

Goodbye to fossil fuels? Not quite yet

But Utah company's technology may make gas pumps obsolete someday

By Greg Lavine
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It all came down to a small, Utah-made device sitting inside an Idaho pottery kiln.

This recent experiment at a national research laboratory in Idaho Falls, Idaho, may pave the way for an efficient means of extracting hydrogen from water. Hydrogen obtained through this method could one day replace fossil fuels in powering cars and trucks.

But before trading in that gas guzzler, keep in mind it could be decades before this technology finds its way to commercial use. Ceramatec Inc., a privately held South Salt Lake company, worked with researchers at the Idaho National Engineering and Environmental Laboratory to demonstrate the utility of this high-temperature process using a device slightly larger than a brick.

With paper-thin ceramics made from cubic zirconia, an artificial gem, inside the small-scale device, researchers say they separated oxygen from water to leave hydrogen. During a Monday news conference, Ceramatec Chief Executive Ashok Joshi announced his company received a \$2.6 million federal government contract to build a larger version to test the system's commercial viability.

"Hydrogen is a central business and research interest at Ceramatec," Joshi said.

Idaho engineers ultimately hope to use the device in a next-generation nuclear reactor planned for the Idaho Falls lab. To work at its most efficient level, the hydrogen-extracting device needs intense temperatures hotter than those found in today's nuclear power plants.

Michael Anderson, project leader for the U.S. Department of Energy's Idaho hydrogen project, said the Generation IV nuclear reactor could be up and running by 2017.

A major problem with setting up a hydrogen-based economy is that it requires energy to produce hydrogen as a fuel.

"Hydrogen is an energy carrier," said Steve Herring, of the Idaho national lab. "It is not an energy source in and of itself."

Most ways to produce hydrogen involve either natural gas or coal, both of which emit greenhouse gases. The benefit to using hydrogen as a fuel source is that it puts out no harmful emissions. But releasing greenhouse gases from gas or coal to produce a clean fuel source negates the environmental benefits.

Anderson said nuclear power produces no greenhouse gases, so it is a prime candidate for hydrogen production.

While he acknowledged that nuclear power does produce waste, Idaho national lab researchers are developing methods to reduce the amount of nuclear waste that future reactors produce.

This new way to produce hydrogen, using a process called high-temperature electrolysis, was initially demonstrated inside a pottery kiln in Idaho, said Joseph Hartvigsen, project leader at Ceramatec.

Electrolysis, which involves running an electric current through water, has been used for decades. To make the process more efficient, Ceramatec and Idaho national lab researchers added high temperatures. For the next-generation nuclear reactors, temperatures could soar to 1,600 degrees.

Making a commercially viable prototype, which will require an expansion of manufacturing capability at Ceramatec, will require a device 100 times bigger than the test version, he said. Since the company's focus is research and development with an eye toward commercialization, Ceramatec will not be gearing up for mass production even if the material is economically viable.

A successful product could be manufactured by a spin-off company or through a partnership with a larger company, Hartvigsen said.

The commercial prototype is expected to be ready in three years, well before the next-generation nuclear reactor is

expected to come on line. In the meantime, other electricity sources, such as wind power and solar concentrators, could be used with the device.

Anderson said intermediate uses for the device could include using the hydrogen to more efficiently convert low-grade crude petroleum into a usable product and to synthesize other existing fuels. But the long-term goal is producing hydrogen for fuel cells in cars and other devices.

Joshi said the cubic zirconia material in this device was originally designed for solid-oxide fuel cells that the company makes. The state-of-the-art material also fits the purposes of Idaho lab researchers for hydrogen work.

"These are side benefits that we can apply to this project," Joshi said.

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About Ceramatec's plan

Salt Lake City's Ceramatec, Inc., and the Idaho National Engineering and Environmental Laboratory teamed up to develop what they say is a more efficient way to extract hydrogen from water. The method involves electrolysis, or running electrical current through water.

* A planned next-generation nuclear reactor, slated for the Idaho Falls national laboratory in 2017, would produce the intense temperatures needed to make the process work most efficiently.

* The future nuclear reactors could provide the needed high temperatures, up to 1,600 degrees, as well as the electricity needed to separate the hydrogen out of the water.