

Kotzebue Electric Association
Flow Battery Storage Systems
Quarterly Report
4/2012
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Funding

Denali Commission	\$425,000
AEA	\$300,000
CREBS Loan	<u>\$575,000</u>
Total	\$1,300,000



Premium Power Transflow 2000

Project Summary:

The goal of this project is to test an advanced battery system and its' application to Alaskan energy needs. Kotzebue Electric Association's (KEA's) interest is to evaluate a large flow battery in conjunction with wind power in order to improve overall system efficiency and reduce the amount diesel fuel used for electrical generation by time shifting energy from both the wind and diesel systems. Additionally, KEA is interested in the ability of advanced battery systems to provide frequency regulation, provide a substitute spinning reserve, and provide black start and emergency power capability. There are currently a number of batteries in the >1 megawatt capacity being developed by several suppliers. If these batteries become commercially available at the price points suggested by manufacturers their deployment could result in significant diesel fuel savings in similar communities with wind or other renewable energy sources.

Background:

In August, 2009, the Alaska Center for Energy and Power (ACEP), which is part of the University of Alaska and Kotzebue Electric Association (KEA) applied separately for funding to test advanced battery systems through the Denali Commission Emerging Technologies Grant Fund. These projects were organized differently based on the different project management needs, two classes of batteries, and the level of technology readiness. The larger Premium Power battery is most appropriate for Kotzebue, given KEA's excellent track record of integrating new wind turbines with their existing diesel system, with some support from ACEP on data collection and analysis. The smaller batteries were proposed as laboratory tests at ACEP, which proved to be of considerable value during previous testing of the VRB battery, as clean performance data could be collected to assess the validity of the claims made by the supplier. During the second round the Denali Commission requested that the two proposals be combined for a total of \$855,000. This was partially awarded. Since October of 2009 KEA has worked with ACEP to re-scope the work plan to address the reduced funding level of \$500,000, while meeting the original objectives of the project- to demonstrate viable storage options to augment wind-diesel systems in rural Alaska. The re-scoping was further complicated by the existence of another proposal by KEA (see below), which affected the prioritization of effort on this project.

KEA has applied for funding for the Premium Power zinc-bromide battery through the Cooperative Research Network (CRN) to the Department of Energy. This proposal was not funded. Therefore, the re-scope of the joint ACEP/KEA funding through the Denali Commission will focus the majority of funds to KEA's demonstration project. However, this amount is insufficient to outright purchase the Premium Power battery, as it would amount to one-third of the commercial installation price.

The flow battery arrived in Kotzebue on Sunday September 25 and was moved into place the following week.

Installation

The installation on the battery is currently ongoing. A representative from Premium Power must be on site during each installation and commissioning phase in order to comply with the warranty agreement. Installation efforts from October to December 2011 were reported last quarter.

Premium Power had scheduled technicians to return to Kotzebue in January of 2012. However, an extended cold snap in Kotzebue during December and January resulted in several weeks of weather below -30, occasionally going as cold as -45. This weather is not ideal for working outside, and Premium Power did not send technicians to work on the unit during this time.

Premium Power technicians Sam and Dan returned to Kotzebue on Thursday, March 22, 2012 to attempt to start and charge the battery. Communications were reestablished with the unit, using

an isolation card. The KEA SCADA system will communicate with the battery through a PLC and RS 232 connection, while Premium Power can communicate with the battery directly over the internet. On March 27, 2012, it was indicated that communications have been established with PP headquarters, but it was not clear if this meant that PP could “see” the KEA SCADA system, or if the KEA SCADA system could communicate with the internet.

However, the battery has developed some unexpected leaks, and electrolyte was discovered in the secondary containment in several places. The most significant leak was about 45 gallons, in quadrant where all the electrolyte had been drained out of the stack—indicating that the leak had occurred somewhere in the bottom of the unit. However, the exact location of the leak was not determined. It is thought that this leak may have been caused by the extreme cold weather affecting seals associated with hose clamps—the plastic pipes and hoses under the clamps are likely to contract more in cold weather than the metal bands of the clamps, and so a leak may have developed in one of these areas. The new Teflon tubes were all fine, but other parts of the system are made with PVC piping and rubber hoses. PP technicians intend to return to company headquarters and come up with a solution to this issue. They will then return to Kotzebue and make the necessary repairs.

KEA is working with EPS to establish communications with the battery.

Energy Efficiency Evaluations is also developing some modeling capability to assist KEA with understanding the most effective way to use the battery. A simple model of the PP battery using electrochemical data and parasitic energy demands has been developed, allowing replication of the turnaround efficiency of 65% noted during the FAT. KEA load and wind data have been successfully loaded into a Simulink model, and preliminary baseline cost estimates for a straight diesel system have been calculated. A low penetration run (with the existing 1.17 MW wind farm) has also been completed, indicating modest fuel savings, offset by the higher capital costs associated with the expanded wind farm installation (expanding KEA’s wind farm capacity to 2.94MW).

A high penetration run will be simulated by multiplying the output from the wind farm on a second by second basis, and the battery will be used for both peak shaving and load shifting. Heat loads will also be calculated (KEA currently sells jacket water heat to the City of Kotzebue for heating the water loop).

Efforts for Next Quarter:

As Premium Power is undergoing reorganization (see below) and will formulate a plan to address the cold weather issues (noted above) and the packaging of the battery (see below). KEA will continue with the installation as directed by the manufacturer.

Project Status:

There have been some changes made in the management of Premium Power as new investors have been brought on, and the company is undergoing a corporate restructuring. Most importantly, Gary Colello is no longer company CEO, although he is still employed by the company, and a search is underway to find a replacement. Currently the company is being managed by a committee of three until a new CEO is found. The good news is that the company has a new influx of cash, and will remain viable while developing their products.

One of the changes appears to be that Premium Power is likely to move away from the trailer mounted Transflow 2000 design, and move towards a 125 kW package. The trailer mounted design is transportable (though the shipping to Kotzebue required a total of 5 separate shipping units—the trailer plus 3 containers with electrolyte, and one of spare parts). The major difficulty with the trailer mounted system is that there is very little room to work on the system.

KEA will continue with the installation process of the battery as directed by Premium Power.

To date the project is on budget as set out in the original grant agreement. The total amount of funding provided by the Commission to KEA is insufficient to purchase the battery outright. KEA has moved forward with the purchase of the Premium Power battery by utilizing several funding sources including state and federal grants and a low interest CREBS loan.

KEA has been some unexpected problems with this project (as noted above). Premium Power is going through reorganization and is putting together a plan to address the unit. Premium Power appears to be committed to this project (and to its other customers), and remains intent on getting the battery operating for this demonstration.

KEA is looking forward to the opportunity to install, commission, test, and gain valuable operational knowledge of integrating this technology with a wind-diesel power plant.



Premium Power TransFlow 2000 at the PP factory.



Communications uplink.