Kotzebue Electric Association
Solar Thermal Alternative Residential Heating Methods
Quarterly Report
12/29/2011

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Funding

Denali Commission	$127,000
KEA[1] In-Kind	$5,000
CETF[2] In-Kind	$12,000
Total	**$144,000**

Heliodyne Flat Plate Solar Collector.
Jesse Logan (KEA).

Project Summary:

This project will assess the feasibility of solar hot water heating systems on residential units in the NANA Region of Kotzebue. The Kotzebue Community Energy Task Force (CETF) had identified up to ten (10) Elders homes which are most in need of home heating assistance. System design and budget were considered for each home as well as southern exposure. After detailed review of designs and costs six (6) homes were identified to serve as test sites where solar-thermal systems, some using flat plate and some using evacuated tubes, have been installed (see figure below for manufacturer, installation contractors, collector type and system type). If the technology proves feasible above the Arctic Circle, these systems could be installed in homes throughout the region and serve as a model for alternative methods to heat homes without the use of fossil fuels.

[1] Kotzebue Electric Association
[2] Community Energy Task Force

Manufacturer	Installer	Collector Type	System Type
Viessmann	SES	1 evacuated tube	DHW
Viessmann	SES	2 flat plate	DHW
Heliodyne	ABS	1 evacuated tube	DHW and Space Heat
Heliodyne	ABS	2 flat plate	DHW and Space Heat

A. Administration, Management, and Reporting

KEA is responsible for the short- and long-term management, operations and maintenance of the solar thermal systems, in cooperation with CETF, NIHA[3] and NANA[4]. The Alaska Technical Center will have the opportunity to offer hands on training of the operation and maintenance of the installed systems, however only peripheral discussions have taken place so far. No students were available during installation. Additionally, the Chukchi Campus, a University of Alaska satellite campus, has recently developed a renewable energy training program. While no classes were offered at the Chukchi Campus during the semester of installation, discussions have taken place with program directors regarding a possible role for Chukchi's long term involvement with data collection and analysis.

B. Progress Update

The data from both Veissmann and Heliodyne control systems are recorded in 3-5 second steps. There are gaps in the annual 3-5 second step data for the Heliodyne systems. However, the annual totals are complete. There has been no loss of data on the Veissmann systems, though acquisition has proved to be hit or miss.

At present four (4) of the six (6) systems are operational. Due to technical issues acquiring data from the different system's data loggers the Heliodyne systems were slated be connected to WiFi internet for remote access. However, after severe wind damage occurred to two (2) of the Heliodyne systems the WiFi connection was put on hold.

[3] Northwest Inupiaq Housing Authority
[4] Northwest Alaska Regional Native Association

In November of 2011 a severe winter storm hit the west coast of Alaska causing damage from Nome to Kotzebue. Recorded winds were above 70 miles per hour in the Kotzebue region. While both the Viessmann and Heliodyne systems are rated for wind speeds in excess of 100 miles per hour severe damage occurred to two Heliodyne flat plate collectors- one collector on two different systems (see pictures below). A wind loading analysis was done by ABS and found no fault in the installation site, placement, or angle. The orientation of both of these collectors is within 5 degrees of due south and the strongest wind gusts came from the East by Northeast. It is possible that strong wind collided with the collector's eastern corner and produced a vacuum on the front of the collector panel causing the protective layer to sheer off. These systems are currently not functional.

(As a side note, the two (2) Veissmann flat plate collectors were installed at an angle equal to the pitch of the roof, around 29 degrees, and were not affected by the strong winds.)

Heliodyne has agreed to honor their manufacturer's warranty and will replace the two (2) flat plate collectors. KEA is in discussion with the installation company (Alaska Battery Systems, Fairbanks) to find the most economical way to ship and install the new collectors. Severe winter conditions in the Kotzebue region during January and February may delay the installation. It is not thought that the down-time of these systems (occurring in November through January or February) has caused a significant loss of production due to lack of solar radiation during these months above the Arctic Circle.

a. Analysis

The production values, overall, are below what KEA was expediting to see. However, KEA's main goal with this project is to reduce the use of fossil fuels for residential systems. KEA has obtained historical fuel usage for five (5) of the six (6)[5] homes. KEA will evaluate fuel usage for 2011 at the end of December. The production values shown in data collection may or may not correspond to heating fuel saved.

Several factors may contribute to the seemingly underproduction and KEA has solicited the advice of both Heliodyne and Viessmann corporate offices as well as the contractors to narrow the possibilities.

[5] Historical fuel data not available for one of the homes.

ACEP and KEA have ordered flow meters for the Heliodyne system to better understand the DHW usage in the households. However, this is also on hold until the Heliodyne systems can be repaired. Still, the main criteria for judging the appropriateness of this technology will be reduced diesel fuel use.

C. Conclusion

This demonstration project proved to be somewhat complex due to the coordination of several entities as well as several home owners with different equipment. As with any complex project unforeseen problems arose (see KEA's March 2011 and June 2011 quarterly report for details) and KEA has worked diligently to address each problem in a timely and cost efficient manner.

Production data is available and will be sent to the Commission via ACEP. There may be several causes contributing to the lower than expected production values. KEA has solicited advice from industry experts and will continue to monitor each system. As well, KEA feels that more observation is needed and that data over the course of a full year will be necessary to fully evaluate the economics of these systems.

KEA is also exploring options for the long term management of these systems. The Chukchi Campus and the Kotzebue Tech center have been approached for taking over management and maintenance of these systems to provide hands-on training in conjunction with upcoming renewable energy classes that may be offered.

Following this report the 12 month observation period will come to an end. KEA will be assessing fuel savings for five (5) of the six (6) systems to better understand the economics of installing solar thermal above the Arctic Circle. The final report to The Commission will detail these findings.

Picture 1: Wind damaged Heliodyne flat plate collector

Picture 2: Wind damaged Heliodyne flat plate collector