ACEP

Alaska Center for Energy and Power

Fostering development of innovative solutions to Alaska's energy challenges.

Project Snapshot:

Sustainable Village Energy

Integration of Renewable and Diesel Systems to Improve Energy Self-Reliance

This project is a collaborative research effort between the Alaska Center for Energy and Power, the Institute of Social and Economic Research (UAA), the Institute of Northern Engineering (UAF), the School of Engineering (UAA), and the Institute of Arctic Biology (UAF).

Project Summary

This project continues research funded by an EPSCoR Phase 1 award, which expanded existing capacity at the University of Alaska in the niche market technology of hybrid wind-diesel systems. Phase II broadens the scope to include integration of other renewable energy resources with traditional generation and fuel sources. The project's tasks are designed to reduce barriers to implementation and improve the performance of existing systems by improving data management and addressing engineering challenges.

Project Need

Over the past decade, Alaska has funded the installation of small, community-based renewable energy systems in an effort to diversify its energy portfolio, especially in rural villages where residents rely on expensive imported fuel for both heat and power. Because of Alaska's non-integrated electric grid, most communities have their own, "islanded" systems, which pose unique challenges to the integration of variable (intermittent) renewable energy into their small, diesel-based systems. The fraction of renewable energy in these grids is high and cannot be buffered by large-scale supply and demand dynamics, as is the case in the Lower 48 grid.

The overarching project goal is to increase energy self-reliance in Alaska's remote rural communities by reducing dependence on imported diesel fuel through strategies that can be replicated elsewhere.

Wind turbines on St. Paul Island. Photo courtesy of G. Holdmann, ACEP/UAF

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Project Description

The goal of this project is to enhance the capacity at the University of Alaska to provide leadership in developing diesel-renewable hybrid energy systems for islanded, non-integrated electric grids and their associated oil-based heating systems.

The project runs from October 2013 to September 2016 and consists of four mutually reinforcing tasks, each focused around a key objective:

Improve Data Management

A lack of high-quality performance data has been a significant impediment to the development of renewable energy systems in Alaska for decades. During Phase I, ACEP developed a comprehensive database for renewable energy systems in Alaska as well as robust data collection systems for remote sites. Phase II will continue these efforts, automating the data processing and making the data more readily accessible to researchers and agency partners.

Address Engineering Challenges

Integrating intermittent renewables into a diesel microgrid requires maintenance of power stability, potential use of energy storage, and advanced control strategies. The new energy laboratory at ACEP is capable of recreating an entire village energy grid. We are able to address these challenges not only in isolation or through modeling, but also through full-power and real-world testing and analysis.

ACEP will leverage existing expertise at University of Alaska, national labs, and within the Alaska industry (utilities, developers) to address integration of renewable energy as a component of more sustainable village energy systems. While our work is primarily focused on Alaska, it applies directly to developing nations as they become more energy intensive, and it addresses the resilience of the U.S. electric grid as the nation moves toward greater reliance on distributed generation sources.

A full report for Phase I of this project, "Making Wind Work for Alaska: Wind-Diesel Systems for Isolated Communities," can be downloaded from ACEP's publication database at uaf.edu/acep.

Project Funding Partners

U.S. Department of Energy — EPSCoR

Project Research Partners

Alaska Energy Authority
Denali Commission
Department of Energy:
- **Wind and Water Program**
- **Indian Energy Program**
- **Office of Electricity**
- **EERE Deployment Office**
- **Geothermal Technologies**

National Renewable Energy Laboratory
Sandia National Laboratory