7.0 SURVEYS

The final means of gathering information regarding the performance of the SWAP program is the use of qualitative surveys. Rather than emphasizing performance related issues, these surveys were meant to provide some general information regarding low-income households and also to provide some feedback regarding the solar system. Information from the surveys could be used to address the following:

Perceptions of the solar system.
Problems with the solar system and/or installation.
Compare perceived savings and usage with actual savings and usage.
Identify changes in the household.
Indicate general information about households receiving SWAP systems.

This information could be used to improve a full-scale implementation of SWAP.

7.1 SURVEYS: IMPLEMENTATION

Creation of a survey form and cover letter was the first step of the survey process. The survey form addresses the following categories of information:

Household occupancy.
Water usage patterns.
Perceived savings of the solar system.
Satisfaction with the solar system.
Amount of hot water available.
Other WAP measures taken.
Use of air conditioning.
Understanding of the solar system.
Usage of anti-scald valve and/or water heater on/off switch.
Receipt of owner's manual.
Additional questions and/or comments.

A copy of the cover letter and survey form is included in Appendix 14. These surveys were mailed (or filled in during an inspection) to all participants in the SWAP program after the systems had been installed for at least one year. The responses from the surveys were entered in to the SWAP database.

7.2 SURVEYS: RESULTS

In general, the surveys indicate satisfaction with the solar systems and the realized energy savings. There are several issues that these surveys have revealed that should be included for future programs. The results documented here sample the more significant points of the survey responses. The details of all the responses are indicated in Appendix 15. Thirty-seven percent of the surveys were returned, yielding a good sample of information from the participants. In general, the results follow the survey form; some items, which have been used for administrative purposes, are not indicated here.

In response to "Are you satisfied with your solar system?"

77%	Responded Yes
14%	Responded No
9%	Responded Somewhat

Of those not satisfied with their systems, the top four reasons were:

29% No energy bill savings
22% Not enough hot water
6% Run out of hot water
6% Water is not hot enough

This indicates that water quantity accounted for 1/3 of the dissatisfied participants, although it is unclear whether the existing system would have elicited more or fewer complaints.

In response to "Do you see any reduction in your utility bill since the solar system was installed?"

63% Responded Yes
15% Responded No
22% Responded Can not determine

Of those indicating yes, the average monthly reduction was $24.38. This figure is approximately twice the average savings projected from the hard monitoring phase.

In response to "Do you have more hot water than you had before the solar system was installed?"

44% Responded More
31% Responded Same
16% Responded Less
9% Responded Sometimes

Of those not responding more, the following top 4 reasons were given:

22% More hot water in summer and less in winter
18% Not enough hot water when there is no sunlight
18% The amount of hot weather depends upon the weather
14% Run out of hot water

These results indicate that the occupants observe the weather-sensitive nature of the system, but are not satisfied when the auxiliary heater cannot keep up with demand.

In response to "Do you use more hot water now that you have the solar system?"

21% Responded More
65% Responded Same
11% Responded Less
2% Responded Sometimes

Of those responding to all except "Same", the following 2 reasons were given:

75% Would use more hot water if water was hotter (3 responses)
25% Added other appliances that use hot water

The first result is non-intuitive. Perhaps this indicates dissatisfaction with the amount of water available. Note that there were few responses to this question and the responses were mixed.

In response to "Is the water hot enough?"

76% Responded Yes
14% Responded No

10% Responded Sometimes

Of those not responding “Yes”, the following top 3 reasons were given:

50% There is more hot water in summer and less in winter
17% There is not enough water when there is no sunlight
17% No reason given

The responses to this question (and also the general satisfaction) indicate that the majority is satisfied with the water temperature. However, a significant minority feels that the temperature is too cold and too easily impacted by the weather. In many cases, the simple solution to this problem is to increase the temperature of the bottom heating element, although this will reduce solar performance, especially for the active systems.

In response to “Is the water too hot?”

3% Responded Yes
90% Responded No
7% Responded Sometimes

Due to an error in the survey form, the only detailed response of interest was “The hot water took to long to arrive.” From these responses, the overheating of water does not appear to be a big problem.

In response to “Does your solar system have an on/off switch at the water heater for turning the electricity to the water heater on or off?”

36% Responded Yes
23% Responded No
41% Responded Don’t Know

Note that the 41% response to “Don’t know” emphasizes the need for systems to operate with a minimal amount of user intervention.

In response to “If you have this on/off switch, do you use it?”

63% Responded Yes
37% Responded No

Of those responding No, the following 2 top reasons were given:

64% Don’t know how to use the switch
14% There is not enough hot water when the sun does not shine

This response indicates the need for explanation of the system operation and availability of an owner’s manual. The second response indicates the limitation of this switch.

In response to “Does your solar system have an anti-scald valve installed?”

19% Responded Yes (43% of these actually have an anti-scald valve)
9% Responded No (0% of these actually have an anti-scald valve)
73% Responded Don’t know (23% of these actually have an anti-scald valve)

Of those responding “Yes”, how many know how to adjust the valve:

11%	Yes
89%	No

These results indicate that few users are aware of this device or function.

The surveyed participants were also asked to rank water usage for the top three times of usage. The total count indicates those results:

5-10 Hrs.	160
10-12 Hrs.	80
12-15 Hrs.	71
15-18 Hrs.	137
18-21 Hrs.	191
21-24 Hrs.	110
0- 5 Hrs.	11

In general, the self reported water usage matches the measured profile: The measured peak was from 8-10 PM during the self-reported peak. The minimum was reported in the same time period as the measured minimum. The reported peak appears to dip more than the measured peak, but this may be because only the top three choices were offered.

In response to “Does the solar system inconvenience you in any way?”

6%	Responded Yes
84%	Responded No
10%	Responded Sometimes/Somewhat

For those indicating that the system did or sometimes inconvenienced them, the following 2 top reasons were given:

63%	When no hot water is available
32%	Water does not get hot

This question reaffirms the importance of the amount/temperature of the delivered hot water temperature. Note that no maintenance, operation or aesthetic issues were raised, indicating that these issues were not significant for this group. Overall, few were inconvenienced by their systems.

In response to “Is your system presently working in a satisfactory manner?”

78%	Responded Yes
22%	Responded No

For the “Yes” responses, the reported ways of knowing are:

61%	Plenty of hot water
22%	Appears to be working
6%	Electrical bill has been reduced

For the “No” responses, the reported ways of knowing are (5%=1 response):

14%	No hot water
14%	Run out of hot water
14%	Can’t tell if system is working

10% Water is not hot enough
10% Not enough hot water
5% Water is not hot enough when no sun
5% Water hotter during daylight hours
5% Pump is always running
5% Doesn't know how it works

Both of these questions indicate that there is little correct understanding of how the system responds when it is or is not working. In many cases, these responses indicate a symptom that may or may not exist and a problem that may or may not exist. Unfortunately, diagnosing problems can be difficult without a full understanding of the system operation. Without this knowledge, system failures may not be recognized and rectified.

In response to "Do you understand how the solar system works?"

69% Responded Yes
31% Responded No

In response to "Did the solar installer explain to you how the system works?"

74% Responded Yes
26% Responded No

In response to "Do you know how to check to see if your system is working?"

33% Responded Yes
67% Responded No

The results illustrate that many think they know how the system works, but to the system working question, only 15% gave credible answers regarding checking system operation.

In response to "Do you have the owner's manual that explains how the system operates?"

54% Responded Yes
46% Responded No

"If Yes, Have you read the manual?"

54% Responded Yes
44% Responded No

This is a very high rate for reading manuals. All of the participants should have received a manual, although some of them may have been lost.

In response to "Do you have any questions about anything you have read in the manual that you do not understand?"

71% Want an owner's manual
12% Want to know how to use on/off switch

These responses reaffirm the number without an owner's manual and the lack of understanding about using the on/off switch.

In response to "Have you had any problems with your solar system?"

19% Responded Yes

81% Responded No

In response to “Do you have the name and address of the solar installer?”

59% Responded Yes
41% Responded No

This information is required by the system certification on the tank and in the owner’s manual and is useful if any problems develop or routine maintenance is required.

In response to “Does your house have an air-conditioning unit?”

30% Have a window/wall unit
67% Have a central air unit
3% Have no air conditioning

Although the interest for this weatherization option is water heating, the air conditioning has a large impact on the analysis of the utility bill data. Clearly, this survey shows that air conditioning is present in most (97%) of the homes that participated in the weatherization program. This is contrary to the belief that low-income residences do not have air conditioning.

In response to “Do you have any other questions or comments regarding the solar system?”

17% Want an owner’s manual
17% Don’t know how the systems work
10% Have inquiries about the system
10% Don’t know how to use the on/off switch
10% Have no questions
7% Expressed their appreciation for the solar system

These responses indicate that having the owner’s manual with adequate explanation about the system and its operation would have eliminated most of the questions. A positive aspect is the voluntary expression of appreciation.

Overall, the results of the surveys indicate several key issues that should be addressed for any future work:

- There is a high degree of satisfaction with the solar systems. Perceived energy savings were double the average measured savings.
- The most often mentioned shortcoming is low water temperature/lack of hot water supply when the solar is not in operation.
- Many participants lacked an owner’s manual that should have been provided.
- Many participants are interested in how the system operates, but have little information to this effect.
- The indicated ability to evaluate system operation is low. This may be from the fact that the participants do not have an owner’s manual, or the owner’s manual does not contain this information.

8.0 CONCLUSION AND RECOMMENDATIONS

The development of the SWAP program has involved many activities, including system type selection, system sizing, training, hard monitoring, soft monitoring, inspections, and surveys. Much data have been acquired and many lessons have been learned. This wealth of information provides a stepping point for the following recommendations. These recommendations are meant to address the findings from this

program and how they can be used to improve upon this implementation of SWAP into the standard WAP program.

MONITORING RESULTS

The hard monitoring phase of the SWAP project yielded much data, denoting an overall SIR of 1.0, indicating the viability of SDHW as a weatherization measure in Florida. The data also showed that the low-income families tend to have peak water usage from 8-10 PM with a continual hourly average use throughout the daylight hours. This indicates that the application of solar to low-income residences is particularly beneficial to the residents and also to the functioning of the solar systems. Although there was considerable scatter to the data, a general guideline is that a minimum pre solar energy consumption of 3,100 kWh (10.6 MMBTU), or a minimum flow rate of 60 GPD will achieve sufficient savings to justify this as a weatherization option. Because reported occupancy data appear to have been at times questionable, the use of some type of short term monitoring of a proposed weatherization site would be recommended. The calculation of the SIR for NEAT could be improved by the inclusion of an estimate of maintenance that is necessary for many appliances, including SDHW systems.

As part of the evaluation of the hard monitoring, F-Chart was used to compare measured and simulated energy usage. The results indicate that the average measured active system energy usage was more closely matched to the F-Chart average predicted energy usage than the ICS average measured energy usage was. A re-examination of the F-Chart program would be useful to explain this difference and the different system type prediction trends indicated. Additionally, F-Chart cannot be used to model more complicated systems that are be encountered (such as PV powered pumps, timers, mixing valves, etc.).

The system sizing criteria indicates an overall agreement with the targeted goal of 50% solar fraction. However, examination by climate zone indicates that 0% of the systems in the Northern zone, 54% of the systems in the Central zone, and 100% of the systems in the Southern zone met this goal. Improvements to the sizing procedure would include sizing the system by load. Additionally, the use of a sizing range would optimize SIR for the systems.

The soft monitoring program was set up to determine if energy savings from SDHW could be evaluated through utility bill analysis, rather than through the more expensive and time consuming process of instrumented monitoring. In general, the results from this analysis were inconclusive on a statewide basis. Even with expanded site selection criteria, fewer than 2/3 of the selected sites had acceptable fits for calculating savings. The state comparison indicated no agreement between the hard monitoring and soft monitoring savings. Although no one problem was identified, several theories were indicated, including undocumented occupant changes intermittent heating usage, and summer seasonality effects. One indicated improvement to the PRISM program is the ability to de-select poor reference temperatures for the automated model selection mode. It is possible that this may have improved some of the fits. Based upon these problems, there is not sufficient evidence to rely upon soft monitoring for measured savings of solar domestic hot water system retrofits.

SYSTEM TYPE SELECTION

One issue of particular concern is if the selection of system types was appropriate and cost effective for this particular application. In general, the active systems did well in Southern Florida, and the Passive systems did well in central Florida. The passive systems in Northern Florida had low performance, with no SIRs above 1.0, due to the cooler winters and higher installation costs. Overheating did not occur on any of the systems. Freeze damage occurred on only one active system (which led to an adjustment of the installation of system types in a small region.

Overall, the ICS systems seem to be the best systems for low-income clients in central and southern areas. ICS systems are so simple in their operation that client interaction is truly not required. There are no moving parts that can malfunction. Ancillary valves, such as air vents and freeze prevention valves,

are not necessary on ICS systems installed in Central and South Florida thereby reducing further component use and possible failure. (Of course, ¾" copper piping and ¾" thick pipe insulation should also be used for piping freeze protection.) The other valves installed on this system are the isolation and drain valves, which are unlikely to cause any trouble during the lifetime of the solar system. The only other valve required is the collector loop pressure relief valve, which also is quite trouble free. Therefore, excluding the air vent and freeze valve leaves one with a system that is basically service free for the lifetime of the ICS unit. There is truly no system owner interaction required with these units.

Experience with variations of active system type indicates that certain variations and/or components should be re-examined for use with low-income clients. One of the variations of the active system was the use of a timer instead of a differential controller to reduce installed cost by approximately $100. Inspections of this system indicated that the system's bottom feed/return fitting can be crimped during some installations. This seems to occur primarily when installed on those water heaters that have a convex bottom that blocks the fitting's long input nozzle. Several systems also exhibited what appeared to be airlock problems. Both of these problems severely hindered system performance.

Another problem was that the timers were accidentally or incorrectly re-set, leading to the problem that the systems were not operating properly. In addition, after one year, the timers' back-up batteries need to be replaced. If the batteries are not replaced and eventually expire, the operation set times will be inadvertently changed during power failures. Very often, the installer did not leave timer instructions with the client. Routine inspection of timer systems revealed that the SWAP clients did not know how the timer operated or even that batteries had to be replaced.

Since these systems do require periodic checks to make sure that the timers are still set accurately and require an annual replacement of the timer batteries, unless the clients are willing to devote time and energy to these systems, these may not be the ideal systems for low-income clients.

FSEC inspections also revealed that several differential controllers had somehow been disconnected from the AC power source. This, of course, left the solar system owner with an inoperative system. FSEC also had to replace several controllers as well as sensors that had failed.

These examples serve to emphasize that solar systems used in low-income residences need to be as simple as possible, have a minimum number of components, and require no client interaction.

Another system variation was the use of an on-off switch on the water heater of active systems. As indicated by the monitored data, these switches have the potential to dramatically increase performance, although they were most utilized by the families having small water heating loads and an SIR less than 1.0. They do add some complication and $30-50 to the system cost. They were also often not understood nor used by the majority of homeowners. Although these switches can be useful, they were not found to help high energy use homeowners (the ones with SIR's greater than 1.0) save significant amounts of energy.

Anti-scald valves were required on all active systems as a safety device. Concern leading to the use of these valves centered around the number of small children and elderly clients that could possibly forget to temper the water during hot water draws. The valves are self-adjusting, allowing one to regulate the temperature of the water entering the house. The maximum allowed hot water was 140^0 F at the highest setting. (Settings ranged from 1 to 4, 4 being the hottest.) Most installers set the anti-scald valve at either the 3 or 4 setting. Some clients did not like the valve since it constricted the input of very hot water, which at times they desired.

During inspections on systems that had been installed for at least one year, FSEC staff noticed that some valves became stuck and that quite some force and the use of large pliers were required to turn the valve's adjustment knob. Residents were informed by FSEC that they should exercise the adjustment knob every several months to prevent the valve mechanism from becoming stuck due to hard water calcium build-up, etc. Nevertheless, FSEC also inspected many other systems where the valve was not stuck. Undoubtedly, the condition of the local water has much to do with this.

The need for anti-scald valves is debatable. No clients have reported that they were scalded when using hot water. This includes numerous sites that FSEC inspections revealed no valve had been installed. The valves were installed only on a few of the ICS systems. No scalding problems were reported. The valves do operate quite well when they are new, but only time will tell how many fail due to scale build-up on the inner components of the valve. (FSEC has been advised that the inner mechanisms of the valve are now being manufactured with a Teflon coating in order to prevent possible sticking of the inner components due to scale or other build-up.) Exercising the valves would undoubtedly prevent this from happening, but unfortunately, once again, many clients cannot be expected to provide any type of simple maintenance or interaction with the solar system and its components.

The current building codes (Southern Standard for Florida) are now requiring anti-scald protection for showers; this does not necessarily imply that the solar system requires this device, but concerns of liability may have an influence on this decision.

In regards to when the solar systems should be installed, future program managers may consider conducting solar installation programs during slow periods of the year for solar installers. This is usually during the spring and summer months. The busy season is usually during the cooler months, when solar pool heating systems are being installed. This would provide quicker installations as well as a niche market for the solar industry during their slower periods.

INSPECTIONS

The inspection program was implemented to verify initial installed quality and to verify the quality of SWAP agency inspections. In general the results indicated that the inspections were critical in verifying that the highest quality of workmanship was being used to install the systems. The FSEC inspections showed that few critical problems had been missed and most systems were working fine. However, smaller problems were present at some of the sites.

It is clear that not all of the sites were being adequately inspected by the local agencies and that the quality of installation varied by contractor. This indicates that an on-going program to assess contractor installation quality should be evaluated and that local inspections are critical to getting proper installations. An initial evaluation of component operation indicates that relatively few component failures have occurred.

System approval means little without inspections. System installation inspections are a must for any successful program. All solar collectors and solar systems, including the major equipment used, are certified by FSEC. This ensures that the equipment that is being installed in the field is suitable for that particular system. Unfortunately, FSEC can not currently verify the installation process, as this occurs only when a system is being installed. This is the cause of the majority of discrepancies that have been observed in the field. As stated in the report, since a solar system includes a variety of components, installation steps, and tasks that overlap electrical, plumbing, and roofing disciplines, installers must maintain high levels of workmanship and attention to many details during installations. A successful program requires conscientious inspections of all installed solar systems.

Some type of modularization of system components and/or subsystems would greatly reduce the possibility of errors and improper installations. Modularization is often complicated due to the individual layouts of various water heaters, attics, and roof structures. Nevertheless, work toward that goal should be accelerated.

WATER QUALITY

An unexpected finding from this study centers on water quality. Water heater and solar system manufacturers have known for quite some time that there are areas through Florida and other states that pose specific problems due to local water conditions. This became quite obvious during the course of the SWAP program, since several system problems occurred that were the result of poor water quality. In the

future, solar program developers need to be aware of the condition of the local water supply before initiating a solar program in specific areas. This could reduce problems and often exorbitant water and metals analysis costs incurred while attempting to isolate the problems. Very often, a simple pH and TDS meter will suffice to provide suitable information.

PERMITS AND BUILDING DEPARMENT ISSUES

Local building departments need to adopt FSEC's solar equipment certifications and installation methods. Both FSEC and several installers had problems with local building department officials who did not have a firm grasp of solar and did not seem interested in being informed of proper industry wide standards and procedures. The two major problems were in Dade and Pinellas Counties. The Pinellas County problem has been described in the report. Basically, it centered on having to provide structural engineering drawings for each installation. This would have made each installation quite cost-prohibitive. Pinellas County building officials were quite open to meeting with FSEC and interested in resolving this issue. And indeed, the issue was resolved by requiring one type of collector mounting that was applicable to all sites and precluded structural certification requirements for each individual site.

This, unfortunately, was not the case in Dade County. Dade County officials did not accept FSEC and the solar industries' recommended roof penetration sealing methods. Instead, they required a method that did not provide as positive a seal as that recommended. There is a need to educate code officials about solar systems and the available standards and certifications that can make solar approval easier for them and the contractors. This will, of course, also greatly affect the quality of installations.

PARTICIPATING AGENCIES

The majority of agencies participating in the SWAP program were quite enthusiastic about the program potential for their clients. Their enthusiasm for the program and the anticipated savings to their clients carried over to the clients themselves, who were quite eager to obtain these systems. Choosing residences for solar installations was often somewhat frustrating. Although a family may have qualified economically, an inspection of the residence would at times reveal that there was insufficient solar access for the solar systems. Agency staff had to work that much harder to identify enough clients to meet the goals of the program. Nevertheless, the clients that received solar systems and saw the savings that resulted often rewarded the agencies with shows of gratitude.

SURVEYS

The final phase of the program evaluation was the surveying of the recipients of the solar systems. This stage was meant to assess the recipient's perceptions of the systems and perceived savings. In general, the results were positive, but they did indicate several things that could be done to improve the program quality. Among these were that the auxiliary tank temperature and/or volume needs to be large enough for the anticipated load (in many cases raising the lower tank temperature solves this problem), an owner's manual needs to be left with the homeowner (a current requirement), and greater information about system operation needs to be explained to allow for system troubleshooting.

Among other facts gleaned, was that the perceived savings of the solar system were twice the average measured savings and that 97% of the surveyed homes had some type of air conditioning.

CLIENT SELECTION AND INTERACTION

Future low-income solar programs should strive to use clients that have high energy bills (LIHEAP participants, etc.), high verified occupancy levels and use more than 60 gallons of hot water per day (3100 kWh per year). Generally, without using a large amount of hot water, the system will not save enough energy to be cost effective. Unfortunately, determining water consumption can only be done by monitoring actual water usage with a flow meter. This in itself is costly and may include invasive methods. The use of a clamp-on ammeter that totalizes for a short period of time (e.g. one week), could be used along with voltage to project annual energy consumption instead of using a flowmeter.

Low-income clients should be made more responsible toward understanding what the solar system does and what maintenance or periodic checks should be taken. The system should be seen as a personal investment. The client must have some type of interest in the system. Perhaps attending some type of educational seminar on the system, its method of operation, and what the homeowner needs to be aware of, would be beneficial. Unfortunately, FSEC has noticed that many clients do not care to become more aware of the system's (and ancillary components', such as anti-scald valves, and water heater on/off switches) requirements.

Selecting participating agencies and clients from urban areas lowers installation costs related to logistics and provides greater access to certified solar installer and technicians. In addition, and if possible, it is beneficial to select residences that are in the same neighborhoods, or at least close to each other, so that installers can conduct several installations during the course of a day.

EDUCATION AND TRAINING

A client education program must be established for future programs of this type. Without proper instruction, which it seems the solar installer or local agency did not always provide, system owners do not fully understand how the system operates, and more importantly, what such components as the anti-scald valve and water heater on/off switch are for. In some cases, the clients did not even have a system operation manual or the name and telephone number of the installer! FSEC and local staff attempted to educate the clients during system inspections. Explanations were geared for the specific client and often written instructions were left for future reference. Many times, one could tell that the clients were intimidated with this new technology and perhaps created an understanding block simply because they were afraid that they could not understand it. FSEC recommends that in future programs, simple owner's manuals and ancillary system information and instruction handouts be developed separately from the basic solar manufacture's owner's manual.

System inspections reveal that there is a need for additional training of the industry as well as building department officials and their inspectors. Although the quality of equipment that is being installed is of good durable quality, the primary deficiencies are those centered on the installation. As previously stated, solar systems are made up of many components, each of which must be installed separately. Therein lie many of the causes for a variety of the problems that have been encountered. For example, air vents were not always installed in a true vertical position, freeze valves were not installed according to the manufacturer's recommendations, exterior pipe insulation and sensor wiring were improperly installed and not protected from ultraviolet ray damage, etc. Without proper training and education, this will continue.

POST INSTALLATION

Pre-funded routine inspection and periodic maintenance of installed solar systems should be part of future low-income solar system programs. System checks every two to three years are recommended. These would identify any potential problems as well as correct minor discrepancies, such as degraded exterior insulation, leaking valves, etc. The majority of these minor discrepancies could be corrected on the spot. In addition, for those systems that are inoperative, the systems could be fixed and thereby prevent the waste of previous investments.

A long-term study needs to be developed to obtain accurate information on long term operation, maintenance requirements, and maintenance and repair costs of these types of solar systems. FSEC has developed an extensive database of all 801 installed SWAP systems. FSEC staff members have also developed a good rapport with the clients, and would be quite amenable to conducting this long term study, funds provided.

Since all SWAP clients have back-up elements on their electric water heaters, which will provide hot water even if the solar system is not working, they, in general, will not pay to fix a system as long as they have hot water. Also, many "can not" pay to have the system repaired due to their income restrictions.

This very quickly destroys the gains made by the installation of the solar water heating system. Thereby, we need to have a follow-up program to check these systems. A basic operational check of a SWAP system should take no more than 30 minutes. Very often, the required adjustments on problem systems are very minor and can be completed in as short a time, depending on the task.

Overall, the SWAP pilot program was a success. Documents and methods were developed to implement a program that showed the viability of solar water heating as a weatherization option in Florida.

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