

Re: READ IT AND WEEP YOU POOR BASTARDS

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Source: <http://sci.tech-archive.net/Archive/sci.energy.hydrogen/2005-08/msg00254.html>

- *From:* "Ron Herfurth" <rgh2z@xxxxxxxxxxxxx>
 - *Date:* Wed, 17 Aug 2005 14:54:00 -0400
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"Marc" <mdandml@xxxxxxxxxxxxx> wrote in message
news:1124215076.459174.237410@xx
<http://pubs.acs.org/subscribe/journals/esthag-w/2005/aug/t> Sunlight
turns landfill gas into renewable hydrogen
Amid record-high gasoline prices and capricious summer weather that
hints at global warming, renewable production of hydrogen (H₂), a clean
fuel whose only combustion product is water, seems like the solution to
the world's energy and greenhouse-gas woes. More than 95% of the
world's H₂ is currently made with polluting fossil fuels, and a cadre
of researchers is working on new technologies that use renewable
sources, such as solar and wind power, to generate H₂. Now, Canadian
entrepreneurs have demonstrated for the first time a solar-powered
system that can produce H₂ from landfill methane (CH₄).

So why not just burn the CH₄ directly to produce electricity or compress it
for use in a car? Sure, the products of combustion are carbon dioxide and
water but if you reform the methane to get pure hydrogen, what happens to all
the carbon that was in the CH₄? Doesn't it just wind up in the atmosphere?

snip

By preventing 81,000 tons (t) of CO₂ equivalent from entering the
atmosphere every year,

"But Madam Rudolph, where did the Carbon go?"

with profus apologies to Richard Pryor

ron herfurth

the reactor will satisfy half of Regina's goal
to reduce greenhouse gas emissions by 1 t per household as part of
Canada's Kyoto Treaty commitments.

There are lots of ways to produce H₂ from renewables, and SHEC is not

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the first to use solar power to convert CH₄ to H₂, says Brant Peppley, a chemical engineer with the Queen's–Royal Military College Fuel Cell Research Centre (Canada). However, what is unique about SHEC's project is that the company is using solar power to convert renewable landfill CH₄ to H₂, he says. "For every molecule of waste biogas methane that we convert to hydrogen, the atmosphere benefits because methane is 21 times more powerful than CO₂ as a greenhouse gas," he says. Using H₂ from landfills as a renewable energy source in place of fossil fuels creates even more advantages for health and the climate, Peppley adds.

The solar concentrator technology at the heart of the SHEC system has been around for decades. However, it has been drawing renewed attention in the wake of the development of the very high efficiency solar cells—above 37%—that are now widely used for powering satellites. "This development demands that we take a fresh look at the potential of solar concentrators for generating low-cost electricity or hydrogen," according to the U.S. National Renewable Energy Laboratory (NREL).

SHEC's system does not use photovoltaic cells, but it has helped push solar concentrators back into the limelight. Most importantly, the company has cut the cost of solar collection by using inexpensive materials to create mirror assemblies that are not labor-intensive to construct, says Ray Fehr, vice president of marketing at SHEC. The company dropped its costs by one-third by developing new methods to form the reflectors before mirror finishing, he explains. Each square-foot facet in the array concentrates the sunlight falling on it to the size of a thumbnail. "When you put 25 of those together, you get the power of 5000–8000 suns," Fehr says.

A water-cooled aperture, also a new invention, operates under computer control like the iris of a camera to adjust the amount of sun in the reactor, thereby maintaining the temperature of the reaction at 850 °C, the optimum level for the catalyst, he says.

The system is also innovative in "the way we have integrated the solar mirror array and shutter system, reactor core, catalyst and control system," Fehr says. CH₄ extraction wells capture the landfill gas, which is composed of a mixture of CH₄, CO₂, and other impurities that are then separated from the CH₄. In the first dry fuel reformation reaction, CO₂ and CH₄ are quickly heated to 850 °C in the presence of a catalyst to form H₂ and carbon monoxide (CO). The CO and water then flow into a water–gas shift reactor at 200 °C to yield H₂ and CO₂. The H₂ is separated from the CO₂, which is recycled into the first reaction, Bakos says.

SHEC's approach of using a proprietary catalyst to split CO₂ and CH₄ into H₂ and CO has a number of advantages, Bakos says. Most importantly, it requires less energy than the industry norm of using steam to "reform" CH₄, he adds. "It normally takes a lot of

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energy to heat water," he says. Using the catalyst, and thereby eliminating the water, means that it takes less energy to bring the gases to 850 °C, and the temperature is easier to control, Bakos explains.

More than 98% of the CH₄ that feeds the reaction is converted to H₂, Bakos says. In energy terms, for every 40 megajoules (MJ) of CH₄, the process yields 45.7 MJ of H₂, a net energy gain of more than 14%. However, when the energy from the sun is factored in, SHEC's system turns out to be quite inefficient because a great deal of the solar energy is lost in the form of heat, Bakos admits. "SHEC will, in this commercial project, implement heat exchangers to recover the majority of the heat energy and apply this heat to the process," Fehr adds. By using the abundant and free energy of the sun, energy losses are not as critical when comparing SHEC's process to other processes that require fossil fuels, he says.

SHEC nonetheless expects to be able to produce H₂ much less expensively than conventional processes can. Bakos estimates, on the basis of the pilot plant's operation, that H₂ production costs will be Can\$0.75/kg, compared with Can\$1.25/kg for traditional H₂ methods that use natural gas. A kilogram of H₂ has about the same energy content as a kilogram of gasoline.

"Even if that estimate is just for production cost alone, [Can]\$0.75/kg is way too low because the solar technologies are expensive," counters Margaret Mann, a chemical engineer at NREL. The price rises even further when you factor in the cost of compressing and transporting the H₂, she notes. The U.S. Department of Energy has set a target for H₂ production cost at US\$2/kg for this year.

However, the production cost of H₂ varies widely, depending on the feedstocks used and the source of energy, notes Ry Smith, manager of the Hydrogen Village program for Fuel Cells Canada, an industry association. "In the next 5–10 years, increasing consumption as well as a number of new technologies will bring the price of hydrogen down to where it is competitive with gasoline in terms of distance traveled," he says.

SHEC will be selling food-grade H₂ to food producers, mainly for hydrogenating vegetable oils, Fehr says.

"The landfill methane cost is independent of the price of fossil fuel—we are purchasing methane for pennies on the dollar—and the operating costs will be much lower because we are using sun, not fossil-fuel, energy," Bakos responds. Traditional methods of solar energy collection and usage have been expensive, but SHEC's technology is commercially viable because of its inexpensive concentrator design and manufacturing techniques, Fehr adds.

The components that SHEC has created for its dry reformation of

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landfill CH4 will also be used for the company's efforts to use solar power to directly split water—a holy grail for researchers, Fehr says. However, that development will be at least 10 years in the making, he says. JANET PELLE
ech/jp_sunlight.html

Ahhahahahahahahahahahahahaha. Looks like another few Million for yours truly. Ahahahahahahahahahahaha. You idiots!!!
Ahahahahahahahahahahaha.

• *Follow-Ups:*

- ◆ **Re: READ IT AND WEEP YOU POOR BASTARDS**
◇ *From: Al*

• *References:*

- ◆ **READ IT AND WEEP YOU POOR BASTARDS**
◇ *From: Marc*

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