

# Cambridge Solar Power Case Study

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## Residence at 31 Chilton Street

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**Action** Installation of 2.64 kilowatt solar photovoltaic system to generate electricity on site

**Location** 31 Chilton Street

**Date** June 2006



### About the Building and Household

A triple-decker wood frame house built in 1910 with a flat roof and gas-fueled steam heat. The building contains three condominiums, so all owners had to agree to the improvements.

### What they did

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**Motivation** After learning about the effects of global warming, the owners wanted to lower their global warming pollution emissions.

**Project Goals** After making comprehensive energy efficiency improvements, the Sprengnether-Gonzalez family wanted to use clean energy sources.

### Key Players

- The condo owners
- NSTAR
- Zapotec Energy
- Massachusetts Technology Collaborative (MTC)

### Actions

- The owners installed a 2.64 kilowatt (DC) solar photovoltaic system to generate electricity on site. The system consists of 22 panels manufactured by Evergreen Solar of Marlborough, MA, a single "Sunny Boy" inverter manufactured by SMA America, monitored by a Hialeah meter. The system was installed by Zapotec Energy, a Cambridge-based firm specializing in energy conservation, management, and renewable energy production.
- Before the panels could be mounted to the roof, extra support had to be added to the roof joists. A 1' by 6' "sleeper" was then added to distribute the weight of the panels and secured to the rafters by 10" lag screws. The panels were fixed at 190-degrees; 10-degrees off due south, providing the most secure positioning possible and minimizing the potential for wind lift. All installation materials were from Unirac, located in Albuquerque, NM.
- 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 PV system is connected to the main grid, allowing the house to supplement its needs with electricity distributed by NSTAR. Excess energy is sold back to the grid in the summer months.

### Results

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The efficiency improvements and the solar PV installation together reduced the family's CO<sub>2</sub> emissions by 55%.

The main equipment costs of the solar PV system were \$12,000. However, there were additional peripheral equipment costs of \$4,600 which included the additional roof support and tie to the power grid, and there were installation and design fees totaling about \$9,500. This upfront cost was offset by an \$8,280 renewable energy grant from the MTC, a one-time \$1,000 personal income tax credit from the state, and a one-time federal income tax credit of \$2,000. Therefore the upfront cost of the entire project was about \$14,820. At current electricity rates, the PV system will produce \$630 of electricity annually. In 2007 the system produced 2,692 kWh of electricity.

#### Other Benefits

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- Raised awareness in the community about the need to move toward renewable energy systems and greenhouse gas emission reduction.
- The green renovations have helped encourage the family to make environmentally-friendly decisions in other aspects of daily life, such as commuting with public transportation.
- Increased sense of pride in the home.
- Enough electricity is produced in the summer months to sell some back to the electric grid.
- Support of local manufacturers and local economy.

#### Lessons Learned

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##### **What Worked Well**

- Electricity use was reduced so much that a 2 KW photovoltaic system would be sufficient to power 2 of the 3 condo units.

##### **Unexpected Events or Outcomes**

- The payback time for the solar photovoltaic system will depend on the future cost of electricity. At current rates, the payback is over 20 years, but will decrease if rates increase.
- The need to add support to the roof joists added significant cost to the project. Therefore, the family suggests that the best time to consider adding a PV system to an older house is during renovation, when access to the roof structure will be less costly.

#### Contacts

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**Name** Michele Sprengnether  
**Address** 31 Chilton St., #3, Cambridge MA 02138  
**E-mail** [spreng2@comcast.net](mailto:spreng2@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](mailto:Lyons@ZapotecEnergy.com)

For more information please visit [www.cambridgema.gov/climate](http://www.cambridgema.gov/climate) or call 617.349.4628  
Community Development Department, City of Cambridge, Massachusetts