

Cambridge Solar Power Case Study

Residence at 45 Antrim Street

Action Installation of 3.12 kilowatt solar photovoltaic system to generate electricity on-site

Location 45 Antrim Street

Date October 2006



About the Building and Household

A single-family wood-frame home built in 1897. The house was originally the rectory for the church next door.

What they did

Motivation After watching *An Inconvenient Truth*, the owners felt compelled to do as much as possible to lower their greenhouse gas emissions.

Project Goals Reduce as much electricity use from the regional power grid as possible.

Key Players

- The home owners
- NSTAR
- Zapotec Energy
- Lighthouse Electrical Contracting
- Massachusetts Technology Collaborative (MTC)

Actions

- The owners installed 26 photovoltaic panels, each able to generate a 120 watts of electricity, for a total production capacity of 3.12 kilowatts. The panels were manufactured by Evergreen Solar of Marlboro, MA.
- Paul Lyons of Zapotec Energy, a Cambridge based solar contractor, did a site visit to determine what kind of system could installed, helped the owners prepare to meet with the Historical Commission, and prepared both the grant application from Massachusetts Technology Collaborative and the application for an intergeneration contract with NSTAR. He also designed and supervised the PV installation. Installation of the panels and other equipment was done by Lighthouse Electrical Contracting.
- Before installing the PV panels, the owners took other steps to reduce their electricity consumption. As a result of an energy audit performed by MassSAVE, the old and inefficient refrigerator, washer, and dryers were all replaced with new, efficient models. In addition, all traditional light bulbs were replaced by compact florescent lights (CFLs).
- How the wiring works: the sun's rays strike the semiconductor material inside the cells, causing electrons to excite. The electrons are then captured to produce direct current (DC) electricity. This current is then fed into the house, where it is converted to alternating current (AC) electricity by the inverter located in the basement and made available for household use. The inverter was manufactured by Magnetek Alternative Energy.
- The owners have an interconnection agreement and power purchase contract with NSTAR, which means that when more electricity is produced by the panels than consumed, the excess is sold back to the grid for NSTAR to use elsewhere. When the panels are not producing enough electricity, the homeowners or occupants can supplement the power supply by drawing from the grid. In the summer months the meter often runs backwards.

Results

The efficiency improvements and the solar PV installation together reduced the household's grid electricity use by 85%. In the first year alone, the PV system was responsible for preventing 4,480 pounds of CO₂ from being released into the air.

On bright winter days the system produces about 3 kilowatt-hours of energy; on sunny summer days it produces up to 12 kilowatt-hours (kWh). Prior to making any changes, the house used about 7,500 kWh of electricity a year. In the first year the PV system generated about 3,500 kWh of electricity, or almost half of what the family previously used. Yet with the energy efficiency improvements and the installation of the PV system, at the end of the year the family had only bought 750 kWh of energy off the grid from NSTAR, or one-tenth of what they had previously drawn. About half of the 85% savings are from the solar panels, and the rest from the other conservation steps the family took.

The cost for the PV project was \$28,000, but the owner's received \$11,000 back within the first year- \$8,000 from Mass Technology Collaborative, and \$3,000 in federal and state tax credits. Therefore the installation cost a total of \$17,000. At current electricity costs, the PV system will take about 14 years to pay for itself. The owners believe these steps have added to the value of their house, especially as public awareness of climate change grows, and as costs of electricity and fuel rise.

The owners state that the PV system is no work to maintain. Once a month they send the readings from the meter to the Massachusetts Technology Collaborative's Production Tracking System (PTS), which monitors their system and keeps a thorough online record of its performance. They also have to occasionally call NSTAR because the bills are not designed to reflect the net meter readings. However, the owners say, "The entire project went smoothly from start to finish. We are very happy with the results."

Lessons Learned

What Worked Well

- The commitment to save energy taught the family many other ways to reduce their environmental impact.

Unexpected Events or Outcomes

- The owners of the house say that for the sake of recycling they always assumed it was best to keep appliances until they no longer operate and then get new ones. However, they learned that it is better for the environment to replace a functional but aging refrigerator that creates large amounts of carbon emissions.
- The owners also say they were surprised to learn that changing light bulbs and replacing old appliances saved as much energy as installing the solar panels.

Contacts

Name Amy Meltzer
Address 45 Antrim St.
E-mail ameltzerma@comcast.net

Name Paul Lyons, P.E.
Company Zapotec Energy Inc.
Address 675 Massachusetts Ave
Cambridge, MA 02139
Tel. 617-547-5900
Fax 617-547-5901
Email Lyons@ZapotecEnergy.com

For more information please visit www.cambridgema.gov/climate or call 617.349.4628

Community Development Department, City of Cambridge, Massachusetts

Written by Kristine Babick, Community Development Department August 2008