



Independent Third Party Battery Testing and Verification for the Alaskan Market

Markus Mager, Billy Muhando,
Dennis Witmer, Gwen Holdmann
Alaska Center for Energy and Power
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Outline

- ▶ Needs of the Alaskan Market
- ▶ Alaska Center for Energy and Power
- ▶ History of Testing and Verification
- ▶ Need for Batteries
- ▶ Battery Testing to Date
- ▶ Summary



Needs of the Alaskan Market



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- ▶ ~700,000 inhabitants
- ▶ ~490,000 in 3 population centers
- ▶ area: 1,717,854 km²
- ▶ ~390 communities
- ▶ Challenges
 - ▶ long distances
 - ▶ low population
- ▶ Climate of Alaska



ACEP
Alaska Center for Energy and Power

Needs of the Alaskan Market

- ▶ Utility structure
 - ▶ Railbelt
 - ▶ Isolated community grids
- ▶ Rural electricity cost
 - ▶ Diesel cost
- ▶ Renewables
 - ▶ Hydro
 - ▶ Wind
 - ▶ Biomass, Geothermal, Solar, Hydrokinetic
- ▶ **Need for Batteries!**



Alaska Center for Energy and Power

- ▶ **Applied Energy Research at the University of Alaska**
- ▶ **ACEP Research Mission**
 - ▶ To meet state and local needs for applied energy research by working toward developing, refining, demonstrating, and ultimately helping commercialize marketable technologies.
- ▶ **Role of ACEP**
 - ▶ Verify performance and reliability of equipment
 - ▶ Assess technical and economic feasibility
 - ▶ Improve grid integration
 - ▶ Work with manufacturers to improve products for use in Alaska
 - ▶ Resource assessment
 - ▶ Test emissions

History of Energy Research at ACEP

- ▶ Fuel cell testing
 - ▶ Began in 1998, testing PEM fuel cells designed for stationary power applications
 - ▶ Systems designed to generate hydrogen from diesel fuel
 - ▶ Research identified significant barriers to success, including reliability, cost, efficiency, and hardware availability
 - ▶ Switched to testing Solid Oxide fuel cells in 2002
 - ▶ Systems proved to be more efficient and robust than PEM systems, but still not able to meet market requirements.
 - ▶ Tested a total of 12 fuel cell systems



History of Energy Research at ACEP

- ▶ **Diesel Generator Test Bed**
 - ▶ Diesel power generation remains dominant electrical source for most Alaskan villages
 - ▶ Low capital investment, robust, able to load follow, able to store energy for entire year (barge delivery of fuel in summer)
 - ▶ Testing of new fuels
 - ▶ Synthetic Fischer-Tropschs fuels (from natural gas)
 - ▶ Biodiesel, especially fish oil biodiesels
Identified significant operational issues with fish oil operation.

History of Energy Research at ACEP

- ▶ **Flow Battery Testing**
 - ▶ VRB/Prudent Energy
 - ▶ Purchased battery in 2006
 - ▶ Conducted deep discharge cyclic testing
 - ▶ Battery lasted longer than the company
 - ▶ very good working relationship--we tested, they supported the product in the field
 - ▶ had product they are willing to sell, and we are willing to test

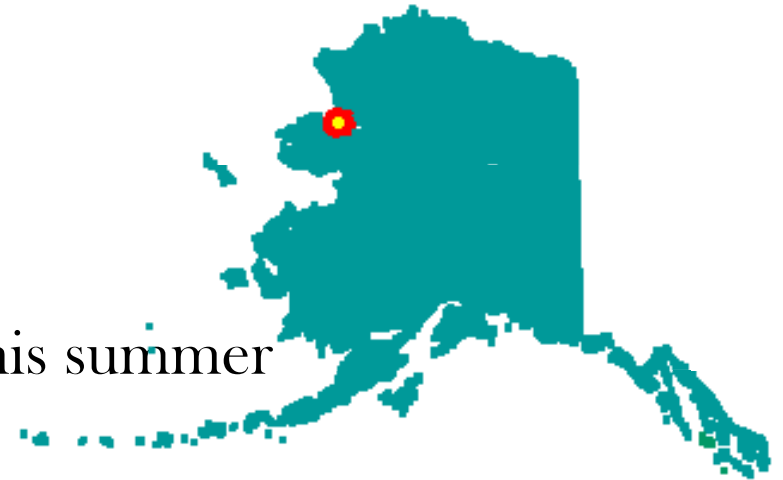
History of Energy Research at ACEP

- ▶ Flow Battery Testing
 - ▶ VRB/Prudent Energy



Premium Power Battery for Kotzebue

- ▶ Larger Battery (500 kW, 3.4 MW hr) not suitable for laboratory testing
- ▶ Working with Kotzebue Electric Association to test battery at wind farm location
- ▶ Battery currently under construction
- ▶ Will be shipped to Kotzebue later this summer



Wind Diesel Hybrid test bed

- ▶ Wind is an excellent resource in many parts of Alaska, but is not always available when needed
- ▶ Current systems use diesel generators to provide load following capability--but systems need to be integrated into a hybrid system--
-Wind can drive system to instability
- ▶ ACEP is developing a Wind-Diesel test bed to address these issues
- ▶ Energy storage (batteries, flywheels) are desirable for adding stability to systems



Need for batteries in Wind Diesel Hybrid

- ▶ Batteries provide two specific advantages
 - ▶ Frequency stabilization (milli-second to seconds)
 - ▶ Load shifting (minutes to hours)
- ▶ Frequency stabilization requires high currents, rapid charging and discharging (high power)
- ▶ Load shifting requires large energy storage--big batteries--but much lower currents and current densities
- ▶ Current batteries are too costly and insufficiently robust for use--it's still cheaper to burn diesel--but we're hoping that will change



Summary

- ▶ Alaska needs good, cheap reliable megawatt-hour sized batteries
- ▶ ACEP is third party independent testing organization, working with Alaskan utilities, companies, industry and funding agencies to verify battery performance to assure these meet Alaskan needs
- ▶ Interested in pre-commercial products

Thank you for your attention!

Questions?

Markus Mager
Energy Analyst

markus.mager@alaska.edu

Billy Muhando
Assistant Research Professor

ebmuhando@alaska.edu

Dennis Witmer
Senior Analyst
eedew@gmail.com

Alaska Center for Energy and Power

University of Alaska

www.uaf.edu/acep



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