California Environmental Protection Agency

Air Resources Board

California Energy Commission
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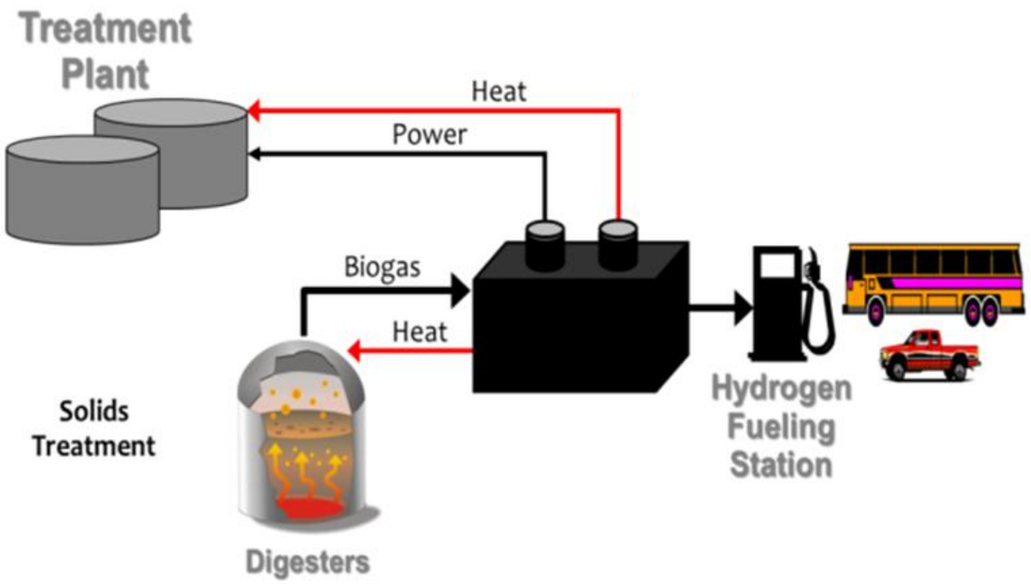
Learnings Regarding Hydrogen Infrastructure and Performance

Presentation to the California Energy Commission

June 29, 2012



Technical Requirements for Hydrogen Station Dispensing

Consider the following:

- Ensure hydrogen is available when vehicle pulls in
  - Match station capacity with expected throughput w/ability to upgrade somewhat
  - Kg throughput based on 12-14 hour peak use period (PUP)
  - Size stations according to anticipated use:
    - Connector station = approximately 50 kg/ PUP
    - Expansion/future cluster station = 100 – 150 kg/PUP
    - Established cluster anchor station = 200 – 400 kg/PUP

Technical Requirements for Hydrogen Station Dispensing (Continued)

Consider the following

- Ensure each customer gets a safe, full fill in a requisite amount of time
  - Safe means within J2601 protocol guidelines
  - Full means at least 95% state of charge
  - Requisite time means – roughly equivalent to the time it takes to fill a corresponding model of gasoline/diesel LDV (3-6 minutes average for example depending on tank status upon arrival)
  - Acknowledge that in early days, during peak fueling windows, the fill time for the 3rd or 4th back-to-back customer may or may not be exactly the same as the first customer, pending station type.

Hydrogen Station Market Diversity

Technology Providers

- Air Products
- Linde
- Hydrogenics
- Proton
- Fuel Cell Energy
- Quantum
- Air Liquide
- Powertech

Hydrogen Technology

- Central SMR gaseous
- Central SMR/Liquid
  - Delivered high pressure gas
  - Delivered liquid H2
- On-site Steam Reformation
- Onsite Electrolysis
- Onsite Digester Gas/HTFC

What Infrastructure can $30 Million Co-Fund?

- 12 – 17 stations tailored to where it can best serve the most customers
  - Proportional geographic spread relative to OEM rollout numbers
- An appropriate mixture of station capacities
- A appropriate mixture of station performance specs
- A appropriate mixture of station technologies
- A appropriate mixture of experienced qualified partners/teams

PON Considerations

- Consider multiple simultaneously released PONs or single PON that allows:
- Mixture of geographic priorities
- Mixture of station capacities
- Mixture of station performance specs
- Mixture of station technologies
- Mixture of experienced qualified partners/teams
- Separate PON evaluation tools allowing scoring between similar station specification/performance categories for example
  - Incentive funding for higher capacity/performing stations
  - More cost share for remote low throughput connector stations