T he Hydrogen Economy: Environmental Concerns and Opportunities

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Addressing Hydrogen/Fuel Cells

- Institute for Lifecycle Energy Analysis – "Critical Analysis of the Hydrogen Economy"
- Climate Solutions – Mission to make Northwest a global warming solutions leader

Hydrogen Concerns

- Concerns
  - New infrastructure
  - Coal mining impacts
  - Fossil emissions
  - Hydrogen emissions
  - Vehicle technology pathways

Hydrogen Opportunities

- Environmentally-driven economic development
- Smart Energy alternatives to traditional power infrastructure investments

New Infrastructure

- Plants
  - Fossil
  - Wind
- Pipelines

Coal and Hydrogen

- Coal – 90% of remaining fossil reserves
- Scenario:
  - Windpower at 2.5 cents/kWh
  - Electrolyzer efficiency to 88% (74% today)
  - Electrolyzer capital costs down 40%
  - Still produces hydrogen at twice cost of coal gasification with geological sequestration using current technologies.

Coal Mining Impacts

- Land
- Water
- Air

Carbon Emissions

- Substantial emissions from fossil-driven electrolysis or chemical derivation from fossil fuels.
- One scenario for coal-derived H – 2.6 GT/CO2 sequestration capacity needed annually.
- FCVs still a greenhouse gain
  - 70% - ADL
  - 60% - Pembina

Hydrogen Emissions

- Not greenhouse-neutral
- Stratospheric water vapor – H2 + OH = H20, H
- Increased methane
  - Today – CH4 + OH > CH3, H > H20, C02
  - H2 competes to react with CH4

Vehicle Technology Pathways – 20 years

- "…judging solely by lowest life-cycle energy use and GHG releases, there is no current basis for preferring either FC or ICE hybrid power plants for mid-size automobiles for the next 20 years or so. That conclusion applied even with optimistic assumptions about the pace of future fuel cell development."
  - Comparative Assessment of Fuel Cell Cars," Weiss et al, MIT, 2003

Vehicle Technology Pathways – 30-50 years

- "If auto systems with significantly lower greenhouse gas emissions are required in say 30 to 50 years, hydrogen is the only major fuel option identified to date."
  - John Heywood

Hydrogen Opportunities

- Environmentally-driven economic development
- Smart Energy alternatives to traditional power infrastructure investments

Economic Development

- Environmental driver - Fuel cell efficiency spells reduced emissions
- Northwest's emerging cluster includes Ballard, Avista, Idatech.

“Poised for Profit”

- Partners: Climate Solutions, Bonneville Power Administration, BC Hydro, and the lead economic development agencies of Washington State, British Columbia, Seattle and Portland.
- $3.5 trillion industry through 2020
- 32,000 Northwest jobs by 2020
- NW targets – fuel cells, power electronics, solar
- www.climatesolutions.org

Smart Energy Network

- $450 billion to upgrade power infrastructure through 2020 along standard pathway.
- Smart Energy optimizes grid with IT - $78 billion in economic benefits by 2020.
- Fully integrates distributed resources including fuel cells
- Offers T&D upgrade alternatives – distributed, efficiency, load management

Upcoming Reports

- www.climatesolutions.org
- www.ilea.org
- Patrick@climatesolutions.org