several residential/commercial customers to interconnect PV systems to our electrical grid, accounting for 87 kW.
- **Renewable Distributed Generation and Storage System with Demand Side Management (DSM).** In partnership with University of South Florida's (USF) Power Center for Utility Exploration, this project will install two solar arrays on the USF, St. Petersburg campus and Williams Park. The output of these arrays will be stored in an advanced battery system known as a Vanadium Flow Battery. The stored energy will add to the solar output to reduce the power system summer peak. During the winter peak, the battery will allow the intermittent solar energy to reduce the power system winter peak.

Solar Thermal Projects

- **The SunBuilt Grant:** The SunBuilt new construction grant is a collaborative effort between PEF and the Florida Solar Energy Research and Education Foundation to increase builder awareness of and desire for solar water heaters in the residential new construction market. The program combines state and federal renewable energy rebates and credits with Progress Energy Florida's \$450 Solar Water Heater with EnergyWise credit and a SunBuilt incentive to the builder of \$500.
- **Jamestown Solar Thermal Water Heating Pilot:** This project involves installation of six solar thermal water heating systems in a community east of Orlando, FL. These systems are being monitored to determine the energy impact of the solar thermal systems on Progress Energy Florida's system peak.

Lighting Projects

- **Solar Hybrid Lighting:** Sunlight Direct, a DOE startup, and two commercial customers are partnering with PEF to determine the cost effectiveness of Solar Hybrid Lighting. This new technology uses a solar collector on the roof to concentrate the sun's energy into a bundle of fiber optic cables that distribute the solar light into the business building. The system also has the ability to dim or shut off the normal incandescent or fluorescent lighting system when there is enough day lighting. PEF will monitor the energy and demand saved to determine if this can become a DSM offering with participant incentives.

Conclusion

Progress Energy Florida has a solid track record of almost 20 years of working with solar energy systems. With the growing demand for renewable systems and environmentally-friendly power generation, PEF will continue to research potential innovative solar solutions and implement cost-effective programs to meet Florida's increasing customer needs.