

Is the Sun Rising for Utility Solar Water Heating Programs?

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Introduction

Electric utilities are increasingly looking to energy efficiency as an alternative to capacity additions. Solar water heating is one of a number of options that can be considered as a DSM measure. Some utilities are showing a renewed interest in solar water heating.

Solar Domestic Hot Water (DHW) Impact on Electric Utility Loads and Demand

Water heating is an important energy end-use. Nationally 8% of the energy used in residential and commercial buildings (3 quads) is used to heat water. While the majority (54%) of water heating in U.S. households is accomplished with natural gas, electric water heating holds a significant and growing market share. Electricity currently provides water heating in 35% of U.S. households, and in 1989 almost half of all water heaters sold were electric.

Several studies over the last 10 years have used measured performance to assess the influence of residential solar water heaters on electric utility peak load. The results of three of these studies are presented in Figure 1 (Carlisle 1992).

In all three of these studies, the greatest coincident demand savings, which equaled approximately 0.4 kW in two studies and 0.7 kW in the third, occurred in the winter. This is because hot water use is a strong component of the utility's early morning winter peak, but it is not as critical during the summer peak period, which is typically in the afternoon.

In a more recent study by the Canada Center for Mineral and Energy Technology, researchers assessed the benefit of a solar system with a programmable thermostat that allows for multistage off-peak charging. The programmable thermostat was set to 45°F during peak hours and 64°F during off-peak hours (between midnight and 4:00 a.m.). During off-peak hours a reduced amount of auxiliary power (1 kW) was available on demand. The system provided a net capacity displacement of 0.86 kW

during a 16-hour period on the winter peak day in the Ontario Hydro service territory.

NREL Solar Water Heating Workshops

NREL sponsored two workshops for DSM professionals to explore the problems and opportunities for residential solar water heating as a DSM measure. The workshops had 20 utility participants from 17 utilities and 2 power marketing authorities.

The utilities discussed the perceived benefits and problems for solar water heating and offered possible solutions and next steps for utilities interested in undertaking a program. Barrett (1992) describes the workshops in more detail.

Current and Planned Utility Programs

The workshops identified the need for utilities to conduct pilot- or full-scale programs as the next step to evaluate solar water heating as a DSM measure. Brief descriptions of several utility programs follow.

Santa Clara Municipal Utility

The City of Santa Clara, California has been operating a municipal solar domestic hot water (DHW) and pool heating rental program since 1975. The program has made its greatest impact serving multifamily residential buildings with central water heaters. Over 400 residential units receive solar hot water from equipment rented from the city.

Eugene Water and Electric Board

The Eugene, Oregon Water and Electric Board initiated a solar rebate program in May 1990. The rebate, which is based on predicted system performance, ranges from \$100 to \$400. The rebate can be combined with the Oregon

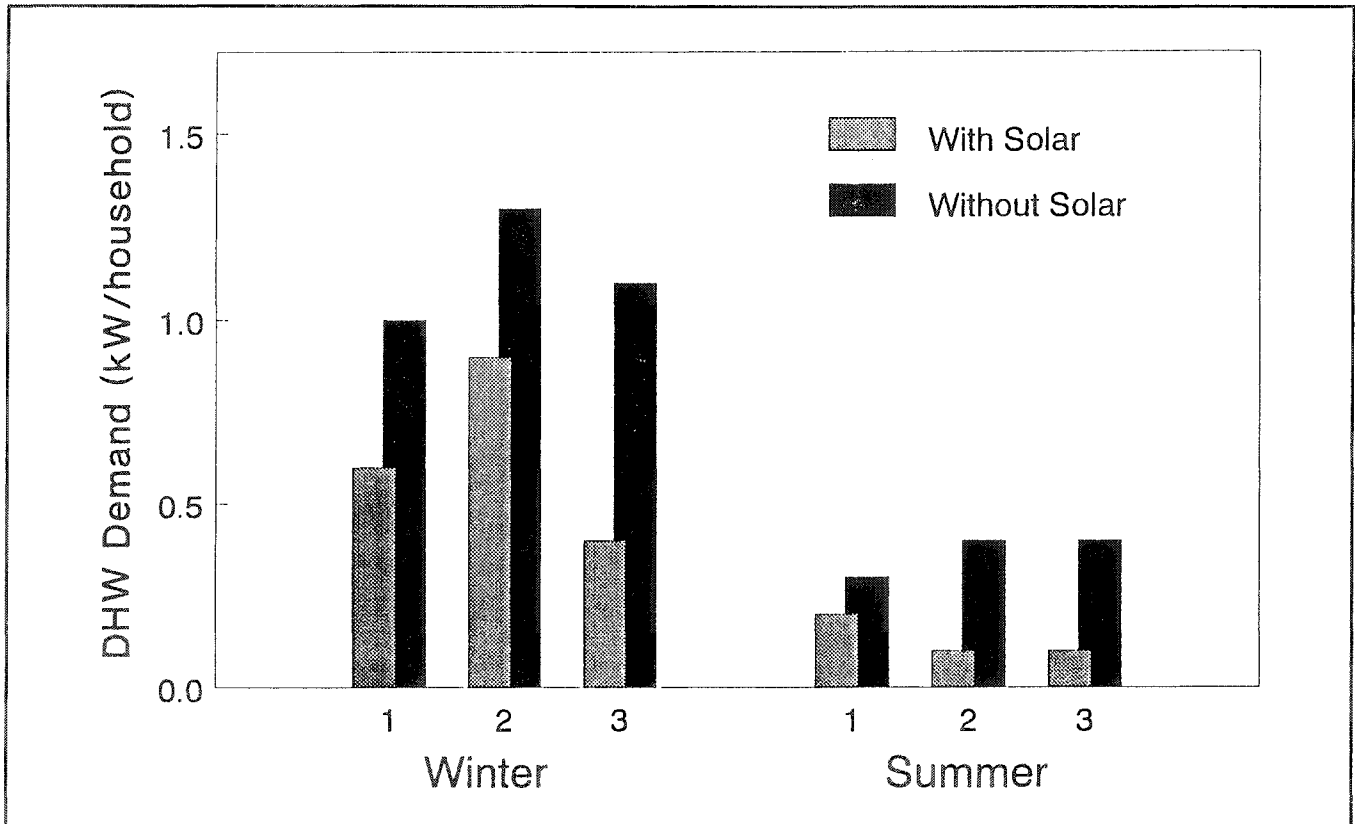


Figure 1. Coincident Diversified Demand Impact of Residential Solar DHW Systems on Electric Utilities. [Study 1 was conducted in North Carolina with a sample of 55 electric and 24 solar customers (2); Study 2 was conducted in Texas with a sample of 15 electric and 15 solar customers (3); Study 3 was conducted in Florida with a sample of 19 electric and 19 solar customers (4).]

state tax credit for alternative energy systems. To date, 120 residential systems have been installed through the program.

Central Vermont Public Service (CVPS)

CVPS is conducting a solar domestic hot water test project in which they plan to install and monitor the performance of 16 solar systems for 2 years throughout their service region. The project is aimed at different load groups.

Projects in the Planning Phase

Sacramento Utility District (SMUD) and the New England Electric System are also in the planning phases of solar programs. SMUD is establishing an ambitious program including a performance-based solar DHW rebate program that provides rebates up to \$1525; The New England Electric Service (NEES) is currently planning a pilot project to collect cost, energy, and demand impact

information on solar water heating for single family, multifamily, and small commercial applications.

Conclusions

Through integrated resource planning (IRP) programs, utilities offer good opportunities for the promotion of solar DHW. Several key studies have been done that show that solar DHW can positively impact a utility's peak demand in both cold and hot climates. Solar DHW programs offer advantages to utilities, and solutions appear to be available to overcome the utility-perceived problems. Several utilities are currently operating solar DHW programs.

Acknowledgments

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References

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