Small Business Innovation Research (SBIR) Award Success Story

Proton Energy Systems

Proton Energy Systems is a successful small business specializing in clean production of hydrogen from water for diverse applications. Much of the technology development has been supported by the U.S. Department of Energy's (DOE's) Fuel Cell Technologies Program within the Office Energy Efficiency and Renewable Energy.

Proton Energy Systems designs and manufactures proton exchange membrane (PEM) electrochemical systems to make hydrogen from water in a zero pollution process producing safe, pure, reliable onsite hydrogen to meet today's global hydrogen requirements. The Company has been developing and manufacturing electrolysis systems since 1996, with more than 1,600 units currently deployed in 62 countries. Proton's PEM systems are used in the U.S. military, aerospace, vehicle fueling, and renewable energy industries. Today, Proton has over 70 employees and generates over $20M in revenue.

Technology

Proton's commercial products are designed to meet high purity hydrogen needs for a variety of applications. For example, Proton's FuelGen® hydrogen fueling system is a fully-integrated, packaged electrolysis system that produces medium pressure, high purity hydrogen from water and electricity at capacities of up to 65 kg/day. The system includes the electrolyzer cell stacks, outdoor-rated enclosure with shrouds, integrated vent stack with automatic drain trap, support and safety systems for regulating electrolyzing operations, on-board feed water purification system, automated tank-topping option, power conservation during stand-by, and remote monitoring for a full service solution. Proton also manufactures the HOGEN RE® hydrogen generation system, which includes a DC to DC power converter and a software operating system that allows for several modes of operation in conjunction with renewable energy input. Renewables that can be coupled with HOGEN RE® hydrogen generators are wind, solar, hydro, and wave power.

Hydrogen from Renewables

Proton's electrolyzer technology development has been strongly supported by the U.S. Department of Energy's Fuel Cell Technologies Program, in part through Small Business Innovation Research (SBIR) Awards. Since 2008, specific DOE-funded SBIR projects at Proton have included: the Low Cost Large Scale PEM Electrolysis for Renewable Energy Storage project and the Home Fueler Development project, while non-SBIR DOE funds have supported Proton's Bipolar Plate Development project. These projects have demonstrated feasible pathways for reaching the DOE targets for hydrogen production cost and efficiency. In particular, the renewable energy storage project has demonstrated significant efficiency improvements through catalyst and membrane research, while the bipolar plate development project has already resulted in a 12% decrease in Proton's commercial stack cost and shown the potential for another 50% reduction in the bipolar plate cost.

Proton's development of grid-level support for energy storage is another important initiative for solving energy problems domestically and globally. Their regenerative fuel cell (RFC) systems offer modular, scalable backup power systems that are superior to traditional lead acid batteries and diesel generator sets. For this application, Proton has developed a high pressure PEM cell stack which can generate hydrogen from water safely and efficiently directly to storage pressures without the need for mechanical compression. By integrating PEM fuel cells with high pressure PEM electrolyzers and hydrogen storage subsystems, the RFC systems deliver a predictable and uninterrupted source of backup power. The home fueler development supported by SBIR enables Proton to electrochemically compress hydrogen directly to 5000 psi, from the current 2800 psi technology.

SunHydro fueling station in Wallingford, Connecticut

Challenges Met

This year, Proton Energy Systems has been an integral part of the SunHydro East Coast Hydrogen Highway initiative, an upcoming chain of hydrogen fueling stations making it possible to travel from "Maine to Florida on sun and water." SunHydro is the vision of entrepreneur Tom Sullivan, founder of Lumber Liquidators, who has recently acquired Proton Energy Systems as part of his portfolio of renewable energy companies.

The first station was opened in October 2010, at 10 Technology Drive in Wallingford, Connecticut, Proton's headquarters. The station is run by SunHydro and allows limited public access as a start but plans for full public access in the future. It will offer businesses and government vehicles a quick and easy option to fill up their fuel cell vehicles, and will provide the infrastructure to support broader availability of fuel cell electric vehicles, which is expected in 2015. The SunHydro fueling station generates hydrogen on-site using Proton Energy Systems' enhanced PEM technology.

Next Steps

In August 2010, SunHydro announced an agreement with Toyota Motor Sales, USA, Inc. to place ten Toyota Advanced Fuel Cell Hybrid Vehicles (FCHV-adv) in the Connecticut area. The vehicles are supporting the new SunHydro fueling station, as part of a nationwide fuel cell demonstration program that will place more than 100 vehicles over the next three years. Ten fuel cell vehicles have been deployed to Connecticut and are being used by SunHydro/Proton Energy Systems staff, in addition to other community members.

Proton has also partnered with Linde to install 2 fueling stations at AC Transit in California to produce hydrogen from electrolysis for fuel cell buses. AC Transit operates a 575 kW solar power station which feeds into the electric grid. Electricity credits earned will be used to pay for the electrolyzer, which, when compared to the diesel buses that the fuel cell buses replace, will result in an estimated 40% reduction in CO_2 emissions. The first station is expected to be commissioned later this year.

For More Information

More information on the Fuel Cell Technologies Program is available at *http://www.hydrogenandfuelcells.energy.gov*.

The Proton Energy Team

U.S. DEPARTMENT OF ENERGY
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