FuelCell Energy

Delivering reliable, sustainable, cost-effective energy solutions

March 2021

Company Overview

- The future of clean energy begins with FuelCell Energy
- SureSource fuel cell platforms provide clean baseload power, heat, distributed hydrogen, long duration energy storage, for commercial, industrial, and utility customers
- Turn-key solutions from design and installation of a project to long-term operation and maintenance of fuel cell system

Global Leader in Fuel Cell Technology

- Distributed Generation
- Distributed Hydrogen
- Hydrogen & Energy Storage
- Carbon Capture

Global Customers

Over 250 MW Operating on 3 Continents

Enable The World To Live A Life Empowered By Clean Energy
Objectives

Secure Reliable Supply of Energy

Modular, reliable and resilient – eliminate reliance on traditional grid sources – no single point of failure, firm baseload power

Achieve Reliable Power with Competitive Pricing

Grid power is expensive and increasing every year – achieve predictable operational expectations

Realize Long-Term Energy Sustainability

Industry is pushing toward net-zero carbon - fuel flexibility allows the SureSource system to be capable well into the future
SureSource Molten Carbonate Application

**Electrochemical conversion of fuel to electricity**

- **No combustion**
- A fuel cell is comprised of many individual cells that are grouped together to form a fuel cell stack.
- Consists of two electrodes—a negative electrode (or anode) and a positive electrode (or cathode)—sandwiched around an electrolyte.
- A catalyst at the anode separates hydrogen molecules into protons and electrons, creating a flow of electricity between cathode and anode.
- The chemical reaction also produces water and heat.
SureSource Solid Oxide Application

**Power Generation Mode** – Configured for electric only or in combined heat and power mode on a wide range of fuels, including natural gas, biofuels, propane, and hydrogen

**Electrolysis Mode** – Produce hydrogen from steam with power input

**Energy Storage Mode** – Alternate between power generation and electrolysis producing hydrogen from water
# Fuel Cell Energy’s Broad Technology Portfolio

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<th>SOFC 250 kW – 1 MW</th>
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<td>VALUE</td>
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<td>Net-Zero on Natural Gas via CCU/CCS</td>
<td>Multi-MW platform for Large Industrial &amp; Grid Export with CCS</td>
<td>Hydrogen co-production for ports and Urban microgrids</td>
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| MARKETS | • Hospitality  
• Assisted Living  
• Big Box Retail  
• Light Industrial | • Food & Beverage  
• Data Centers  
• Hospitals  
• Microgrids | • Food & Bev CHP-CCU  
• Oil & Gas  
• Hospitals  
• Muni & Wastewater | • Ports  
• Urban Microgrids  
• H₂ for Mobility | • Small biogas plants  
• Blue and Green H₂  
• Ag & Muni digesters  
• Repowering | • Energy storage  
• Mobility  
• Pipeline injection  
• Repowering |
| KEY BENEFITS | • NG & H₂ fuel  
• Carbon Capture  
• CHP capability  
• High Reliability  
• Competitive Cost of Electricity | • High Reliability NG & H₂ fuel  
• Low levelized cost of electricity (LCOE)  
• Hot-swap-ability  
• Carbon separation | • High Reliability  
• CHP capability  
• Beverage grade CO₂  
• Fuel Flexibility: NG + Biogas fuel | • Fuel Flexibility: NG + Biogas fuel  
• Competitive cost of electricity & H₂  
• CHP capability | • Low cost of H₂  
• Carbon capture capability  
• Compression, storage and transport | • 85% Efficiency with electric only input, 100+% with external heat  
• Reversible for Long Duration Energy Storage |

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**Multiple platforms based on a common cell stack technology**
Combined Heat and Power

**Hot Water**
- Boiler feedwater preheating
- Domestic hot water
- Seasonal comfort heating
- Pool heating

**Steam**
- Typical supply – 15 psig to 250 psig
- Ideally utilize steam return/condensate

**Absorption Chilling**
- Exhaust driven chiller
- Example: 1,400 kW MCFC can provide 200 RT
Microgrid

**Grid Connect w/Export**
Allows for net metering
Grid goes down – fuel cell goes down

**Drop & Pickup**
Allows for net metering
Grid goes down – Customer stays up
Pickup delay based on speed of main breaker – similar to a backup generator configuration

**Seamless Operation**
Allows for net metering
Grid goes down – Customer stays up
No delay on customer critical loads
**SureSource CO₂ Capture & Utilization**

**SureSource CCU System**
- Three value streams from one source
  - Electricity - generation at lower than utility rate; reduce demand and services charges by 40% to 50%
  - Purified CO₂ - CO₂ provided at well below 3rd party rates; eliminate future market volatility
  - Thermal energy - reduce demand from onsite equipment
- Based on field proven SureSource fuel cell technology; greater than 260MW of installed SureSource modules worldwide
- Enhanced power and CO₂ reliability; eliminate grid outage risk and 3rd party supplier delivery interruptions

**Sustainability & Science Based Target initiative**
- Heat Recovery (CHP) and CO₂ Recovery support SBTi goals
  - Meet or exceed Scope 1 & 2
  - Directly impact Scope 3
- Recovering CO₂ from fuel cell (Stage 1) enables beneficial use e.g. food & beverage, chemicals, dry ice
- Recovering additional CO₂ from on site boilers (Stage 2) dramatically lowers carbon footprint – *Only FCE's Carbonate fuel cells can do this!*
SureSource H₂ Solutions

Clean, efficient power and hydrogen production from multiple fuels
- Green Hydrogen from renewable biogas
- Low-carbon hydrogen from natural gas, propane, associated gas, coke oven gas
- Blue hydrogen with carbon capture

SureSource Electrolysis: High efficiency electrolysis input power is converted to hydrogen

SureSource Storage: Reversible Solid Oxide cells generate hydrogen in electrolysis mode and consume hydrogen to make power in fuel cell mode

Solid Oxide power generation from supplied hydrogen
### Delivering Value

**Reliable**
- ✓ High availability
- ✓ Modular installation
- ✓ Maintainable while operating

**Resilient**
- ✓ Firm baseload generation
- ✓ Clean power signal delivered
- ✓ Eliminate “dirty” power issues

**Sustainable**
- ✓ Meet site goals of net-zero
- ✓ Support SBTi goals
- ✓ Provide a carbon free generation source

**Achieved while delivering operational value**
# SureSource 250 SOFC

## ESTIMATED PERFORMANCE

### POWER OUTPUT
- Power @ Plant Rating: 250 kW
- Standard Output AC Voltage: 480 V
- Frequency: 60 Hz std., 50 Hz opt.
- Optional Output AC Voltage: 240, 208 V

### EFFICIENCY
- LHV (Natural Gas): 62 ± 2%

### AVAILABLE HEAT
- Exhaust Temperature: 675 ± 20°F
- Exhaust Flow: 1900 lb/hr
- Allowable Backpressure: 5 in
- Heat Energy Available for Recovery (to 120°F): 289,000 BTU/hr

### FUEL CONSUMPTION
- NG (@ 20,400 BTU/lbm): 20 scfh
- Heat Rate (LHV): 5420 BTU/kWh

## WATER CONSUMPTION
- Power Generation Mode: 0
- Startup: 3 GPM
- Water Discharge: 0

## POLUTANT EMISSION
- NOx: 0.01 lb/MMBtu
- SOx: 0.0001 lb/MMBtu
- PM10: 0.00002 lb/MMBtu
- VOC: Negligible

## GREENHOUSE GAS EMISSIONS
- CO2: 750 lb/MMBtu

## NOISE LEVEL
- Standard: < 80 dBA @ 10 feet
- Optional: 65 dBA @ 10 feet

## PHYSICAL CHARACTERISTICS
- Overall Height, Installed: 10 ft
- Overall Width, Installed: 9 ft
- Overall Length, Installed: 24 ft
- Weight: 65,000 lbs

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1MW Power Generation
SureSource 1500 – 1.4MW MCFC

**PERFORMANCE**

**Gross Power Output**
- Power @ Plant Rating: 1,400 kW
- Standard Output AC Voltage: 480 V
- Standard Frequency: 60 Hz
- Optional Output AC Voltage: By Request
- Optional Output Frequency: 50 Hz

**Efficiency**
- LHV: 47 +/- 2 %

**Available Heat**
- Exhaust Temperature: 700 +/- 50 °F
- Exhaust Flow: 18,300 lb/hr
- Allowable Backpressure: 5 lwc

**Heat Energy Available for Recovery**
- (to 260 °F): 2,216,000 Btu/hr
- (to 120 °F): 3,730,000 Btu/hr

**Fuel Consumption**
- Natural gas (at 930 Btu/ft³): 181 scfm
- Heat rate, LHV: 7,250 Btu/kWh

**Water Consumption**
- Average: 4.5 gpm
- Peak during WTS backflush: 15 gpm

**Water Discharge**
- Average: 2.25 gpm
- Peak during WTS backflush: 15 gpm

**Pollutant Emissions**
- NOX: 0.01 lb/MWh
- SOX: 0.0001 lb/MWh
- PM10: 0.0002 lb/MWh

**Greenhouse Gas Emissions**
- CO2: 980 lb/MWh
- CO2 (with waste heat recovery): 520-880 lb/MWh

**Sound Level**
- Standard: 72 dB(A) at 10 feet

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**KEY FEATURES**

- Continuous Power
- Highly Efficient
- Fuel Flexible
- Clean
- Scalable
- Modest Footprint
- Quiet Operation
SureSource 3000 – 2.8MW MCFC

PERFORMANCE

Gross Power Output
- Power @ Plant Rating: 2,800 kW
- Standard Output AC Voltage: 13,800 V
- Standard Frequency: 60 Hz
- Optional Output AC Voltages: By Request
- Optional Output Frequency: 50 Hz

Efficiency
- LHV: 47 +/- 2 %

Available Heat
- Exhaust Temperature: 700 +/- 50 °F
- Exhaust Flow: 36,600 lb/h
- Allowable Backpressure: 5 iwc

Heat Energy Available for Recovery
- (to 350 °F): 4,433,090 Btu/h
- (to 120 °F): 7,460,000 Btu/h

Fuel Consumption
- Natural gas (at 330 Btu/ft³): 302 scfm
- Heat rate, LHV: 7,260 Btu/kWh

Water Consumption
- Average: 9 gpm
- Peak during WTS backflush: 30 gpm

Water Discharge
- Average: 4.5 gpm
- Peak during WTS backflush: 30 gpm

Pollutant Emissions
- NOx: 0.01 lb/MMWH
- SOx: 0.0001 lb/MMWH
- PM10: 0.00002 lb/MMWH

Greenhouse Gas Emissions
- CO2: 598 lb/MMWH
- CO2 (with waste heat recovery): 520-680 lb/MMWH

Sound Level
- Standard: 72 dB(A) at 10 feet

KEY FEATURES
- Continuous Power
- Highly Efficient
- Fuel Flexible
- Clean
- Scalable
- Modest Footprint
- Quiet Operation
Advantages

- **Highly efficient**
  - Electrical efficiency of up to 62% (commercially available solar: 15% - 22%; wind: 30% - 50%; traditional generators: 25% - 39%)

- **Multiple useable outputs**
  - Can provide electricity, thermal energy (hot water/steam/chilling), hydrogen, carbon capture for utilization

- **Efficient use of space, small footprint**
  - Offer more energy per square foot than solar panels (20W/sq ft) or terrestrial wind (0.5W/sq ft)
  - Molten Carbonate fuel cell (625W/sq ft to 755W/sq ft; based on configuration)
  - Solid Oxide fuel cell (1,000W/sq ft)

- **Reliable, continuous power delivery**
  - Continuous source of energy without the issues of intermittency
  - Ideal baseload generator to support microgrid, charging station, battery and intermittent generation applications

- **Fuel flexible**
  - Able to operate on a variety of fuels: hydrogen, methane (natural gas), renewable natural gas, biogas, anaerobic digester gas
  - Capable to meet future developments in the energy market

- **Ease of siting and permitting**
  - Low to net zero emissions output; qualifies as a Class I renewable in CT
  - Quiet operation
  - Easily concealed, seamless and unobtrusive installations
Shared Clean Energy Facility Program (SCEF)

- Passed by the legislature and signed into law by Gov. Lamont as Section 7(a)(1)(c) of Public Act 18-50 on May 24, 2018, the SCEF program is a six-year competitive procurement program that will support up to 150 MW of new clean power generation in Connecticut. Maximum rating of individual project is 4MW.

- Currently in Year 3, RFP is expected to be released January 21, 2022, and Bid Submittal is set for March 4, 2022.

- Incentive is based on a 20-year tariff agreement between the Project Developer and the EDC in which the SCEF project is located (Eversource). Project Developers submit bids into the RFP based on a combined $/kWh rate representing the electricity generated and the renewable attribute of a Class I generator (Renewable Energy Credit – REC). Projects may be no more than 4MW maximum and are in front of the EDC revenue meter, serving energy generated directly to the local grid.

- Benefits to subscribers (Eversource customers, identified by Eversource): Eligible subscribers will receive a credit on their monthly bill equal to $0.025 multiplied by their average monthly usage for twenty years.

- Benefits to site owner (Town of Winchester): Ground lease and/or associated taxes
Non-Residential Renewable Energy Solution (NRES)

- New program designed to replace the Low and Zero Emission Renewable Energy Credit Program (LREC/ZREC). Six-year program that combines Net Metering and Renewable Energy Certificates (REC) payments into one program offering 20-year agreements with selected Bidders. Projects have a maximum rating of 2MW. 2022 will be Year 1.

- Projects (>200kW) awarded based on a competitive solicitation. Bidders have a choice of one of two tariff structures, both represent a $/kWh rate for electricity generated and associated RECs. Year 1: RFP is expected to be released February 1, 2022, and Bid Submittal is set for March 14, 2022.

- Buy-All Tariff: Project is in front of the customer revenue meter and delivers electricity to the local EDC first. EDC then provides an on-bill credit to the customer of record for the project site or provides a direct payment to an identified beneficiary.

- Netting Tariff: Project is located behind the customer revenue meter and delivers electricity to the customer of record first, offsetting site’s consumption. If more energy is produced than consumed, customer site will receive an on-bill credit.

- Benefits (Town of Winchester):
  - Buy-All Tariff – may receive a credit from servicing EDC and/or a ground lease/associated taxes based on site ownership.
  - Netting Tariff: - a reduced supply rate of electricity and a reduction in delivery rate based on reduced consumption. Able to apply any excess electricity not consumed on site to other billing meters (Virtual Net Metering).
Enable the world to live a life empowered by clean energy