Practical Assessment of Advanced Battery Storage Technology for Power Systems in Alaska

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The Alaska Center for Energy and Power (ACEP) is a research center within the University of Alaska whose mission in part is to invest in research projects that will develop transformational energy technologies for widespread deployment in Alaska. ACEP's goal is twofold: 1) to address the high energy costs that exist in many parts of the state, including electric prices up to $1.50 per kW-hr and fuel prices as high as $9 per gallon, by facilitating economic development of locally available energy resources; and 2) address issues resulting from a fractured electric grid infrastructure, which currently consists of over 200 islanded grid networks scattered throughout the state serving a small population base. In working with utilities and communities to address these issues, ACEP initiated a research program in 2006 investigating next generation battery technology for stationary power applications, both for energy storage and to provide greater grid stability. Since then ACEP has worked with manufacturers to test and optimize components for vanadium redox flow batteries (a 10kW system from VRB, Inc., and a 5kW system from Prudent Energy). In addition, ACEP is working with an Alaska utility - Kotzebue Electric Association (KEA) - to test performance of a larger Premium Power Zinc-Bromide flow battery in conjunction with a wind farm in the rural Alaskan community of Kotzebue. The purpose of that project is to demonstrate the battery's ability to stabilize the grid and permit operation in a high-penetration wind-diesel configuration.

The genesis of the testing by ACEP occurred when VRB Power Systems Inc. of Vancouver, Canada began promoting its battery for the Alaskan market in approximately 2002. ACEP was able to purchase an early commercial version of this product, and tested it between August 2006 and mid-2009. After nearly 3 years of testing the 10 kW VRB battery, several issues of concern were identified, including stack failures, leaks (fittings and tanks), computer hardware problems, etc. Some of these issues could be resolved with better selection of components, but all these failures together show how difficult the "balance of plant" issues are for these systems.

A second 5kW vanadium redox flow battery was purchased from Prudent Energy, which had acquired the rights to the VRB Battery technology. Funding for this project comes from the Denali Commission - an independent federal agency based on an innovative federal-state partnership designed to provide critical utilities, infrastructure and support for economic development and training in Alaska. The battery has been performing well since its commissioning and performance tests are ongoing; the presentation will give a synopsis of our work to date.

In summary, the defining research needs for the flow battery testing have been 1) reduction in the cost of energy in Alaska especially for off-grid communities that heavily rely on diesel generators, 2) data collection for utilities with regard to performance of the storage systems in voltage and frequency control for wind-diesel systems and robustness to low temperatures, and 3) establish a fully functional research laboratory at ACEP for conducting educational and outreach activities related to the battery research program (to outlying campuses, distance

learning, etc). The scope of the presentation will highlight ACEP's experience with testing the flow battery technology: performance, materials, operations/challenges, and supply issues.