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Can Iceland run on hydrogen?

on 30 June 2000, 22:00



by [Niall McKay](#)

They called him "Professor Hydrogen" -- and it wasn't supposed to be a compliment. For two decades, Bragi Ernason, a University of Iceland chemistry professor, clung to a vision of his country's future that sounded like something out of an Isaac Asimov novel. He was convinced his tiny North Atlantic nation could become the world's first hydrogen-powered economy. Suddenly, his dream is becoming a reality and he's a national hero. And he's got the whole world watching.

Mr. Ernason's plan to replace fossil fuels with hydrogen-powered fuel cells has received backing not only from the Icelandic government but from automotive and oil giants, including [Shell](#) and [DaimlerChrysler](#), who have ponied up millions to see if Professor Hydrogen just might be right. They want to use Iceland as a test bed for a new generation of cars and buses powered by hydrogen. If the project succeeds, what was once dismissed as a crazy fantasy may become the foundation for the world's transition from the dirty and inefficient process of burning fossil fuels, to the cleaner, more efficient power of hydrogen fuel cells. "We believe that we can eliminate most of our dependence on oil by 2030," says Hjalmar Ernason, chairman of the Icelandic government's committee for alternative fuel, and no relation to the professor.

The reason all eyes are now on Iceland is that a host of countries are looking to replace fossil fuels with hydrogen -- a quest motivated in equal measure by economic, political, and environmental concerns. Within the next 15 years, the demand for oil is projected to outstrip production, and the shortage will make gasoline prohibitively expensive. And there is the environmental factor. Burning fossil fuels causes pollution, and, as scientists are increasingly concerned, global warming. And if that isn't enough, more than two-thirds of the world's remaining oil reserves are in politically unstable regions, such as the Middle East.

"There is no doubt in our minds that hydrogen is the future," says Don Huberts, CEO of [Shell Hydrogen](#). "The only real question is when." Hydrogen fuel cells are clean, emitting steam instead of exhaust fumes. They are more efficient, because they use a chemical reaction rather than squirting oil into a cylinder and setting it alight (see ["Fuel Cells Explained"](#)). And hydrogen is as plentiful as tap water. The eco-friendly William Clay Ford, chairman of [Ford](#), who drives an electric pickup truck to work, has predicted that hybrids -- cars fueled by both hydrogen and gasoline -- could account for 20 percent of all vehicle sales by 2010. Likewise, predictions for stationary applications are optimistic, topping 2.2 million kilowatts by 2010, according to the [American Hydrogen Association](#), a trade association.

But the technology does have limitations. Hydrogen is usually found bound to other elements, such as oxygen and carbon, which means it must be extracted using electricity. And where does much of the world's electricity come from? You got it -- oil. If the predictions by automakers are correct, hydrogen-powered fuel-cell vehicles will begin to appear in delivery and public fleets in the next ten years. And it will probably take another 20 years before they become pervasive. But with gas prices rising to two dollars a gallon in the United States, the economics may change soon. While the gallon equivalent of hydrogen now costs \$3 to produce, it is nearly twice as efficient as gasoline.

If hydrogen power is to become a practical alternative to oil in the long run, then it needs to be created using electricity from renewable sources such as hydroelectric, geothermal, and wind power. That's where Iceland comes in, with its abundant supply of low-cost geothermal and hydroelectric power. Exactly how much? That's the question Bragi Ernason set out to answer in his doctoral research in 1970.

"I discovered that we have enough geothermal energy to provide the equivalent of 100 nuclear power stations and enough hydroelectric power to provide the equivalent of 15 nuclear power stations," says the professor, who is now 65. "So I began to think about ways in which we could use the surplus."

THERMALS UNDERTHERE

Beneath Iceland's capital, Reykjavik (which means smoky bay), magma from volcanic activity far beneath the earth's surface heats fresh water to boiling point. The water turns to steam, which works its way to the earth's surface, collecting debris along the way, and billows out as black smoke. When the Vikings arrived in 800 A.D., they settled here because of the plentiful hot water. They used natural hot springs for bathing.

The only black smoke that can be seen in Reykjavik today comes from the buses and cars that zip around the city. But just 20 miles away at the Sudurnes geothermal power plant, steel vents release the pressure built up under the earth's surface. The excess water, which contains sulfur and silica, is run off into a ravine. Like their Viking forebears, Icelanders today relish natural baths. Many come to bathe in the

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