ACEP

Alaska Center for Energy and Power

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

Flow Battery Testing

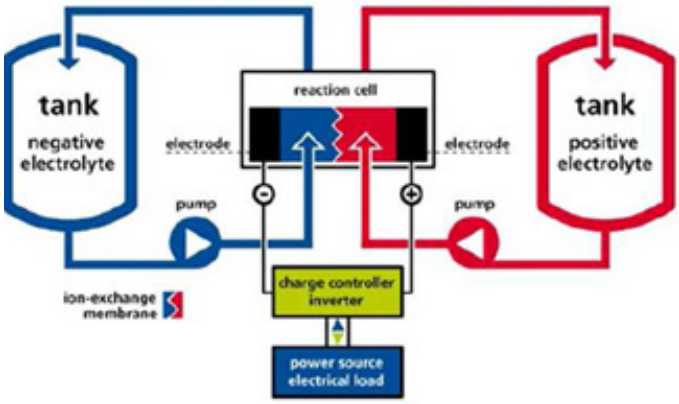
Project Summary

ACEP tested a 5kW Prudent Energy system. This battery is the next generation of a flow battery previously analyzed at ACEP (see inset on back) which was tested to failure. Now owned by Prudent Energy, the battery has been redesigned, in part using lessons learned from our previous research. ACEP tested the battery's performance and long term viability for implementation in rural Alaska.

5kW Flow Battery storage system from Prudent Energy. Photo Credit Julie Estey, ACEP.

Project Need

One of the most significant challenges associated with installing renewable energy technologies on small, isolated power grids like those found in many rural Alaskan communities involves integration with the existing diesel generators and electric grid.



Flow Battery Concept

This issue is complicated even further by the fact that many renewable resources, such as wind, are available only intermittently and do not always match peak load requirements. This requires diesel generators to be available as a constant 'spinning reserve' even when the wind is blowing, limiting the amount of diesel fuel which can be offset by a wind power system in rural Alaska.

One solution is the integration of a battery system. Currently, lead acid batteries have insufficient lifetimes to justify their use in such an integrated system. An alternative technology is the flow battery, which consists of a battery stack with flowing electrolyte fluids. These batteries have the advantage of allowing additional capacity simply by adding larger storage tanks and additional fluids.

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Project Description

ACEP's battery performance testing involves characterization in relation to manufacturer's specifications. Since many of these products are either in development or new to the market, our aim is to verify performance and assess suitability for the unique energy storage needs found in Alaska.

Assessment factors include cycle life, discharge rate, duty cycle, and environmental conditions, including temperature, pressure, vibration, etc. Battery qualification is based on several factors including standby losses (if any), capacity, and accelerated life and storage analysis.

The battery supplied by Prudent Energy was much improved compared to a prior model tested. Many of the balance of plant issues of previous models were resolved.

The battery performed well during cycling and efficiency tests at ACEP. This together with the increased robustness of the system made this battery a promising energy storage candidate for small hybrid-diesel systems. Unfortunately, the cost of vanadium, a key ingredient in this battery's chemistry, increased significantly compared to initial inception of this technology. Hence, the economics of operating this battery remain unfavorable, even though the technology appears ready for market deployment.

Original first-generation 10kW VRB Battery system tested at the University of Alaska. Photo Credit ACEP.

First Generation Flow Battery Testing (2008)

Previous ACEP research included the assessment of a 10 kW vanadium redox battery from then, VRB Power (currently owned by Prudent Energy). VRB's battery was advertised as having high energy conversion efficiencies and extremely long life, however, it was not proven in a real world application.

After procurement in July 2006, their 10kW battery system was impartially tested and assessed through the Alaska Center for Energy and Power (ACEP) between August 2006 and April 2009.

While the battery demonstrated real promise, testing through ACEP revealed several manufacturing and technical challenges which need to be addressed before successful installation in a rural community. This included upgrading a few key components to more substantial materials. The testing proved valuable both for assessing the technology as well as the commitment and expertise of the manufacturer and set the stage for improvements in the technology.

The overall results of ACEP's testing were encouraging, indicating that the technology may prove viable with future iterations of the product.