Distributed Hydrogen with SureSource Hydrogen Trigeneration Systems

October 2018
FuelCell at a Glance

Delivering Clean Innovative Solutions for the Global Supply, Recovery and Storage of Energy

**Snapshot**

- Design & Manufacture
- Turnkey Project Development
- Plant Operation

- Danbury, CT - Corporate, R&D
- Torrington, CT – Manufacturing, Service
- Taufkirchen, Germany – Manufacturing
- Pohang, South Korea – Manufacturing Partner

**Company Overview**

- FuelCell Energy designs, manufactures, undertakes project development, installs, operates and maintains megawatt-scale fuel cell systems
- Serving utilities, industrial and large municipal power users with solutions that include:
  - Both utility-scale and on-site power generation
  - Carbon capture
  - Local hydrogen production for transportation and industry
  - Long duration energy storage

**Global Customers**
SureSource Solutions

1.4 MW SureSource1500™
47% Electrical Eff., up to 90% Total Eff.

2.8 MW SureSource3000™
47% Electrical Eff., up to 90% Total Eff.

2.35 MW SureSource Hydrogen™
2.35 MW Power plus 1270 kg/day Hydrogen

3.7 MW SureSource4000™
60% Electrical Eff. Up to 80% total Eff

Larger Scale Fuel Cell Parks

59 MW

11 MW

15 MW

Individual fuel cell & 350 kW fuel cell stack

Four-Stack Module 1.4 megawatts

Completed module 1.4 megawatts
Hydrogen is produced from methane in the SureSource fuel cell stack modules, using fuel cell product water and waste heat to support reforming.
### Distributed Hydrogen Advantage

**Natural gas as feedstock and thermal fuel**

**Water for steam reforming**

**Large Steam-Methane Reformer**

Central Hydrogen and Long Distance Transport

Additional cost and emissions from transportation from central SMR to stations to filling stations

**Fueling stations**

**Clean / Renewable Power & Heat**

**On-site biogas or biomethane by pipeline is renewable power generation and hydrogen feedstock fuel**

**On-site and/or Local Distributed (<40 miles) Hydrogen using Trigeneration Fuel Cells**

**Efficient co-production of hydrogen with clean power and heat close to users**
Distributed Hydrogen Low Carbon Footprint

Central Hydrogen Production and Long Distance Transport

Large Steam-Methane Reformer

Additional cost and emissions from transportation from central SMR to stations

On-site biogas or biomethane by pipeline is renewable power generation and hydrogen feedstock fuel

Clean / Renewable Power & Heat

Local distribution to stations

Onsite Fueling station

Comparison of CO₂ Emissions for Central SMR and Distributed Hydrogen

kg CO₂ emitted per kg H₂ produced

Distributed Hydrogen Trigeneration systems produce hydrogen with fuel cell waste heat, avoids methane combustion and avoid cost & emissions of long distance truck transport
SureSource 1500 and 3000 power plants have achieved CARB DG Certification on Anaerobic Digester Gas under the California Distributed Generation Program 2013 Waste Gas Standards
Co-production of power with hydrogen improves economics to produce the most affordable hydrogen and generate state LCFS credits & potentially federal RINS
Toyota to Build the World’s First Megawatt-scale 100% Renewable Power and Hydrogen Generation Station

*Tri-Gen will generate on-site hydrogen to supply Toyota Fuel Cell Vehicles, including Project Portal Heavy-Duty Truck Concept*

*Toyota Logistics Services at the Long Beach Port will become first Toyota facility in North America to use 100% Renewable Power*
Supporting the Advancement of California’s ZEV Fueling Infrastructure

Transportation Energy Center

- Landfill Gas
- Organic/Dairy Waste
- Anaerobic Digesters
- Biomethane by pipeline

FuelCell Energy Tri-Gen

- On-site biogas
- Onsite Electricity
- Excess Water
- Hydrogen 1270 kg/day

- Electricity for Vehicle Charging or Export
- Onsite Hydrogen Fueling Station
- Off Site Excess Hydrogen Deliveries
- Onsite Facilities
Thank you

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