Fill'er up... with Hydrogen

Hydrogen Fueling Station Opens In South Carolina

"We are confident that South Carolina's success in deploying hydrogen and fuel cell technologies will create additional opportunities for Atlas Copco and other SC-based businesses in sustainable energy technology areas."

Bill Mahoney, CEO
South Carolina Research Authority

Did You Know?

Atlas Copco is a partner with Energy Star for our Variable Speed Drive compressors.

In March 2009, the University of South Carolina-Columbia Fuel Cell Collaborative opened the Columbia Hydrogen Fueling Station for business. The station, which provides critical infrastructure to support emerging applications and opportunities for hydrogen-fueled transportation, now serves as a hub for the design and execution of pending fuel cell projects involving private, public and military researchers and customers.

The station's first customer is the Federal Transportation Administration's National Fuel Cell Bus Program, which is providing a fuel cell powered bus for demonstration in Columbia. The bus will operate in Columbia for one year as part of a three-year site test program. Station partners are the Center for Transportation and the Environment and the Gas Technology Institute. South Carolina partners include the Boudreaux Group, Mashburn Construction, and GreenField Compression, which is part of the Atlas Copco Group.

A hydrogen fuel cell vehicle such as the bus is much like an electric vehicle because it uses electric motors for propulsion, although it does not store energy in batteries. The bus fuel cell uses the stored hydrogen and oxygen from the air to create electrical energy. An advantage of a fuel cell vehicle is that its range has the potential to substantially exceed that of a comparable plug-in electric vehicle. The only tailpipe emission is water.

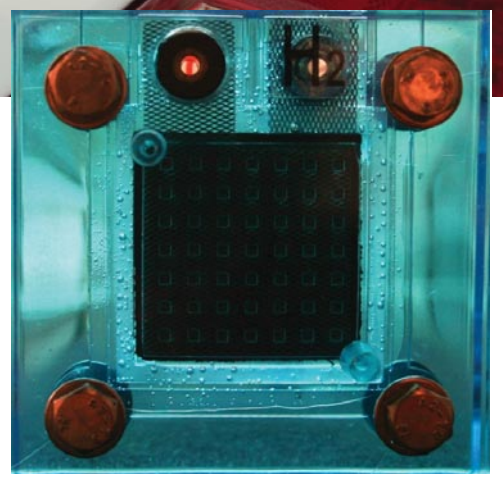
Hydrogen is abundant on the Earth's surface in the form of chemical compounds such as hydrocarbons and water, but elemental hydrogen gas (H_2) needed to power a fuel cell is actually rare in the Earth's atmosphere. For fuel cell applications, hydrogen must be produced by breaking down hydrogen-containing compounds.

The University of South Carolina – City of Columbia Fuel Cell Collaborative was formed by the University of South Carolina, the City of Columbia, EngenuitySC and the South Carolina Research Authority to position Columbia, SC as a leader in hydrogen fuel cell innovation and technology. Its mission is to attract private sector partners, top fuel cell scientists, entrepreneurs and innovators to the Columbia region. For more information, visit: www.fuelcellchallenge.com

"There are two main approaches to producing hydrogen," according to Jared Hightower, Sales Manager for GreenField Compression. "Reforming generates hydrogen from natural gas or occasionally other hydrocarbon containing sources. Electrolysis generates hydrogen from water. Each has benefits and drawbacks. Reforming is a lot more energy efficient. A bit of CO_2 is released in the process, but natural gas is the cleanest of the fossil fuels. While electrolysis creates no emissions at the hydrogen production point, it consumes a substantial amount of electricity that has to be produced somewhere, often at a power plant burning fossil fuel."

However the hydrogen gas is produced, it must be compressed for storage and transportation. "Hydrogen gas has a low density at ambient conditions," Hightower explains. "You need to compress it in order to get a sufficient quantity of fuel on board for a fuel cell vehicle to be practical."

GreenField Compression builds high pressure reciprocating gas compressors for a variety of gases including hydrogen, natural gas, helium, nitrogen, argon, carbon monoxide, and air. At the Columbia fueling station, Airgas, Inc., delivers compressed hydrogen to the station and then a GreenField Compression system delivers the hydrogen to vehicles. "The equipment is much like a petroleum fuel pump except that it dispenses high pressure hydrogen," Hightower says. "All of the hydrogen related components and



metering systems are distinct from petroleum fueling equipment, but the basic idea is the same."

GreenField supplied a S100 DM oil-free reciprocating compressor package, the valving system, the control panel, and the hydrogen gas dispensing system. Controls enable the hydrogen to be shut off in an emergency, monitor the temperature and critical shutdowns, and enable the facility to be remotely monitored. After GreenField was selected for this project, it took about eight months to build the compressors and controls for the plant. "We're excited for the opportunity to broaden our portfolio with an environmental business," says Hightower.

Hydrogen fueling has special requirements, according to Hightower. "It's important that you don't overfill the vehicle tank, which is rated for 5000 psig filling at standard conditions. We use a high tech algorithmic approach under license from the Gas Technology Institute. The algorithm takes into consideration the ambient temperature, the gas temperature, the size of the tank, and the heat of compression in order to establish a target pressure that will fill the tank safely. It's also critical to protect the tank from overheating."

About half of GreenField's business is alternative fuels, principally natural gas vehicle fueling. For example, the majority of public transportation vehicles operating at Boston's Logan Airport run on natural gas dispensed from GreenField's compressor and dispenser systems which are operated by another company. Greenfield equipment is in about a dozen hydrogen stations in California, Texas, Michigan, Missouri, Nevada, Canada and China while its natural gas fueling equipment is in about 2000 NGV stations all over the world.

"Given our experience with natural gas fueling," Hightower explains, "hydrogen fueling is a natural evolution of our business. Hydrogen as a transportation fuel is still in the development stage. It's an experimental technology that's being tested, and GreenField is at work exploring the where and how and cost of that approach. Like a lot of new technologies, it doesn't yet make economic sense the way a petroleum station or a natural gas station does, but it's well worth looking into."

In the race to develop hydrogen into our nation's next viable energy source, South Carolina has been a leader every step of the way. The Columbia Hydrogen Fueling Station may well represent the gas stations of tomorrow. The completion of the Columbia station and a sister fueling station in Aiken represent a clear commitment by business, economic development, academic and political leaders in South Carolina to grow and develop a hydrogen and fuel cell economy.