FuelCell Energy
Ultra-Clean, Efficient, Reliable Power

Project Fact Sheet

Electrochemical Hydrogen Separator (EHS)

A central goal of the Government's Hydrogen Fuel Initiative is to strengthen the U.S. economy and security by reducing America's dependence on foreign oil, and by developing technology for clean hydrogen production and commercially viable hydrogen powered fuel cells. A major barrier to widespread use of fuel cells for transportation applications is lack of infrastructure to support generation, storage, and transportation of hydrogen. An interim solution to this hydrogen infrastructure problem is needed to provide a key component of the longer-term transition to a hydrogen economy.

FuelCell Energy is developing an innovative approach to cost-effective distributed generation of hydrogen. It involves separating excess hydrogen generated by high-temperature fuel cells, such as the Direct FuelCell® (DFC®) and solid oxide fuel cells. The Company's Electrochemical Hydrogen Separator (EHS) provides a unique way to separate hydrogen from gas mixtures with relatively low energy consumption and without need for pressurization. In this electrochemical process, use of the highly reversible hydrogen electrode minimizes the amount of energy expended for hydrogen separation. Hydrogen can also be compressed in the same process step with low energy input and without rotating equipment. The separation process is virtually emission-free.

Technology Development Status: EHS cells operated in the laboratory using simulated DFC® anode exhaust gases indicate significant savings in operating costs (30-60%) are possible when compared with today's commercially available hydrogen separation systems. Hydrogen separation efficiencies of up to 90% have been demonstrated. A 25-cell subscale EHS stack developed by FCE is shown in Figure 1. The EHS cell stack operates with low-pressure drop for efficient integration with DFC®. The modular stack unit is designed for manufacturing using mass-production processes.

Figure 1. EHS Stack Assembled With 25 Cells:
This stack can separate hydrogen without any moving parts

The stack was integrated into a mobile system designed by FCE and operated for over 6000 hours at the Global Fuel Cell Center, University of Connecticut (Figure 2).

Figure 2. Demonstration of FCE's EHS System Producing 30,000 L H2/day at the University of Connecticut (June, 2006)

Development Plans: A subscale system comprising a DFC® cell, and an EHS cell has been successfully tested at FCE Scale-up of the EHS system to integrate with FCE's DFC300® power plant is in progress. This co-production power plant will produce over 250 kW of net electricity and up to 300 lb/day of hydrogen. This hydrogen production rate is sufficient to support a fleet of up to 300 fuel cell vehicles.

Development Partners: US Army-CERL
Connecticut Clean Energy Fund

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