PROTON
THE LEADER IN ON SITE GAS GENERATION.

PEM Electrolysis Technology R&D and Near-Term Market Potential

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Proton OnSite: Current Status

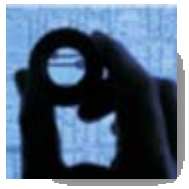
- Industrial markets form base for commercial sales
  - 50% growth over last 2 years
  - Clear technology leader in PEM electrolysis
  - >2000 fielded units, 10 MW capacity shipped
- Continuing to scale output and manufacturing capability

Industrial Markets

Power Plants

Heat Treating

Semiconductors



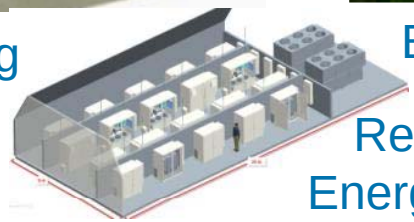
Laboratories

Government

Energy Markets

Fueling

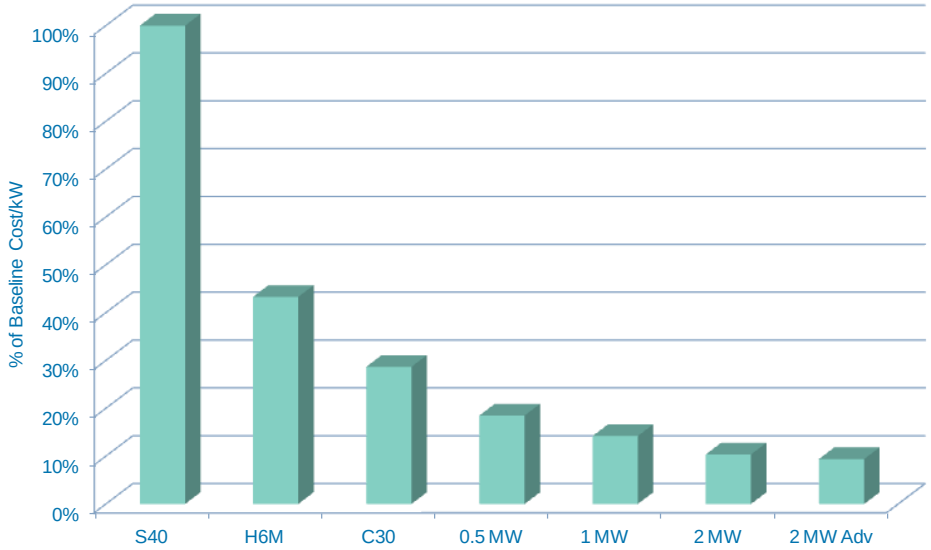
Backup Power



Renewable Energy Storage

Why PEM Electrolysis?

- HES scales with low cost hydrogen storage.
- Making hydrogen allows you to monetize stranded renewables, simply through its commodity value.
- Hydrogen is readily marketed for a variety of applications:
  - vehicle fuel, energy arbitrage, ammonia production, biogas enhancement, power-to-gas, etc.
- Ancillary services markets provide added revenue streams.
- Creates a potential pathway for renewable/low carbon fuel credits: LCFS (California), RINs (Federal), other market based credits.
- Cost scales favorably with increasing scale



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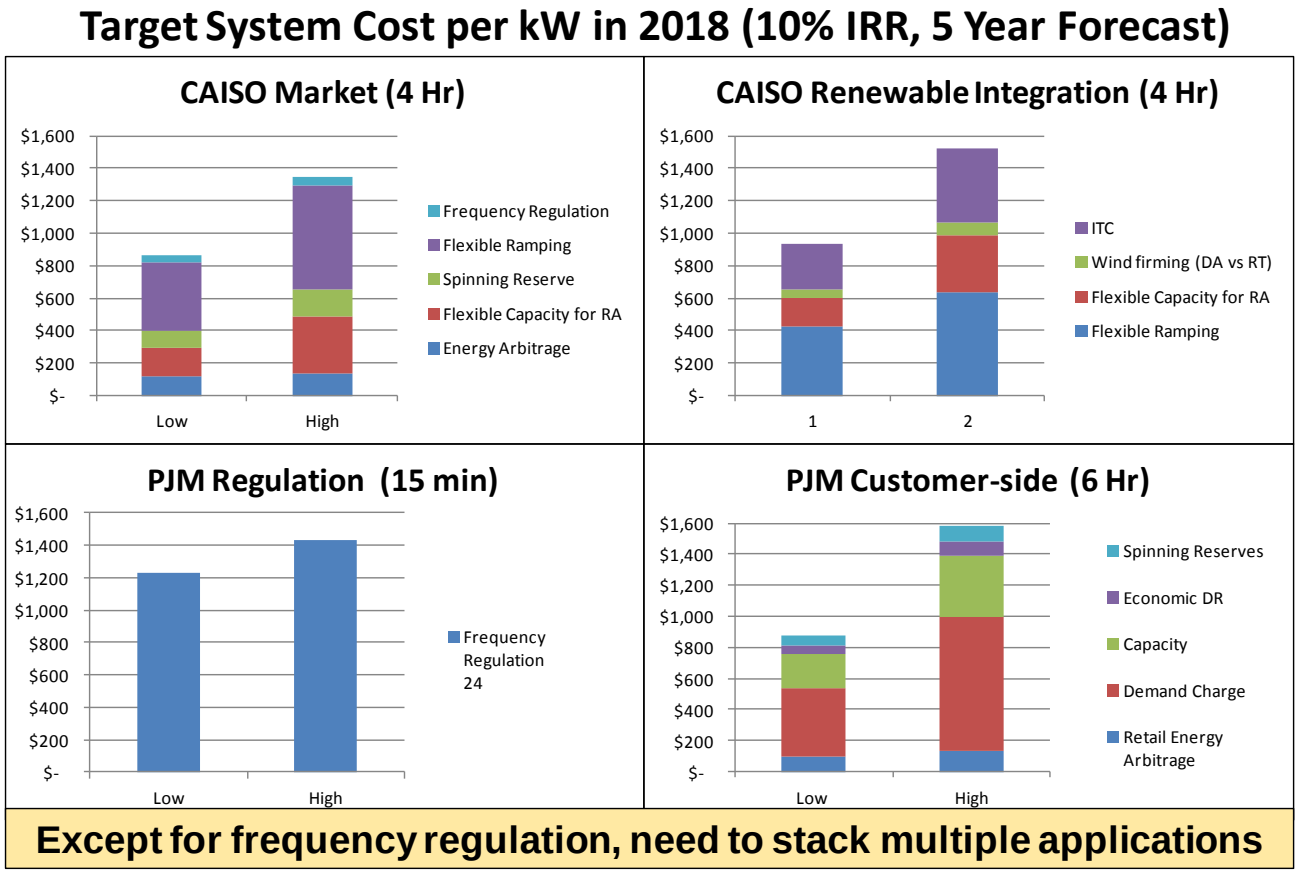
Market feedback for ancillary services

- Capital cost targets are challenging without added value streams



Source: J. Judson-McQueeny, 2013

Case 1: Cheap Power, High Utilization

1 MW station (400 kg/day), 100% electrolysis generation, RINS credit and ancillary service offsets, 90% capacity factor, $0.05/kWhr electricity

Cost Category	Value, $/kg
CAPEX with 20 year amortization	$1.52
OPEX, assuming $0.05/kWh power	$3.60
O&M, assuming 20 year life	$0.30
Fuel credit offsets (RINS, etc.)	($1.00)
Revenue offsets (ancillary services[1], etc.)	($0.60)
Net Cost of Fuel:	**$3.82**

[1]"Study on the Development of Water Electrolysis in the European Union," Fuel Cells and Hydrogen Joint Undertaking Final Report, Feb. 2014.

Case 2: Cheap Power, Low Utilization

1 MW station (400 kg/day), 100% electrolysis generation, RINS credit and ancillary service offsets, 50% capacity factor, $0.05/kWhr electricity

Cost Category	Value, $/kg
CAPEX with 20 year amortization	$2.74
OPEX, assuming $0.05/kWh power	$3.60
O&M, assuming 20 year life	$0.55
Fuel credit offsets (RINS, etc.)	($1.00)
Revenue offsets (ancillary services, etc.)	($0.60)
Net Cost of Fuel:	**$5.29**

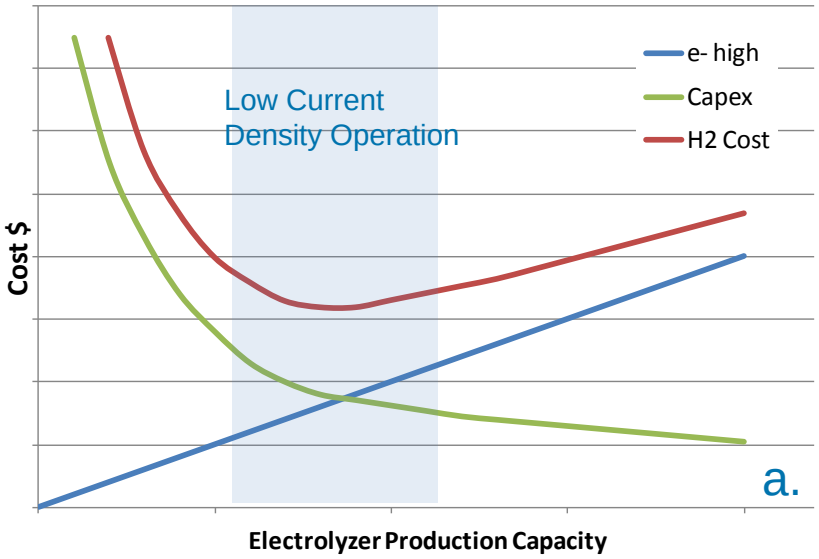
Case 3: Expensive Power, High Utilization

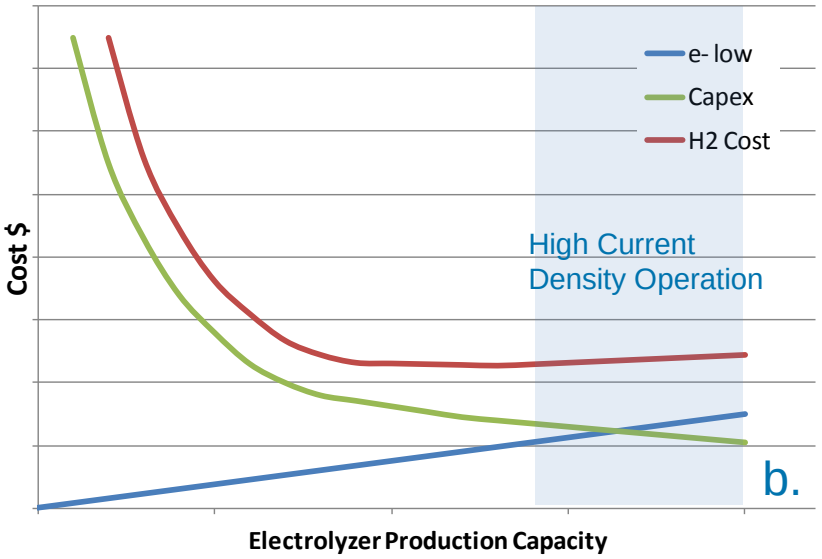
1 MW station (400 kg/day), 100% electrolysis generation, RINS credit and ancillary service offsets, 90% capacity factor, $0.10/kWhr electricity

Cost Category	Value, $/kg
CAPEX with 20 year amortization	$1.52
OPEX, assuming $0.10/kWh power	$7.20
O&M, assuming 20 year life	$0.30
Fuel credit offsets (RINS, etc.)	($1.00)
Revenue offsets (ancillary services, etc.)	($0.60)
Net Cost of Fuel:	**$7.43**

Effect of electricity cost on operating strategy

- Case a: high electricity cost optimizes cost of hydrogen at lower current density.
- Case b: low electricity cost allows higher current density to capture lower CAPEX.





Remaining R&D Priorities

- Cost reduction opportunities for both stack and system
  - Over 50% decrease achievable
- Opportunities in material substitution, automation, and scale up
  - Collaborations established with key partners
- Need investment in manufacturing implementation, internally and in supply chain
- Optimization for grid and/or DC interface