Novel Membranes for Vanadium Redox Flow Batteries

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Lithium-based vs. Vanadium Redox Flow Batteries

**Why Vanadium RFB?**

- Independent scaling up of power and energy density (kW to MW)
- Suitable for frequency regulation and peak shaving services
- 20 years lifespan (>15000 cycles)
- High depth of discharge
- Temperature range: -5 - +50 ºC
- Non-flammable, non-explosive, no toxic gases
- Vanadium electrolytes can be reused indefinitely.
Vanadium Redox Flow Battery projects

World's largest VRFB project in Dalian, China
800 MWh/200 MW

California community energy group
226 MWh

Sumitomo Electric Industries, Japan
60 MW

The United Kingdom's first grid-scale battery
2 MW

Austrian fish farm
6MWh

Two trial projects to support electric vehicle charging in South Korea and Australia
30 kWh/5 kW
Challenge

Electrolyte Tanks

Pump

Electrochemical cell

Electrodes

Current collector

Bipolar plate

Sealing gasket

Membrane

Balance of plant avg. 25%

Electrolyte avg. 40%

Electrochemical cell avg. 35%

Standard Nafion (~30%)

Bipolar plate (<5%)

Electrode (<5%)

Standard Nafion (500 $/m²)
Khataee et al., J POWER SOURCES, 483, 2021.