Transforming Transportation Fuels

2019 Zero-Emission Bus Technology Symposium

Session 4.2. How and When to Scale Up Hydrogen Fueling Infrastructure

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Our Family

- Founded 1964, headquarters in Oklahoma City
- 470 travel stops in 41 states, 22k employees
- 24-hour access to fuel, restaurant offerings, convenience store products
- Network of hotels and storage locations

- Founded 1995, headquarters in Houston
- Alternative fuels service provider: CNG, Hydrogen, and EV Charging
- Design/Build, Operations & Maintenance, Retail Fuel Supply, Renewable Natural Gas
- Commodity supply, trading, and logistics
- Supply Love’s with gasoline, diesel, ethanol, DEF, biodiesel, renewable diesel
- Extensive experience in RFS and LCFS renewable fuel programs
- 765 trucks – fueled by CNG, biodiesel, renewable diesel
- Delivery of 13 million gallons of diesel and other products to Love’s stores

- Quick lube, inspection, and maintenance services to heavy-duty trucks
- 52 nationwide service stations and 25+ years experience
Our Approach

- Consult customer to apply our experience to your needs
- DBOM – Design, Build, Operate and Maintain
- Public, Private Partnership – P3

Every Customer is Unique, So Every Solution is Unique
Price
Area/Availability
Redundancy
Speed
Entry Effort

Speed of fueling = > 5 kg/min per lane
Redundancy = >3 days fuel storage
    extra compression
    backup power
Area = 5 to 15 bus stalls -OR- underground
Hydrogen station equipment

**Delivery**
- **Gaseous**
  - Gaseous compressed storage
- **Liquid**
  - Liquid storage
  - Vaporizer

**Production**
- **Electrolysis**
  - Electrical supply
  - H2O purifier
  - Electrolyzer
  - On site production
  - Carbon credits
  - Larger footprint
  - More expensive
- **SMR**
  - NG supply
  - SMR unit
  - PSA
  - On site production
  - Larger capacity
  - More expensive

**Pipeline**
- H2 supply
- Scrubber
  - Larger capacity
  - Larger footprint
  - More equip.

- Compressor
- Buffer storage
  - Booster compression \( \text{(opt)} \)
  - Chiller
  - Dispenser
Entry effort
Luxfer GTM – 350/700bar, 78kg usable

Pump that can be powered by on-board fuel cell

PowerCube – 500bar, 120kg usable

Automated cascade fueling, 30min/bus (without compressors)
180 bus urban fleet

- Liquid H2 delivery: 3,000 kg/day H2 consumption
- Onsite storage = 2 x 4,500kg LH2 = 3 days fuel inventory
- Footprint = 10 bus stalls
- $6 Million
OCTA up to 50 buses

- Liquid H2 delivery: 1,500 kg/day H2 use
- 1 x 4,500kg LH2 = 3 days fuel inventory
- Footprint = 8 bus stalls
- $4.7 Million includes 3 years warranty/O&M
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