

IEA Hydrogen Roadmap Role of PEM Technology In Energy Storage

Presented by:

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January 28, 2014

Proton OnSite

- A global leader of Proton Exchange Membrane (PEM) hydrogen generators using electrolysis as well as nitrogen and zero air products.
- Founded in 1996
- Headquarters in Wallingford, Connecticut.
- Privately held Tom Sullivan owner
- Over 2,000 installations operating in 80+ different countries.



Certified to ISO 9001:2008



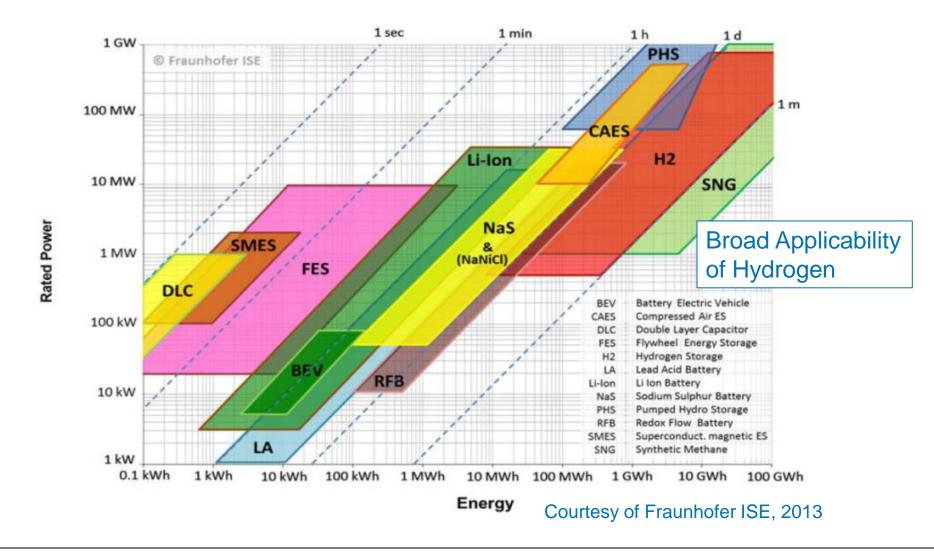


Critical Needs for Energy Storage

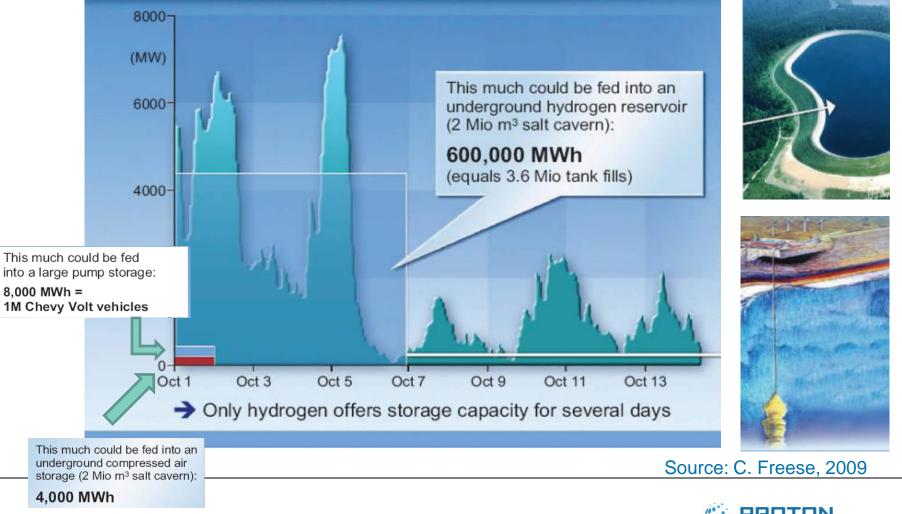
- Renewable energy is growing rapidly world-wide in both wind and solar
 - Inherent intermittency has more impact as RE becomes a larger portion of the grid capacity
 - Up to 20-40% of wind energy can be stranded without storage
- Need generation technologies for storing excess renewable capacity & balancing loads on the grid
- Energy storage can also provide a linkage between utilities & transportation
 - OEM FCV rollouts progressing towards 2015



Energy Storage Segmentation Map

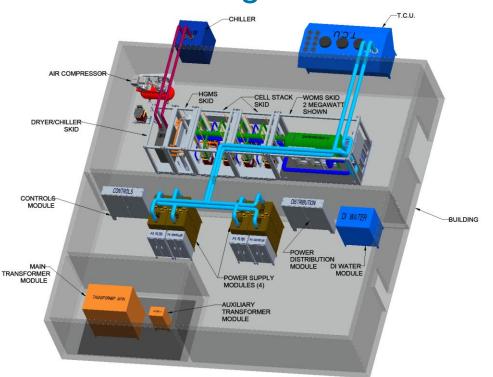


Large-scale Energy Storage



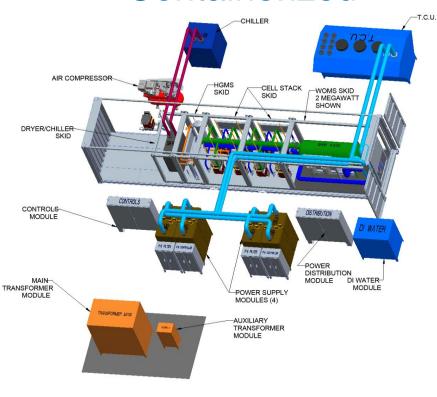
Concepts (2MW shown)

In Building



SCALE 0.025

Containerized



SCALE 0.025



PEM versus Alkaline

- Lack of corrosive electrolyte.
- Smaller footprint.
- Ability to generate hydrogen at pressure while having oxygen at ambient.
- Ability to turn down to near zero production.
- Responds almost instantly to load variations.
- Extremely low maintenance costs.

Cost Challenges

- Power Supply makes up ~ 30% of cost
 - Difficult to cost reduce
- Cell Stack makes up ~ 30% of cost
 - Advances continue to reduce costs
 - Costs ride fuel cell cost curve down
- Balance of Plant
 - Standard industrial design
- Very confident in reaching costs in the \$1,200/kW range

Cell Stacks Costs Coming Down



Gen 1

Gen 2

- 15% Increase in active area
- Smaller overall footprint
- 40% lower in cost

Summary

- US has not seen first hand the issues with renewable penetration – like Germany.
- Electrolyzers do not play everywhere but have a role especially for longer duration storage.
- Thinking of the electric grid and the transportation sector as one energy stream is emerging (overseas first).
- The US is lagging most of the world in recognizing and addressing storage.

Thank You!!