ALBERTA INNOVATES

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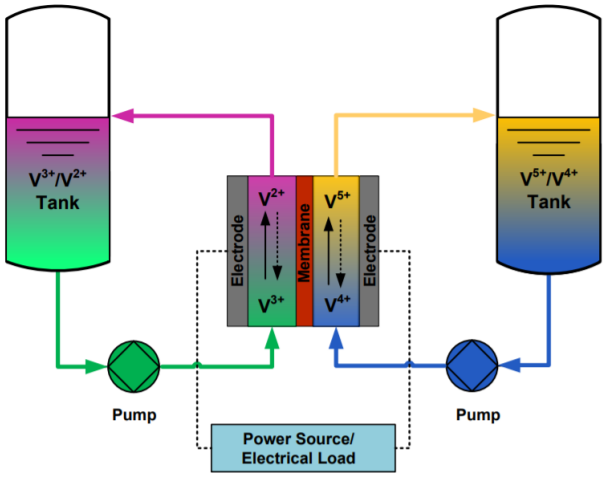
CRITICAL MINERALS AND ENERGY STORAGE

FUNDING DETAILS

Modified Redox Flow Battery Membranes for a Step Change Improvement in Energy Storage Technology

Low carbon electricity grids require cost-effective, flexible energy storage technologies to enable intermittent renewable sources, such as wind and solar, to be dispatched whenever electricity is needed. Redox flow batteries, which store energy in liquids, are a leading candidate for utility-scale electricity storage applications as they have a long life and flexible design. Although the cost of redox flow batteries is decreasing as the technology matures, there is a need for significant additional reductions in cost to enable widespread implementation.

In this project, a novel membrane technology was developed and tested to increase the performance of redox flow batteries. The membrane technology was produced with low-cost materials and through a low-cost, scalable process, intended to increase performance while reducing the cost of battery systems.



RECIPIENT:

Dr. Edward Roberts
University of Calgary

PARTNERS:

Evercloak Inc.
StorEn Inc.
University of Waterloo

TOTAL BUDGET:

$557,220

AI FUNDING:

$278,475

PROJECT DATES:

FEB 2021 – DEC 2023

PROJECT TRL:

Start: 3
End: 4

APPLICATION

Battery technologies are attractive for utility-scale electricity storage since they are flexible and provide fast response, ensuring reliable electricity supply. The membrane technology will be targeted for use in vanadium redox flow batteries (VRFBs) for use in stationary electricity storage applications including residential, commercial and utility sectors. The membrane technology can be fitted directly into existing commercial RFBs or used in RFB technologies under development.

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PROJECT GOALS

- Optimize the membrane technology using lab scale testing to enhance the performance of vanadium redox flow battery (VRFB).
- Evaluate the impact of the membrane technology on the performance of lower cost, non-vanadium redox flow battery technologies.
- Integrate the membrane technology into a commercial VRFB.
- Scale-up the membrane technology to demonstrate the performance enhancement in a 5 kW, small commercial scale VRFB.
- Achieve an increase in the power and energy density of the small commercial VRFB by more than 50%.

BENEFITS TO ALBERTA

- Establishment of a successful university spinoff company to commercialize the membrane technology.
- Creation of new jobs to develop, demonstrate and commercialize the technology.
- Creation of new jobs for membrane manufacturing, business development and establishing a battery supply chain.
- Growth of Alberta's high tech, clean energy economy.
- Reduction of GHG emissions by enabling the transition to and increasing the efficiency of renewable generation.
- Enable residential- to grid-scale energy storage to increase reliability and reduce cost of demand-side and grid-level energy management and use.

5 Publications

8 Students Trained

1 Project Job

60-100 Future Jobs

1 New Product/Service

1 Spinoff Company

Enables GHG Reductions

CURRENT STATUS

JAN 2024

The project is complete, A commercial demonstration did not occur as tests with commercial felt electrodes, modified, graphene-coated membranes did not improve RFB energy density. However, modified membranes appear to improve cycle stability, suggesting potential for thinner, lower resistance membranes to reduce losses and increase RFB power density. In addition, a process for applying graphene coating to membranes was developed, and a new graphene company, Bee Energy Inc., was established. The Final Report is available after June 2024.