



A 30W fuel cell system to supply power for soldiers, made by Protonex.

In the works: A hydrogen economy

Area companies pioneer fuel cell technology

By Kenneth J. St. Onge

The Bay State boasts the country's densest concentration of hydrogen and fuel cell companies and it should act immediately to create an environment that fosters growth in the sector, says a core group of tech-advocates and industry insiders.

Fuel cells produce electric current by using hydrogen or hydrogen-containing chemicals, leaving water as a waste product. Hydrogen is the most abundant element in the universe, so fuel cells make an attractive electricity source, experts say, for a world rife with concerns over global warming and ever-growing fossil fuel prices.

The hydrogen and fuel cell industry plays to the Bay State's strengths, advocates say, namely an abundance of high-tech experience and research institutions and companies. Although broad commercialization of fuel cell products is years away, a growing contingent is agitating the state to invest in creating an "energy innovation economy," says Brad Bradshaw, head of the Massachusetts Hydrogen Coalition,

In June, Bradshaw and tech advocates from the Massachusetts Technology Collaborative in Westboro submitted to lawmakers a "road map" of how to build the state's hydrogen and fuel cell sectors. Among their recommendations:

- Establish a Hydrogen and Fuel Cell Institute to coordinate grants and connect researchers throughout Bay State universities with companies working on similar projects. WPI is a leading candidate to house such a center.
- Create a matching grant program that would help capitalize local companies as they compete for federal grants from the Departments of Energy, Defense and Transportation.



- Extend the job creation incentive plan available to life science companies to hydrogen and fuel cell companies, allowing them to lower labor costs and increase jobs.

Lawmakers need to act soon, says U.S. Rep. James McGovern (D-Worcester), a strong supporter of the pro-hydrogen efforts. States like OH, CT and CA – all of which have taken very aggressive stances in trying to attract companies – pose a challenge to keeping hydrogen and fuel cell ventures in-state.

Military route to commercialization

At the front end of fuel cell technology are companies like Protonex Tech. Corp. in Southboro, which has pioneered methods of building 10W to 500KW units, largely for the military,

Commercializing products for the military is an excellent way for fuel cell companies to bring in revenue, says Greg Cipriano of Protonex Technology Corp.

Fuel cell systems are an attractive technology for the military. One of Protonex's military fuel cell systems, for example, is 62 percent lighter, 50 percent smaller and 20 percent cheaper to run per mission than the traditional battery pack the military was using. And with military spending on batteries exceeding \$1 billion annually, there is a huge market.

For fuel cell makers, "the military is a great way to get money into your company," says Greg Cipriano, vice president for marketing and military development. Protonex, he says, has been awarded \$7.5 million in military and federal contracts to build portable and remote fuel cells.

That revenue has allowed Protonex to further develop commercial applications for fuel cells, such as a generator system for a hybrid scooter and a fuel-cell powered wheelchair.



A combination of incentives, grants and institutions would go a long way in building an "energy innovation economy" in the Bay State, says Brad Bradshaw, president of the Massachusetts Hydrogen Coalition

Powering hydrogen technologies

Fuel cell cars, however, remain years away from mass market availability. Although partnerships and initiatives among car makers have resulted in a handful of cars or buses being developed, fuel cell vehicles will not reach mass production until at least 2010, according to the Department of Energy. Another auto industry development not quite ready for commercialization is internal combustion engines fueled with hydrogen.

Both face a major obstacle that numerous local companies are looking to solve – the availability of high-purity hydrogen to power these devices. A network of fueling stations that can produce hydrogen in cheap, ample amounts may be one of the toughest technical problems the industry faces.

Nanoptek Inc in Maynard is one company looking to solve that problem. The NASA-funded research venture has built a device that fuses nanotechnology and solar technology to extract hydrogen from water.

The device is a crescent shaped mirror that refocuses sunlight onto a water-filled tube filled with titania-coated discs. The discs' coating reacts with the sunlight and splits the water molecules into oxygen and hydrogen, which can be harvested for fuel cells or vehicles.



Nanoptek's founder John Guerra envisions miles of Nanoptek's hydrogen generators lining U.S. highways, gathering hydrogen for fueling stations.

For now, many hydrogen sector companies see the best road to making money is branching out to embrace the range of revenue hydrogen provides.

"Hydrogen is a multi-billion dollar business," says CEO Jeffrey T. Altman of Hy9 Corp, a five-year-old company that makes hydrogen purifiers and devices called reformers that extract hydrogen from other compounds.

In late June, less than a month after relocating to Hopkinton from Woburn,, Hy9 received a \$2.3 million round of financing – for a total of \$5 million – help develop an expanded product line for the ultra-pure hydrogen and fuel cell markets, Altman says.

Hydrogen purifiers, such as those made by Hy9 Corp. in Hopkinton, filter particles from hydrogen so that it can be used in fuel cells or other industrial purposes.

While those markets develop, Hy9 is content to make money and products for the industrial side of hydrogen, which is used in applications as varied as chip-making, where it serves as an atmosphere in etching silicon, to an ingredient in consumer products such as hydrogenated

oils or even toothpaste.