

Kotzebue Electric Association
Flow Battery Storage Systems
Quarterly Report
7/2012
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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

Efforts to install and operate the battery have been reported in previous quarters. Premium Power sent technicians on several occasions for installation and trouble shooting. As a reminder of those efforts the following was reported last quarter and was Premium Powers last trip to Kotezbue:

“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.”

Currently the installation is on hold. KEA will ship the battery back to Premium Power who expects to the first quadrant of the unit ready for shipping in 2013, with the remainder of the unit available for 2014. Premium Power will pay for future shipping.

Efforts for Next Quarter:

Premium Power will be retaining ownership of this battery unit. KEA is awaiting directions from Premium Power for desired shipping dates to return the battery to the manufacturing plant for redesign.

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.

On May 15, 2012 a teleconference with KEA and Premium Power- Ali Amirali and Doug Alderton, as well as consultant Dennis Whitmer, took place to discuss the changes in Premium Power management—the old managers are gone. There has been a significant infusion of new capital, a new board, as well as new management at Premium Power.

The focus was on product performance and reliability—taking the company from a development company to a product company. Premium Power has retained key technical and engineering staff—hired consultants Erigo (battery consultants) and Cambridge (materials for membranes). Premium Power remains committed to the product with a focus on making this projects successful. (As well as trying to resolve issues with existing customers such as KEA).

As noted above, the product will change housing from trailer unit (Transflow 2000) to a 20 foot containerized unit. “Maintainability of the trailer” is not good. KEA experienced issue of fittings that loosened during shipping that could not be accessed in the field.

Notable Premium Power changes:

- PP considers Alaska to be a key market.
- Premium Power will now purchase inverters from others, and use standard interfaces for any SCADA system.
- Erigo Technologies—Chemists, physicists, will be doing battery diagnostics, and failure mode analysis.
- Company will focus on core technology.
- DC—60-70% efficiency (AC efficiency will be reduced by pump parasitics). The teleconference power point showed data, including decrease in stack performance over time, and the development of outliners that fail. Also, as the units are scaled up, the efficiency decreases.
- Aiming for repeatability in manufacturing. Premium Power is aiming to return to product manufacturing in 1Q13.
- Premium Power is willing to provide test information, and willing to talk to anyone on the team.
- Premium Power is willing to ship one quadrant in summer 2013, ship balance of unit in summer 2014.
- Premium Power will pay all shipping from now on.
- Electrolyte freezing—stratified—it is unclear if the electrolyte will recombine—will test with a laboratory, try to determine if electrolyte is good

KEA is aware that due to unforeseen problems with the unit that KEA will be unable to take ownership of the battery before the expiration of this grant program. KEA is hopeful that a way forward with the original funding can be found with the Denali Commission so that KEA can retain the bulk of the funding designated in the agreement for purchasing of the unit.

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.