Re: READ IT AND WEEP YOU POOR BASTARDS

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- *From*: "Bob Eldred" <nsmontassoc@xxxxxxxxx>
- *Date*: Wed, 17 Aug 2005 00:54:33 GMT

"Marc" <mdandml@xxxxxxxxxxx> wrote in message
news:1124215076.459174.237410@xxxxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
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).

Based in the city of Saskatoon in Canada's Saskatchewan province, Solar Hydrogen Energy Corp. (SHEC) has operated a pilot−scale reactor that converts CH4, CO2, and water into H2 and CO2 in two steps: dry fuel reformation followed by a water−gas shift reaction. The project is poised to enter commercial−scale development this fall at a landfill site in Regina, Saskatchewan. Researchers estimate that the $16 million project will produce more than 1.2 million kilograms (kg) of food−grade H2 per year, says Jamie Bakos, manager of environmental services for Giffels Associates, Ltd., a consulting partner on the project.

By preventing 81,000 tons (t) of CO2 equivalent from entering the atmosphere every year, 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 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. CH_4 extraction wells capture the landfill gas, which is composed of a mixture of CH_4, CO_2, and other impurities that are then separated from the CH_4. In the first dry fuel reformation reaction, CO_2 and CH_4 are quickly heated to 850 °C in the presence of a catalyst to form H_2 and carbon monoxide (CO). The CO and water then flow into a water−gas shift reactor at 200 °C to yield H_2 and CO_2. The H_2 is separated from the CO_2, which is recycled into the first reaction, Bakos says.

SHEC's approach of using a proprietary catalyst to split CO_2 and CH_4 into H_2 and CO has a number of advantages, Bakos says. Most importantly, it requires less energy than the industry norm of using steam to "reform" CH_4, he adds. "It normally takes a lot of 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 CH_4 that feeds the reaction is converted to H_2, Bakos says. In energy terms, for every 40 megajoules (MJ) of CH_4, the process yields 45.7 MJ of H_2, 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 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 PELLEY
ech/jp_sunlight.html

Ahhahahahahahahahahahahahahaha. Looks like another few Million for

yours truly. Ahahahahahahahahahaha. You idiots!!!
Ahahahahahahahahaha.

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- ***Follow−Ups***:
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        - *From:* Marc

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