SOLAR 2013: RENEWABLE ENERGY - BENEFITS BEYOND THE MONEY

Kim C. Walton
Grand Valley State University
Michigan Alternative and Renewable Energy Center
200 Viridian Drive,
Muskegon, MI 49441
waltonk@gvsu.edu

ABSTRACT

In 2010, the Sustainable Energy Resources for Consumers Grants (SERC) became available under the American Recovery and Reinvestment Act. The objective of SERC was to expand weatherization to "materials, benefits, and renewable and domestic energy technologies" that were not currently covered. Cost-effectiveness was one of the stated priorities of SERC funding. However, renewable energy may also have additional quality of life benefits to offer families beyond the cost savings.

In Michigan, there were two SERC grants awarded; one to the Muskegon and Oceana Community Action Partnership (MO-CAP) in West Michigan and Oakland Livingston Human Service Agency (OLHSA) in Southeast Michigan. To be eligible, residents had to own their homes and meet income qualification levels.

This paper will look at qualitative indicators to see if the clients perceived personal benefits beyond the monetary savings from the renewable energy systems and if those perceived benefits vary between solar thermal and photovoltaic systems.

INTRODUCTION

In 2010, the Sustainable Energy Resources for Consumers Grants (SERC) became available. Under the American Recovery and Reinvestment Act $90 million was allocated to support the use of a wide range of energy efficiency and renewable energy technologies by 101 high-performing local weatherization providers across the country. The objective of SERC was to expand weatherization to "materials, benefits, and renewable and domestic energy technologies" not currently covered. Cost-effectiveness was one of the stated priorities of SERC funding. However, these projects may have some added or perceived quality of life benefits to the home owner beyond the actual cost saving.

In Michigan, there were two SERC grants awarded; one to the Muskegon and Oceana Community Action Partnership (MO-CAP) and the second to Oakland Livingston Human Service Agency (OLHSA). Both organizations provided a variety of social service programs to Michigan's lower-income communities aimed at decreasing the impact of high energy costs on working families. MO-CAP is in West Michigan, the Muskegon area and OLHSA is in Southeastern Michigan in the Pontiac area. The residents owned their own homes and were income qualified for this assistance.

The combined SERC grant between the two organizations was $7 million, and each project had a target of approximately 200 plus housing units. The first SERC installations were completed in the late

summer and early fall of 2011. These programs now have most of the installations completed and the grant is finished in spring of 2013.

The Michigan Alternative and Renewable Energy Center (MAREC) worked closely with both organizations to provide technical expertise and training to staff at both MO-CAP and OLHSA. MAREC recently received a grant from the Michigan Energy Office to collect and analyze the data from the Michigan SERC grant installations.

PROGRAM LOGISTICS

Both OLHSA and MO-CAP followed similar protocols in setting up their respective projects. Lists of installers from Michigan were invited to submit their qualifications to each organization. After the qualifications were verified for each type of technology, a request for proposals went to those contractors with successful experience in design and installation of photovoltaic (PV) systems, solar domestic hot water (SHW) and solar hot air (SHA) systems for single family homes. Contractors submitting bid proposals for the single family installations could bid on any or all of the solar system technologies being proposed. Contractors were eligible to install only the systems they were pre-qualified to install and then bid on.

The types of technology, system efficiency, the size of the systems were pre-defined for each organization. For example, all the PV systems for MO-CAP were to be 2.4 kW and the solar thermal equipment had to meet certain SRCC efficiency levels. The bids were accepted for each type of technology at a predetermined system size. Bids received were used to formulate an average aggregate contract award for each given technology. For example, if contractors bid to install a two panel Solar Hot Air (SHA) system and the bids received were, $10,000.00, $11,000, $12,000 and $13,000 the price for that type and size of system was award at $11,500.00 to all the qualified contractors bidding (the aggregate contract awards did make allowances for additional roof work or change orders). Jobs were assigned as they became available and contractors had the time to do them. There was a concerted effort to contract with as many different contractors as possible. At each organization, the costs for the installations had to average no more than $12,000.00 per unit. These systems were installed at no cost to homeowners however; they had to agree to maintain them.

Site assessments were conducted by MAREC, MO-CAP or OLHSA staff to eliminate houses that did not have sufficient solar resources or unsuitable structural elements, and to match the homeowners need with the technology. Resource-wise, SHA was the most flexible technology, as it only needed good winter isolation and solar hot water was next because it is more shade tolerant then PV. Once the solar resources and buildings were assessed for suitability then homeowner's needs were taken into account, for example: homes with residents home during the day; elderly, disabled, or preschool children were matched with solar hot air, large families with high water demands were matched with solar hot water systems, and houses with high electric bills and a good solar window were matched with PV when possible.

MO-CAP installed 78 residential units; 22 PV, 18 SHW, 37 SHA and 3 larger multi-unit systems consisting of 64 units total; 27 units of PV and 37 units of SHW (Fig.1).

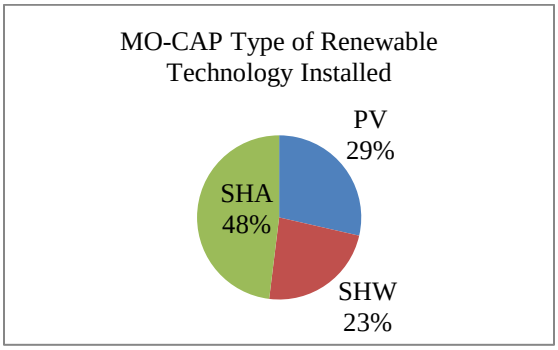

Fig. 1: Type of technology installed by percentage

OLHSA installed 77 residential units; 39 PV, 38 SHA and 2 larger multi-unit systems consisting of 136 units of PV. OLHSA did not install any residential solar hot water systems (Fig.2).

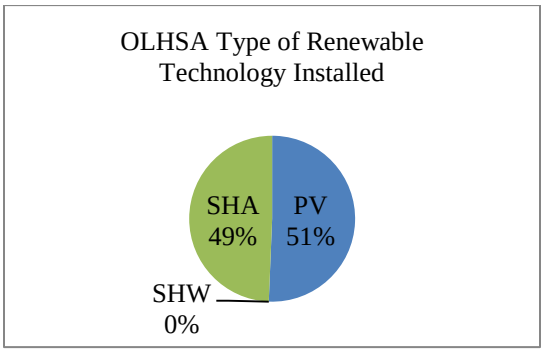

Fig. 2: Type of technology installed by percentage

Homes were selected by MO-CAP and OLHSA from previous lists of weatherization clients, in a few instances the homes were weatherized just before the SERC projects were installed, but in most cases the weatherization was completed 12 to 18 months prior to the systems' installation. In addition to the solar equipment, each system was equipped with data monitoring display either on the equipment in the home or viewable on line.

If they wished, homeowners were shown how to assess and read the data displays. It should be noted that age, education levels and family status of the homeowners were highly varied. Retirees, single mothers, people on disability and family's with one or more adult unemployed or under employed. The education level was not asked, but in speaking with clients during the site assessments, it was not uncommon for education to come up as a topic of conversation.

METHODOLOGY

Residential MO-CAP clients were contacted for a phone survey; there were 26 responses out of the 78 residential unit installations. A series of 10 questions were asked.

The first question asked them to identify the type of system they had, this was used to see if they had basic understanding of the technology installed. Question 2 asks if there were improvements in the utility bills, this was to see if the homeowners' received a monetary benefit, and question 3 followed with to what degree (percent improved) they knew, or thought, savings on the utility bills was. Questions 4 and 5 asked if they had seen "improvements in how your home feels" and if so what they were. Question 4 seeks to establishes benefit beyond monetary and question 5 was for comments on how the home felt better. An example of this would be; if they keep the home warmer than before, more comfortable, or did not run out of hot water as quickly.

Questions 6, 7 and 8 asked about problems with the system and resolution to those problems. This was an opportunity to voice dissatisfaction with the system as a whole or in part. Question 8 asks: Overall how happy are you with this system? Question 10 was for open ended comments, to see if the homeowners' volunteered other benefits such as using the system for social interaction.

For analysis, the technologies of Solar Hot Water and Solar Hot Air were combined into the category Solar Thermal. If there was a positive response to questions 4, 5, or comments identifying additional benefits made in question 10, then it was determined that the home owner perceived some quality of life improvements beyond monetary.

RESULTS

Photovoltaic systems were somewhat easier for homeowners to assess for monetary benefit. The electric utility bills clearly show monthly and year - to - year comparisons. Seventy percent of homeowners stated they had paid less for electricity after the systems were installed. Also the data displays used watt and kilowatts hours, terms most homeowners are familiar with.

Monetary benefits from solar thermal systems were harder for homeowners to ascertain. If they had electric heat or hot water heaters, the savings was be reflected in that utility bill. However, if they had natural gas, propane, or burned wood it was much harder for them to be certain of the amount of savings (Fig.3) also, the solar thermal data displays were in Btu's (a measurement unit that is less familiar). Another factor that may influence perception is that the winter of 2012 was very mild, compared to the winter of 2013. Although solar thermal systems cost savings is much more difficult to observe, 80% indicated they had saved money.

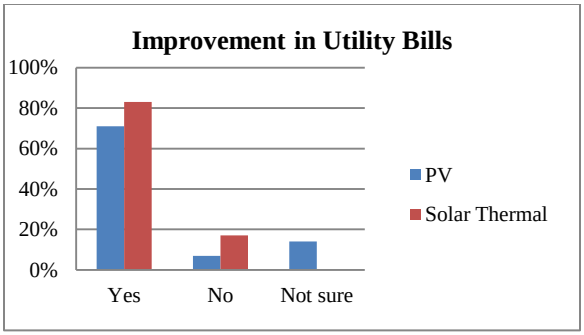

Fig. 3: Percent of homeowners who could determine improvements in utility bills by technology

The photovoltaic systems were generally perceived as having "no problems", although there were comments from three homeowners that the systems were not

working as well during the winter. Problems with the solar thermal system operations were more evident to homeowners. It has not been determined which of these systems are truly not operating properly, and which of the homeowners lack full understanding of how the systems were designed to work (Fig. 4). Several of the solar hot air system owners complained the systems only worked when it was sunny. However, it was determined that one of the solar hot water systems was malfunctioning.

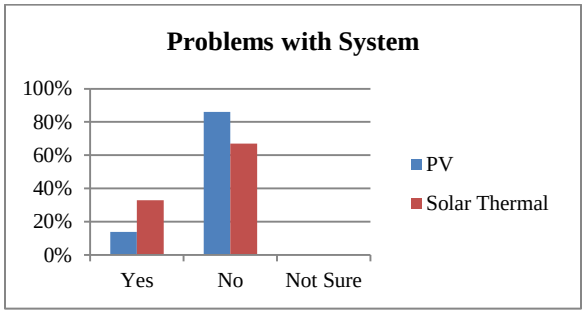

Fig. 4: Percent of homeowners who thought there were problems with their system's operation.

Overall satisfaction was highest for the PV systems. It was easier for homeowners to tell that the systems were functioning and measure how well with the monthly electric bills with 70% indicated they Liked it A Lot. There were no responses that placed PV systems lower on the scale then It's OK. Overall Satisfaction for the solar thermal systems were much more diverse with 50% in the categories of Liked it A Lot and there were responses in every satisfaction category all the way down to Dislike.

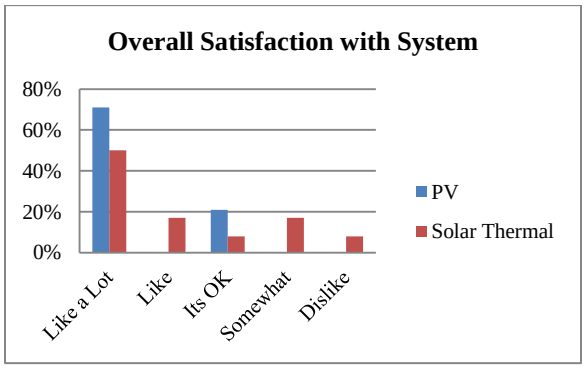

Fig. 5: Percent of overall satisfaction by homeowners

Other Benefits are defined as; increased comfort, social interactions (bragging rights), a sense of environmental stewardship, or increased interest. Increased interest was shown by attending programs on renewable energy, or taking advantage of other education opportunities like borrowing books or resources from MAREC. In the sample of responses 60% of the MO-CAP SERC participates indicated that the renewable energy systems did provide more than just a monetary benefit. One PV owner used his system as a marketing tool for his vegetable stand and one solar thermal system owner started a small business washing table clothes for a catering company, because she had "free" hot water.

It was interesting that, even though the solar thermal systems were more difficult to assess for monetary benefits and more problems with the systems were indicted, the solar thermal systems were thought to provide more additional or Other Benefits (Fig.6). Most often increased comfort was cited as the benefit; the home was warmer or they did not run out of hot water as soon as before.

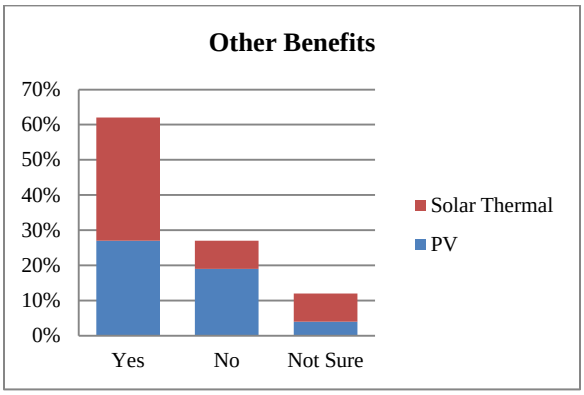

Fig. 6 Percent of homeowners that indicated other benefits in addition to monetary

Social interactions were mentioned several times by respondents, and were counted as a benefit. Homeowners were proud of the systems and showed them off to friends and family. Many of the families attended presentations and educational workshops at MAREC after they had their systems installed. Using the systems as a marketing tool or to start a new small home business was an unexpected, but welcome outcome to the staff at MO-CAP. Environmental or climate concerns were not mentioned.

SUMMARY

The objective Sustainable Energy Resources for Consumers Grants (SERC) was to expand weatherization to "materials, benefits, and renewable and domestic energy technologies" not currently available under weatherization programs. Cost-effectiveness was one of the stated priorities of SERC funding, but are the technologies that were installed appropriate?

Appropriate technology is an approach to technology implementation that is characterized by creative and sound engineering that recognizes the social, environmental, as well as the economic components. The SERC grants were designed to be cost effective, with an average unit installed price of $12,000.00, with return on investment to be five to 15 years. The engineering of systems were designed with to the best management practices available. The environmental benefits of both weatherizing and installing renewable energy systems can be determined with carbon footprint calculators from the data collection.

The most difficult component to identify is social, therefore this study attempted to assess quality of life benefits to these SERC grants. Of course, not all quality of life indictors are of a social nature, but it is a reasonable place to start. Although this study is still in the early stages, it is evident that there is identifiable benefits and value beyond the strictly monetary to renewable energy systems. And a majority of homeowners can readily identify them.

This study is ongoing and updated results will be available at the time of the SOLAR 2013.