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**Task 3.14 - Demonstration of Technologies for Remote
Power Generation in Alaska**

**Semi-Annual Report
July 1 - December 31, 1997**

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Work Performed Under Contract No.: DE-FC21-93MC30097

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ACKNOWLEDGMENT

This report was prepared with the support of the U.S. Department of Energy (DOE) Federal Energy Technology Center Cooperative Agreement No. DE-FC21-93MC30098. However, any opinions, findings, conclusions, or recommendations expressed herein are those of the author(s) and do not necessarily reflect the views of DOE.

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TASK 3.14 – DEMONSTRATION OF TECHNOLOGIES FOR REMOTE POWER GENERATION IN ALASKA

INTRODUCTION

In over 165 villages in Alaska, the use of fossil fuel supplies or renewable energy resources could greatly reduce the cost of electricity and space heating. Currently, diesel generators are the most commonly used electrical generating systems; however, high fuel costs result in extremely high electrical power costs relative to the lower 48 states. The reduction of fuel costs associated with the use of indigenous, locally available fuels running modular, high-efficiency power-generating systems would be extremely beneficial.

OBJECTIVES

The overall goal of this project is the site-specific demonstration of small, environmentally acceptable electrical generating systems fueled on indigenous fuels and waste materials to serve the microgrid or stand-alone power distribution systems typical of remote, isolated Alaska Native communities.

The objective of the project is to develop a commercialization plan that includes an analysis of the quantity, quality, and cost of the available fuels; a mapping of the electrical and district heating needs of a selected community, including electrical distribution layout and interconnecting steam piping; a step-by-step review of the environmental regulations and permit applications that need to be met; and a preliminary design and budget for the demonstration of a 0.5- to 6-MWe power system to be completed by the Energy & Environmental Research Center (EERC) in a manner that provides technical and regulatory readiness to proceed with implementation of the demonstration.

The scope of work is divided into two phases. The first phase will involve a workshop to provide input for the final definition of the technology to be demonstrated and the selection of a study site, followed by process design verification studies as needed (e.g., combustion tests on candidate fuels). The second phase of the work will develop the preliminary engineering design and provide the engineering, economic, and regulatory information necessary to proceed with the full demonstration. Parallel work will be conducted as needed to support the demonstration of other power technologies for additional remote sites.

ACCOMPLISHMENTS

The EERC has been asked to coordinate a number of activities for the Federal Energy Technology Center (FETC) related to the use of fossil fuels to meet the energy needs of Alaska. These activities can be divided into two topics: 1) the demonstration of technologies for remote power generation in Alaska and 2) resiting a coal-fired diesel demonstration project to Alaska and integrating this project with a coal-water fuel demonstration activity. A summary of these activities follows.

Demonstration of Remote Power Generation in Alaska

Two workshops on remote power technologies have identified atmospheric fluidized-bed combustion (AFBC) as a technology with the potential to meet the current and future electricity and district heating needs of villages in rural Alaska.

Two villages, McGrath and Tok, were chosen for further study as potential sites for an AFBC demonstration. Unfortunately, neither of these sites has proven to be a good location for a demonstration activity. In the case of Tok, because of its location on the road system, diesel fuel is available at low cost, leading to a decision by the utility in this village, Alaska Power and Telephone, not to pursue the AFBC option at this time. McGrath has also decided not to pursue the AFBC option at this time. Its smaller-sized load (~600 KWe), the high parasitic power requirement of the Donlee combustor, high capital costs, and much-higher-than-expected coal costs made this site unacceptable.

From these studies, much has been learned. Detailed cost information from the McGrath site, coupled with a range of cost data from the proposed systems at Tok, has been used by the EERC and J.S. Strandberg Engineering to develop a power cost model to estimate the cost of power using AFBC technology and a range of fuel and load options. This model has been used to develop a family of curves (see Figures 1 and 2) to assist in assessing the viability of this technology in rural Alaska. As can be seen in Figures 1 and 2, strong sensitivity has been noted to the variables of fuel cost, unit size, and district heat load. Using the experiences to date, the team involved in the remote power demonstration activity has concluded that the following criteria must be met in a host site for a successful demonstration:

- Electrical load of 2 MWe or greater
- Significant thermal load requirement at the site
- Access to coal or other solid fuel at one-half the cost per 10^6 Btu for oil

A site at Unalaska has been identified that meets these requirements. The utility serving this village is reviewing the current power generation ability and assessing options for enhancing their capacity to meet the projected power needs for the community. Additionally, the fish-processing industry located in this village has significant requirements for process steam. Working with a consultant retained by the village, we are using the model developed in this program to allow them to evaluate solid fuel-firing options for meeting their requirements for future power needs. The factors noted above coupled with a near-term need to enhance the power-generating system and water access to low-cost coal make this site an attractive one for demonstration of the AFBC technology. We continue to work with our Alaskan partners to determine whether a demonstration of a small coal system at this site will be technically and economically viable.

The EERC participated in a Department of Energy Fossil Energy/State of Alaska workshop entitled "One Decade Later: What's Alaska's Future?" in Anchorage, October 28-29, 1997. This workshop discussed how the federal/state of Alaska partnership can continue to bear fruit in efforts to secure the energy future of the state of Alaska.

Figure 1. Cost model results.

Figure 2. Cost model results.

Resiting the Coal-Fired Diesel Demonstration Project to Alaska

The team put together by Arther D. Little has been successful in obtaining roughly \$4.2 million from the Alaska legislature to complete the funding package for the proposed coal-fired diesel/coal-water fuel demonstration. Work is under way on the final design package for the demonstration activity. Coltec Industries has replaced Cooper-Bessemer as the supplier of diesel technology for this activity. The EERC anticipates it will be asked to supply roughly 25,000 gallons of coal-water fuel for diesel testing in April 1998 to allow the activity to move forward as scheduled.