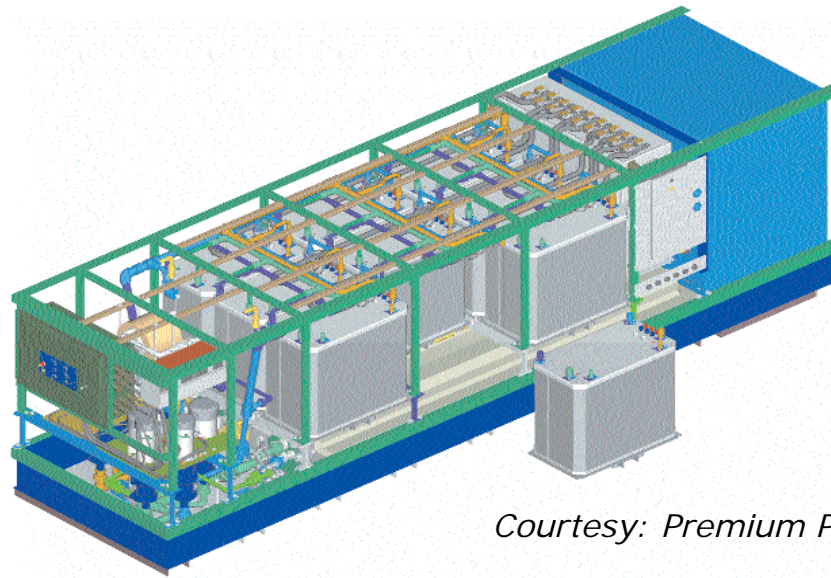


Energy Storage New Opportunities



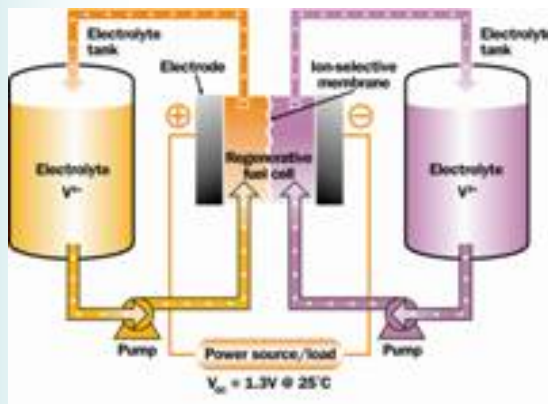
Courtesy: Premium Power Corporation

*John Bingham, TUV NEL and John Bambrough, Optimat Ltd
All Energy, May 2009*

Energy Storage Technologies

Flow Batteries FB (PSB, VRB, ZnBr)

A flow battery is a form of rechargeable battery in which electrolytes flow through an electrochemical cell that converts chemical energy directly into electricity



Advanced batteries AB
eg Li-ion, NaS

Super capacitors SC

Hydrogen Storage

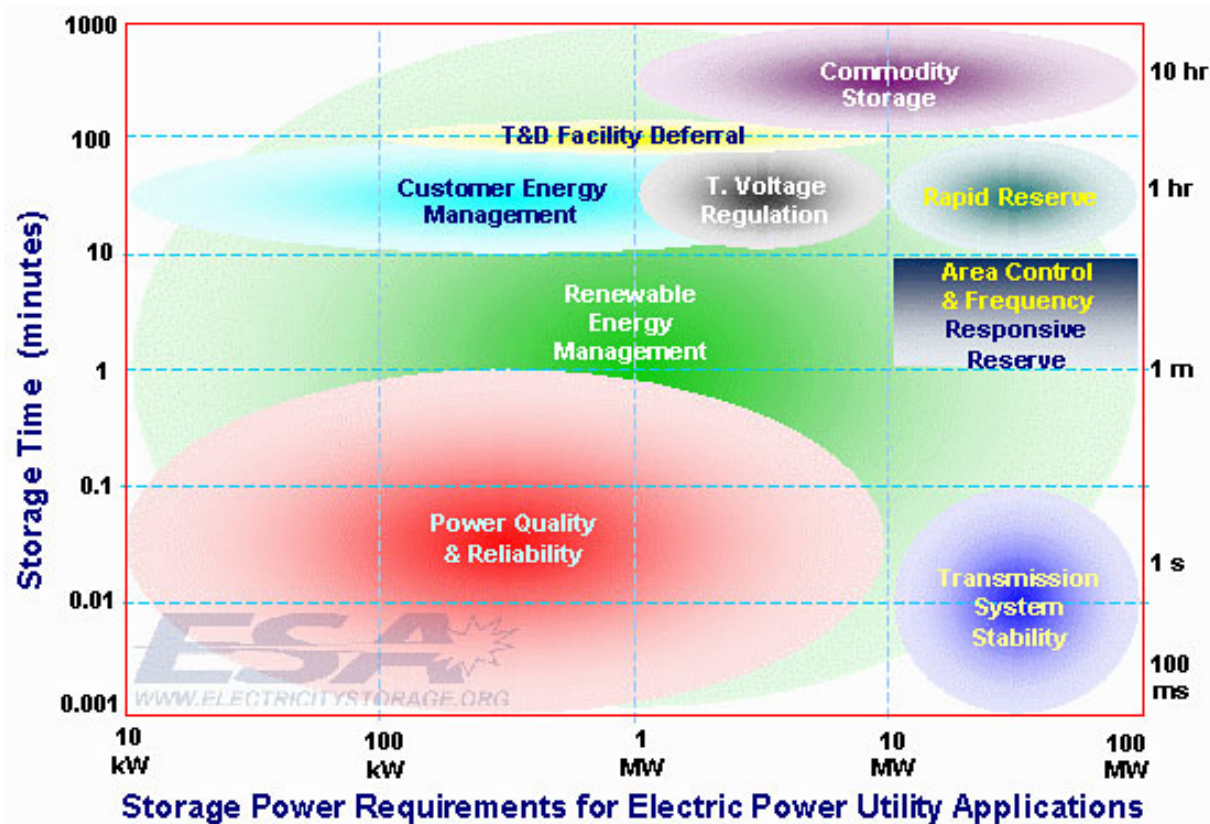
Flywheels FW

Compressed air CARES

Pumped hydro PSH

Superconducting
magnetic energy storage
SMES

Utility Energy Storage Applications



Data from Sandia Report 2002-1314

Power failures, spikes and fluctuations cost the US economy \$120 billion a year

Utility Energy Storage Applications

Enhanced Power Quality

Renewables Support

Utility Support

Transflow 2000



Benefits

- Bulk energy storage for renewables (firming, smoothing, load shifting etc)
- Asset deferral
- Peak demand management
- Voltage support of long radial circuits
- Reducing end-users' electricity costs
- Electric power back-up

Courtesy of Premium Power Corporation

Opportunities for Scotland

- Capture a share of the global energy storage market valued at £30 billion
- Applications for new build and retro-fitting existing wind farms
- Build upon and enhance Scotland's significant energy sector capability and develop a world class supply industry
- Attract inward investment from technology developers
- Help Scotland achieve its renewable energy targets and environmental performance



Collaborative Industry Project

Project scope

- Install flow battery at TUV NEL Myres Hill wind turbine test site
- Site currently has 2 x 1 MW turbines plus smaller units
- Site features 11 kV grid connection
- Initial funding (£200k) secured from DIUS National Measurement Office Innovation R&D scheme



Collaborative Industry Project

Project objectives

- Acquire real world experience of flow batteries in wind energy application
- Measure and log all aspects of performance
- Gather data on durability in different charge/discharge cycles
- Assess techniques for early fault detection
- Develop strategies for optimum energy management

Collaborative Industry Project

Partners currently sought

- Power generation companies
- Wind farm operators
- Flow battery developers and suppliers
- Organisations with interests in grid issues
- Sensor developers and suppliers
- Contact:

John Bingham, TUV NEL

jbingham@tuvnel.com

John Bambrough, Optimat

john.bambrough@optimat.co.uk

