MILLION Solar ROOFS

SUCCESS STORIES

The goal of the Million Solar Roofs Initiative is to install one million solar energy systems on U.S. buildings by 2010. President Clinton announced the Initiative on June 26, 1997 in a speech before the United Nations Session on Environment and Development. The Initiative focuses on two types of solar energy technology — photovoltaics that produce electricity from sunlight, and solar thermal systems that produce heat for domestic hot water, space heating or heating swimming pools. The U.S. Department of Energy leads this effort in partnership with the building industry, other federal agencies, utilities, the solar energy industry, financial institutions, state and local governments, and non-governmental organizations. These partnerships concentrate on removing market barriers and developing and strengthening demand for solar energy products and applications. As progress is made toward the goal of one million solar roofs, greenhouse gases and other harmful emissions will be reduced, high tech jobs will be created, and the U.S. solar energy industry will retain its competitive edge.

DEPARTMENT OF ENERGY · UNITED STATES OF AMERICA

Project: Florida PV Demonstration Project

Type: Grid-connected, Super efficient, PV residential home

Location: Lakeland, Florida

Background: During the summer of 1998, the Florida Solar Energy Center (FSEC) working in conjunction with Sandia National Laboratories and Lakeland Electric and Water, conducted a photovoltaic (PV) demonstration project in Lakeland, Florida. The project compared a PV, energy efficient residential building (PVRES) with a standard (control) home. These homes are situated within one hundred yards of each other in Lakeland, Central Florida. The main goal of the project was to measure the potential for constructing new single family homes built to lower air conditioning loads so that most of the cooling can be accomplished by a PV system. The PV system would provide most of the daytime electrical needs. In order to reduce the cooling loads, a white reflective roof was installed on the PVRES home. Additional steps were taken to reduce the need for air conditioning which included an interior duct system, exterior insulation over masonry construction, wider overhangs, solar controlled windows and a high efficiency air conditioning system. FSEC installed detailed instrumentation to monitor the PVRES and the control home. The control home utilized traditional appliances and insulation compared to the PV home which utilized energy efficiency measures.

System Description: A 4kW PV array was installed on the PVRES. The array was wired and tied into the grid with an AC inverter. Hutton Communications was the system integrator. They assured the compatibility of the component parts and provided the balance-of-system components. Siemens provided SP75 solar modules for the roof of the house. Fifty-four single crystalline modules were used. These came with a maximum power rating of 75W and selectable voltage of 12V or 6V. The arrays were installed in panels composed of three modules connected in a series. Twelve panels were installed on the south side (2.7 kW) of the building and six panels on the west side (1.3 kW). This was done in order to produce power later in the day. Trace Engineering provided the inverter which converts the DC power from the array to the AC power that interacts with the utility grid. The performance of the PV system is monitored to determine the feasibility of incorporating PV into residential grid-connected homes in Florida.

Financing: The demonstration project was cofunded by Sandia National Laboratories and the Florida State Energy Office. Sandia provided funding for the actual PV system while the Florida State Energy Office funded the energy efficiency features. Both Sandia and the Florida State Energy Office sponsored the research involved in monitoring this project. Lakeland Electric and Water assisted with metering issues and will maintain the PV generation system.

Climate: Climate conditions varied from sunny to cloudy with rain. Over this period, the average daily net power to the grid was 15.2 kW with a peak 15 minute power production of 3.0 kW typically around 1:45 pm. Even during overcast conditions the system is able to generate 800 watts of electricity.

Total Installed Cost: The PV portion with the balance-of-system components would have cost approximately $40,000, if commercially installed. The added cost of the efficiency features was approximately $23,000.

Optimum Maintenance Costs: To date there have not been any maintenance costs. Generally, this system will require little maintenance.

Savings: A record high of 101° (F) was recorded on June 18, 1998. On this day the control home used 71 kW with a 4 ton air conditioner running constantly between 11 am and 6 pm and was unable to control the interior air temperature to 76° (F). In comparison, the PVRES home two ton air conditioner cycled on and off maintaining the interior at 74° (F) and only used 20 kWhrs for cooling, a 70% reduction. In addition, the PV power production played a crucial role. PV electrical generation sent to the grid totaled 15.6 kW during the day. When the solar electric power production is considered, the PVRES house had a near zero net electric demand on the grid during peak hours. The highest demand for electricity in the PVRES home was during evening hours. When more electricity was generated than needed the excess electricity was sent back to the grid. This project demonstrated that energy efficient homes built in Florida can be built to exert little net demand on the grid during peak periods.

Environmental Benefits: During the month of June, 1998, the control home used approximately 61.2 kW/day of electricity. This amounts to approximately 122 pounds of carbon dioxide emissions per day or 44,000 pounds of carbon dioxide emissions per year. The PVRES home only used 14.7 kW/day. However, much of the electricity generated came from the PV system which does not produce any harmful carbon dioxide emissions.

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