QUALITATIVE AND STATISTICAL ANALYSIS OF THE FLORIDA PHOTOVOLTAIC REBATE PROGRAM

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ABSTRACT

The Florida Photovoltaic (PV) Rebate Program, which began in March of 1999, has led to the installation of 52 utility interactive PV systems in seven electric utility service territories. The Program offered $4 per installed DC Watt to Florida electric consumers who installed grid-connected photovoltaic equipment in accordance with a series of quality control requirements developed and administered by the Florida Solar Energy Center. All rebated installations are currently being monitored in an effort to collect statistically significant reliability, performance and cost data on grid-connected PV systems. Funding for this program was provided through a one-time grant from the Florida Energy Office/Department of Community Affairs. Through an arrangement with Sandia National Laboratories and the U.S. Department of Energy, the labor costs of administering the program were covered by the Photovoltaic Southeast Regional Experiment Station. In addition to those inquiries that resulted in successfully funded PV installations, the Program also generated more than 2,000 electronic mail and telephone inquiries during its duration, which did not lead to the disbursement of rebate funds.

This paper will summarize and statistically analyze the physical and economic parameters of those systems that were installed, and will qualitatively assess the barriers to program participation based on a survey instrument given to commercial and residential building owners in Florida who inquired about the rebate program. The results of this analysis are used to gauge the success of the Florida PV Rebate Program and make recommendations for the handling of future rebate programs in the State of Florida.

1. INTRODUCTION

In 1999 The Florida Solar Energy Center (FSEC) received a contract from the Florida Energy Office (FEO) to distribute $525,000 to buy down the cost of grid-connected photovoltaic systems installed in the State of Florida. Funding for this pilot program was provided through Petroleum Violation Escrow (PVE) dollars. The program ultimately resulted in the installation of 52 PV systems, but experienced many administrative and technical stumbling blocks along the way.

2. INITIAL PROGRAM MODIFICATIONS

At the program's inception, residential and commercial customers were offered $2 per nameplate rated Watt up to a maximum of $8,000. This initial offering resulted in the installation of 17 systems over a period of 2 years. 13 of these systems were part of a $100,000 lump sum award to a municipal utility, JEA, for PV systems on schools. During this period, FSEC received few inquiries about the program and most applications were the result of utility partnerships.

2.1 Financial Revisions

In June of 2000, FSEC raised the rebate amount to $4 per Watt and set a maximum of $16,000 for residential systems and $40,000 for commercial system. It also added an additional rebate of $2,000 for systems installed on model homes. In addition, FSEC began publicizing the program via press releases to news media groups throughout the state. These modifications greatly enhanced consumer interest in the program. This interest was signified by a tremendous increase in the number of rebate inquiries received via telephone and electronic mail each month.

The program also initially included a cap on the price allowed for rebate systems of $7 per nameplate Watt, but this idea met with severe opposition from the Florida Solar Energy Industries Association (FLASEIA). For this reason, FSEC removed the cap. The program did, however develop and enforce a number of quality assurance measures to protect the consumer and ensure access to meaningful performance data.

2.2 Quality Assurance Improvements

Despite initial negative feedback from PV industry members, FSEC enacted a series of quality assurance measures that were required in order to receive funding through the Florida PV Rebate Program. These requirements were molded around FSEC's Florida Photovoltaic Buildings Program as shown in the figure below. The most vital of these measures are the design review and approval process, the authorized installer list and the FSEC system acceptance test.

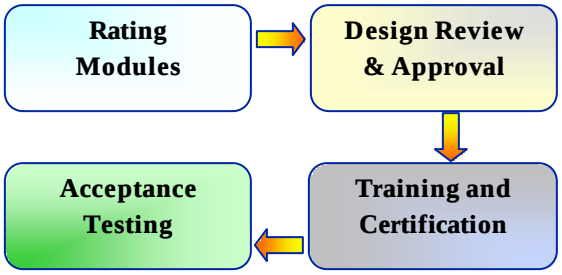

Fig. 1: FSEC Quality Assurance Program

The design review and approval process ensures that systems being installed through the rebate program meet all appropriate building and electrical codes and standards. This process encouraged PV manufacturers and systems integrators to produce high quality "packaged designs" that could be purchased by any consumer. These packages eliminated some the time and guesswork required in selecting PV system components and piecing together a workable design.

The value of this process is apparent when reviewing installed system costs for the program. The average system price for a packaged design with a standard roof mounted configuration was $7.56 per Watt compared to an average price of $11.93 per Watt for those systems that required customization.

The authorized installer list also greatly increased the quality of system installations through this program. This requirement compelled licensed solar and electrical contractors to take the FSEC PV installer authorization exam, which decreased the probability of failures due to improper equipment installation.

The program was eventually able to provide rebate applicants with a list of state-licensed contractors that have hands on experience with grid-tied PV systems. Initially, many program participants had difficulty locating qualified contractors. By the end of 2001, however, FSEC's list of qualified PV installers gradually grew from just a handful to more than 20.

Acceptance tests served a similar function. Like the installer authorization examination, the acceptance test greatly decreased the likelihood that the newly installed PV system would experience a failure due to improper installation. The acceptance test was the last line of defense for the program and was required in order to receive the rebate check.

FSEC field technicians were also able to identify any performance hindrances such as shading or faulty components equipment via field-based performance measurements and visual inspection of the site. Identification of these problems prior to system start up would allow modifications to be made to the system or the site.

3. PROGRAM RESULTS

The Florida PV Rebate Program resulted in the installation of 52 different systems throughout the state. Nearly half of all systems were on residential buildings as shown below in Figure 2.

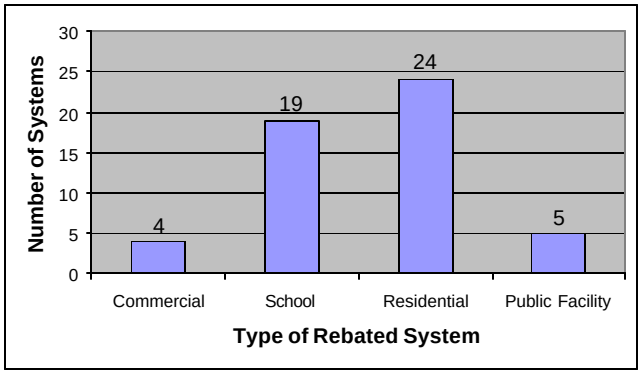

Fig. 2: Types of rebate systems installed.

A total of 170 Kilowatts of PV was installed during the program. The total value of these systems is $1.73 million dollars, with $516,000 funded through the rebate program. On average, the rebate program contributed 39% of the total installed system cost of each system.

As part of the rebate application process, applicants completed a cost summary sheet. This sheet allowed FSEC

to track equipment costs, interconnection and permitting fees, as well as installation and design costs separately. Statistical summaries of installed system costs are provided in Table 1.

The average installed cost for rebate systems was $9.73 per Watt. The population values were slightly skewed right with a median value of $9.91 per Watt. Equipment costs made up approximately 75% of the total installed costs with an average price of $7.15 per Watt. Labor costs averaged $2.38 per Watt and comprised approximately 25% of the total installed cost.

TABLE 1: INSTALLED SYSTEM COST SUMMARY STATISTICS

	$/Watt
Mean	**9.73**
Median	**9.91**
Standard Deviation	**3.08**
Range	**14.03**
Minimum	**5.09**
Maximum	**19.12**
Count	**N=52**

Labor costs varied significantly for the systems installed. The range of labor costs was $.17 to $14.71 per Watt. The average cost for labor was $2.38 per Watt. The differences can be attributed to a number of factors including:

- Custom system versus packaged system
- Self-Installation versus solar contractor installation
- Roof Mounted versus pole or other mounting configuration

The range for equipment costs varied much less than range for installation costs. Prices per Watt ranged from $3.96 to $11.58. The lower values can be mainly attributed to bulk purchasing from equipment manufacturers by electric utilities.

4. THE PV REBATE QUESTIONNAIRE

In February of 2002 FSEC released a PV Rebate Consumer Satisfaction Questionnaire. The purpose of this survey was to identify and remove barriers to program participation and revise the program's funding levels and requirements to better meet the needs of potential applicants.

Questionnaires were emailed or hard mailed to any person that made an inquiry about the rebate program through January 2002. Overall, 900 surveys were distributed and 82 were completed and returned to FSEC. A willingness to pay for PV question was included in the survey and the results are shown in Figure 3. The most popular response to the WTP question was $4 per Watt.

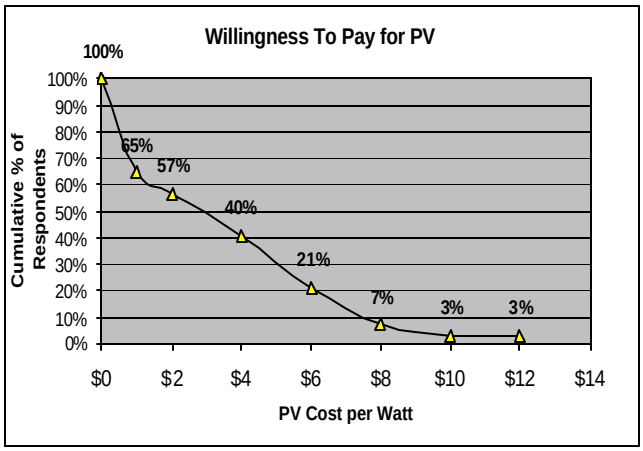

Fig. 3: Consumer willingness to pay for PV survey results.

Question number three of the survey dealt with barriers to participation in the rebate program. The initial price of PV equipment surfaced as the most hindering barrier among respondents, followed by obtaining an interconnection agreement and locating an FSEC-approved installer.

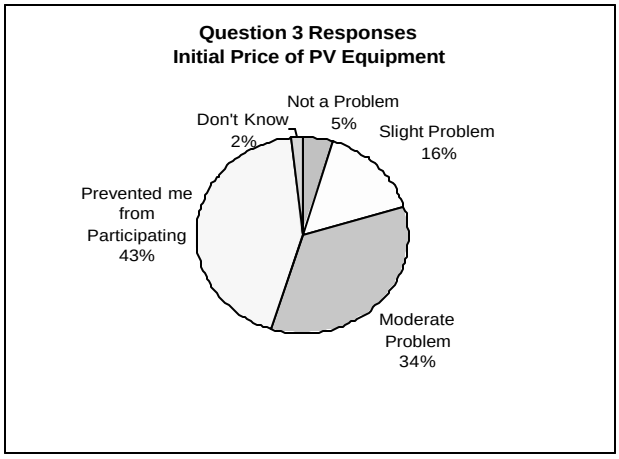

Fig. 4: Survey response to barriers to program participation.

Questions four of the survey asked about the perceived benefits of owning a PV system. Of the potential benefits provided, those that were considered "very important" by the majority of respondents included:

- PV's role in conserving natural resources (73%)
- PV's ability to reduce monthly electric bills (69%)

- PV's ability to reduce dependence of foreign oil (67%)

Question 5 of the survey discussed methods of providing alternative financial incentives for purchasing a PV system. The most popular financial incentive for purchasing a PV system was receiving $.05 per KWH over retail for power fed back to the grid (in place of net metering). Receiving a federal income tax credit, and qualifying for a zero interest loan to cover PV equipment and installation costs were also popular choices. Property tax exemptions and net metering were also listed as "must haves" by the majority of respondents.

Of those who responded to the survey, 80% were married, 94% were male and 64% had at least a bachelor's degree. Just over 30% were employed in professional occupations (doctor, lawyer, etc.). The most common household income bracket provided was $100,000 to $149,999, followed closely by the $40,000 to $59,999 bracket. Fifty percent of those who responded were in the 26-49 age category, followed closely by 50 to 64 year olds at 42 percent.

5. CONCLUSION

Overall, the Florida Photovoltaic Rebate Program has been a success and a valuable learning experience. It prompted the installation of 52 PV systems in the State and clarified some of the current barriers to creating a sustainable PV market in the United States. Operational data from these systems will provide FSEC and others with valuable insight about where efforts should be focused on making improvements in the solar industry.

The information gleaned from this program will also provide a roadmap for plotting potential future cost reductions for PV. Based on the vast range of installed systems prices (some as low as $5.09 per Watt), significant cost reductions for this technology are achievable in the near term. Increased use of pre-designed packaged PV systems and a more experienced and competitive labor force may play a mammoth role in meeting cost reduction goals.

The program will also provide a clearer understanding of the types of policies and infrastructure-building activities that are needed to create a sustainable solar industry in Florida.