

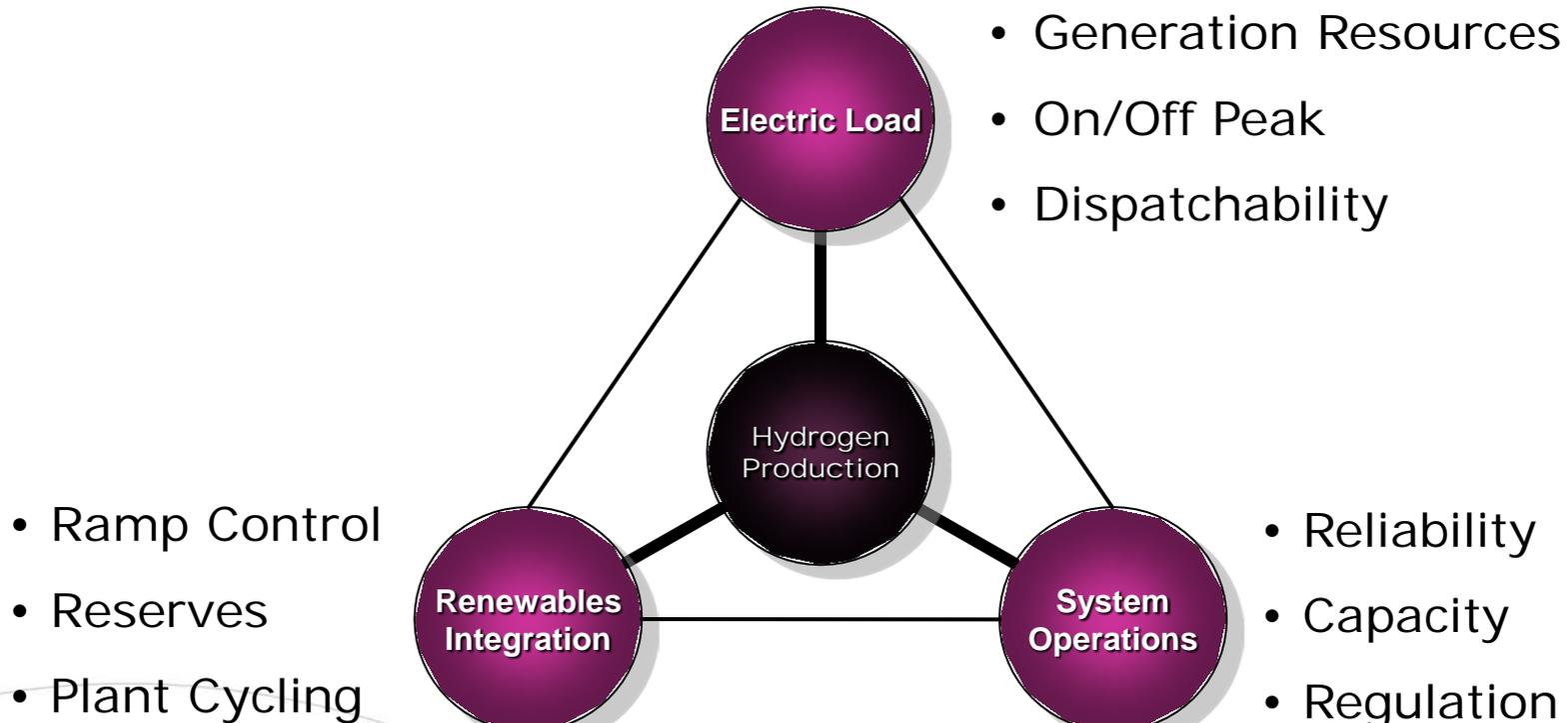
Electrolytic Hydrogen Production Potential Impacts to Utilities

Electrolytic Hydrogen Production Workshop

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Electrolytic Hydrogen Production Potential Impacts - Electric System



Unique Opportunities - Electric

- **Increased Load (Including Compression):**
 - ◆ **Electrolysis: 43 – 63 kWh/kg H₂**
(Versus Natural Gas Reformation: 4 – 5 kWh/kg H₂)
- **System Regulation**
 - ◆ **Electrolysis can deliver fast response regulation services**
 - ◆ **Regulation market is small; Expect to saturate quickly**
- **Renewables Integration**
 - ◆ **Increased off-peak load reduces wind curtailment**
 - ◆ **Dispatchability can support variability mitigation**
 - ◆ **Potential to enable high penetrations of renewables**

Ancillary Services Markets

- **Organized Markets (e.g., MISO, PJM)**
 - ◆ **Published pricing for capacity and “mileage”**
 - **2013 Average MISO Capacity Price: \$9/MW**
 - **2013 Average MISO “Mileage” Price: \$0.5/MWh**
 - ◆ **Also compensation for energy provided**
- **Bilateral Markets (e.g., PSCo)**
 - ◆ **Limited transparency in market pricing**
 - ◆ **Potential to offer service under utility demand response program or resource plan process** (focused on more attractive interruptible service discount prices, rather than paying for regulation service)
 - ◆ **FERC may be interested in regulation services in bilateral markets**

Questions

