



FuelCell Energy

World Leader in Ultra-Clean Power

## **Thrust Area: Co-production of Hydrogen and Electricity**

**Objective:** Demonstrate the technical and economic viability of a full-scale Hydrogen Energy Station using FCE's high-temperature fuel cell system designed to co-produce electrical power, hydrogen and thermal energy from conventional fuels such as natural gas, and renewable fuels such as digester gas. In the near term the co-production system will employ FCE's MCFC or DFC technology, and in the long term it will be FCE's SOFC technology. Overall, this thrust area aims at further enhancing the value proposition offered by FCE's fuel cell power plants.

**Introduction:** Development of hydrogen infrastructure is an important need to facilitate the widespread deployment of hydrogen fuel cell vehicles. One of the major techno-economic barriers to the hydrogen infrastructure is the delivered-cost of hydrogen to the fuel cell vehicle. On-site generation of hydrogen can potentially eliminate the costs associated with the hydrogen distribution and delivery. However, the conventional on-site hydrogen production plants tend to be relatively smaller leading to higher production costs. FuelCell Energy is developing an innovative solution for cost-effective distributed generation of hydrogen.

**FCE's DFC Power Plants for Co-production of Hydrogen:** FuelCell Energy is actively engaged in commercialization of its Molten Carbonate "Direct Fuel Cell" (DFC) Power Plants in USA, Europe and Asia. Over 50 power plants have been deployed worldwide with a cumulative generation of over 150 million kWh of clean, efficient electricity. DFC power plant operation has been demonstrated on a variety of hydrocarbon fuels, such as natural gas, digester gas, methane, propane and diesel. The baseline DFC units have an electrical efficiency of 45-50%. The fuel cell system produces its own hydrogen internally from the hydrocarbon fuel while simultaneously providing cooling for the fuel cell stack. Unutilized excess hydrogen from the anode exhaust is available at no additional cost for reforming.

Co-production of electricity and hydrogen offers a potentially lower cost option for the hydrogen infrastructure. High temperature fuel cell power plants can produce electricity, hydrogen and heat at an overall efficiency of 80-85% and offer ultra-low emissions. The electricity produced on-site can power the local grid, while hydrogen can be used for fuel cell vehicles or industrial customers. The fuel cell power plant cost is paid for by the on-site power sold to the grid, and the by-product hydrogen is available practically for "free" except for the cost of its separation. The ability to generate multiple products and the flexibility to vary the hydrogen and electricity production to match with the on-site demand helps to improve the overall economics of on-site hydrogen generation.

## Thrust Area Goals

- Integrate a molten carbonate fuel cell (MCFC) with a hydrogen generation unit and a sewage treatment digester at commercial scale.
- Demonstrate the feasibility of using digester gas for both power and hydrogen production.
- Demonstrate the feasibility of using natural gas for both power and hydrogen production.
- Demonstrate high efficiency (70+ %) by integrating all functions together.
- Demonstrate the concept of a Hydrogen Energy Station configured to operate with various hydrocarbon feedstocks. See below **Hydrogen Energy Station Vision**.

