The Oil Drum: Australia & New Zealand

DISCUSSIONS ABOUT ENERGY AND OUR FUTURE

The Bloom Box: Initial Evaluations of an Energy Breakthrough

Posted by Big Gav on February 23, 2010 - 8:34am in The Oil Drum: Australia/New Zealand
Topic: Alternative energy
Tags: bloom box, bloom energy, cogeneration, fuel cell [list all tags]

Fuel cell company Bloom Energy made quite a stir over the weekend, with a spot on the CBS "Sixty Minutes" TV program in the United States (The Bloom Box: An Energy Breakthrough? - see the link for the video and transcript).

Bloom has spent 8 years and close to US$400 million developing their product and the company is now leaving "stealth mode" and actively promoting themselves. Fortune also has an article on the company (Is K.R. Sridhar’s 'magic box' ready for prime time?) and the company will be holding a launch event on Wednesday.

Bloom has had a number of companies testing the product in data centres, including Google, FedEx, Staples and eBay.

> In the world of energy, the Holy Grail is a power source that's inexpensive and clean, with no emissions. Well over 100 start-ups in Silicon Valley are working on it, and one of them, Bloom Energy, is about to make public its invention: a little power plant-in-a-box they want to put literally in your backyard.
>
> You'll generate your own electricity with the box and it'll be wireless. The idea is to one day replace the big power plants and transmission line grid, the way the laptop moved in on the desktop and cell phones supplanted landlines.
>
> It has a lot of smart people believing and buzzing, even though the company has been unusually secretive - until now.
>
> K.R. Sridhar invited "60 Minutes" correspondent Lesley Stahl for a first look at the innards of the Bloom box that he has been toiling on for nearly a decade

GreentechMedia has more background on Bloom - Video: The Bloom Box Lands, And The Unanswered Questions Are....

> The Bloom Box--which costs $700,000 to $800,000 now--essentially is a device for making electricity on demand. Methane or other hydrocarbons are fed into the device along with oxygen. The mixture is heated to around 1,000 Celsius. As the gases pass through catalytic plates, the machine produces electricity, some heat, carbon dioxide and water. Other fuel cell manufacturers say they can convert 80 to 90 percent of the energy inserted into their boxes into usable energy. Bloom remains a little vague on efficiency, but if the company ranks with these competitors, the device will be more efficient than the traditional grid. Less than half the power burned at power plants turns into usable power in your home.
>
> Bloom eventually hopes to make home units that cost around $3,000. That would be a lot less than the ones currently sold by Panasonic in Japan or ClearEdge Power in California. ClearEdge sells its 5 kilowatt system for $56,000. Ceres Power in England comes out with fuel cells for residences next year that in part are made from diesel engine components to cut costs. Utilities in the UK and Ireland will sell it.

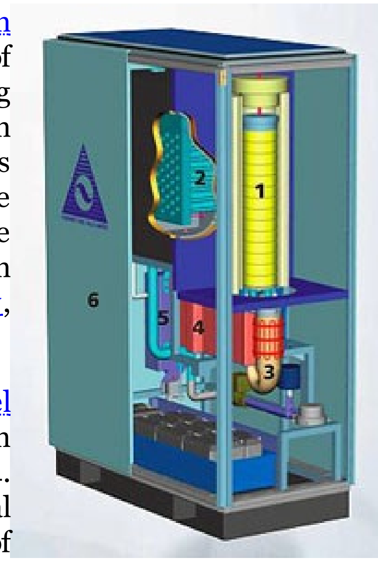
One of our staff members, Rembrandt Koppelaar, made the following rough cost calculations of the return on investment for the Bloom Box, excluding the cost for grid connection. Based on his calculation, it takes 15 years to get back the investment cost. (The time would be longer, if the cost for grid connection were included.)

> **Conservative assumptions based on the video:** (All amounts in US $).
>
> - $800,000 for a Bloom Box that generates power for 100 American Households
> - American household energy usage is 10,000 kWh per year (10,600 in 2001)
> - Bloom Box hence generates 1 million kwh per year at an investment cost of $800,000
> - Production costs US for electricity from natural gas for residential use is $ 0.10 per kwh (http://www.eia.doe.gov/cneaf/electricity/epm/table5_3.html)
> - costs for 1000 cubic foot of natural gas for residential use is 12 dollars (http://tonto.eia.doe.gov/dnav/ng/ng_pri_sum_dcu_nus_m.htm)
> - 1 cubic foot of natural gas has an energy content of 1,034 BTU
> - 1 kWh is equivalent to 3413 BTU spent in an hour
> - Bloom Box can turn natural gas into electricity at an 80% conversion efficiency
>
> **Calculation:**
>
> - Costs per year for 1 million kWh from natural gas from centralized power sources is $100,000.
> - 1000 cubic foot of natural gas gives 1,034,000 BTU which can be converted at 80% efficiency, hence 827,200 BTU of power which is equivalent to 242 kWh, costing $12 for the fuel. So 12/242 = $ 0.05 per kWh incorporating fuel costs only. Which amounts to a total fuel cost of $50,000 for 1 million kWh.
>
> At an investment cost of $800,000 dollars it would take approximately 15 years (800,000 / 50,000) to pay back investments, excluding the costs of connecting to the grid.

The grid tie would presumably providing considerable services--including metering the electricity, doing the billing, and maintaining the grid wiring, so the cost would not be insignificant.

The text below repeats an Oil Drum post on the cogeneration / fuel cell industry from March 2008 - Cogeneration At Home: Ceramic Fuel Cells And Bloom Energy.

Cogeneration At Home: Ceramic Fuel Cells And Bloom Energy



The Engineer-Poet recently had a post on The Cogeneration Stopgap at the Oil Drum, which looked at how the combination of cogeneration (generating combined heat and power - CHP - using natural gas) and heat pumps could be used to heat North American homes much more efficiently and extend the life of North America's dwindling natural gas reserves for a period of time while houses are retrofitted to make them more energy efficient and natural gas use is replaced with electricity. The only example of cogeneration technology touched on in the article was from Climate Energy, whose CHP unit is made by Honda.

An Australian company working in this area called Ceramic Fuel Cells was in the news recently after landing a $240 million deal with Dutch energy company Nuon to supply 50,000 CHP units by 2014. The company still needs to meet a number of commercial requirements set by Nuon - in particular improving the durability of the cells from two years to four.

The company is hoping that production will begin by June 2009 in a new €12.4 million factory in Heinsberg, Germany, which aims to produce 10,000 2 kW units per year. The cells are expected to emit 60% less carbon dioxide than traditional combustion generators. The company is also partnering with Britain's Powergen, Germany's EWE and Gaz de France.

Ceramic Fuel Cells

Ceramic's fuel cells have been under development for several years, listing on the ASX in 2004 and the AIM shortly after. The company specialises in solid oxide fuel cells, which convert natural gas (and presumably biogas) into power and heat without burning the fuel. The cells convert about 50 per cent of the energy in the fuel to electricity - traditional gas-fired power stations manage around 30 per cent - with another 35 per cent of the potential energy captured as heat from the catalytic process.

The company doesn't have any plans to market units in Australia in the foreseeable future, preferring to concentrate on the European market due to higher energy prices, specific CHP rebates in Germany, feed-in tariffs and possible carbon credits for trading on the EU emissions trading scheme (set up under the Kyoto protocol).

CHP in Britain

Reuters reported that boilers containing Ceramic's units could be sold in Britain in 2010 if utility company Powergen orders units this year. The article estimates that fuel cell units for home units will be priced between 1,500 and 2,000 pounds and that larger units priced at over 3,000 pounds will be operated by utility companies. The same report goes on to speculate that because utilities will save so much money by producing electricity using CHP (which they believe is twice as efficient as centralised generation and sending power through the grid), that they expect utilities will eventually start giving next-generation boilers to customers for free, with the units having a 4-5 year payback period.

Powergen has also previously looked at a different micro-CHP approach using Stirling Engines attached to water boilers. I can't tell what happened to this plan, though the company is assume was the prospective supplier - Disenco - is still marketing a CHP product (although full production isn't due to begin until this year, which may explain the absence of progress).

Another British CHP company called Ceres Power received an order for 37,500 units from British Gas owner Centrica in January, for delivery from 2011. These units are smaller but cheaper than Ceramic's units. Carbon Commentary have looked at this unit and claimed the main challenge facing CHP vendors in the UK is a the lack of feed-in tariffs - which would presumably affect Ceramic as much as Ceres.

Bloom Energy

Another company that has received a lot of attention in the fuel cell market is US company Bloom Energy, who are also developing solid oxide fuel cells (though there is some legal argument underway about who actually developed the technology in this case).

The company is investigating using natural gas and ethanol as fuel for the cells, and most reports speculate the cells will be able to generate 100 kw of power (the company's web site says absolutely nothing). One report from Business 2.0 claims the company is aiming to sell units for around US$10,000.

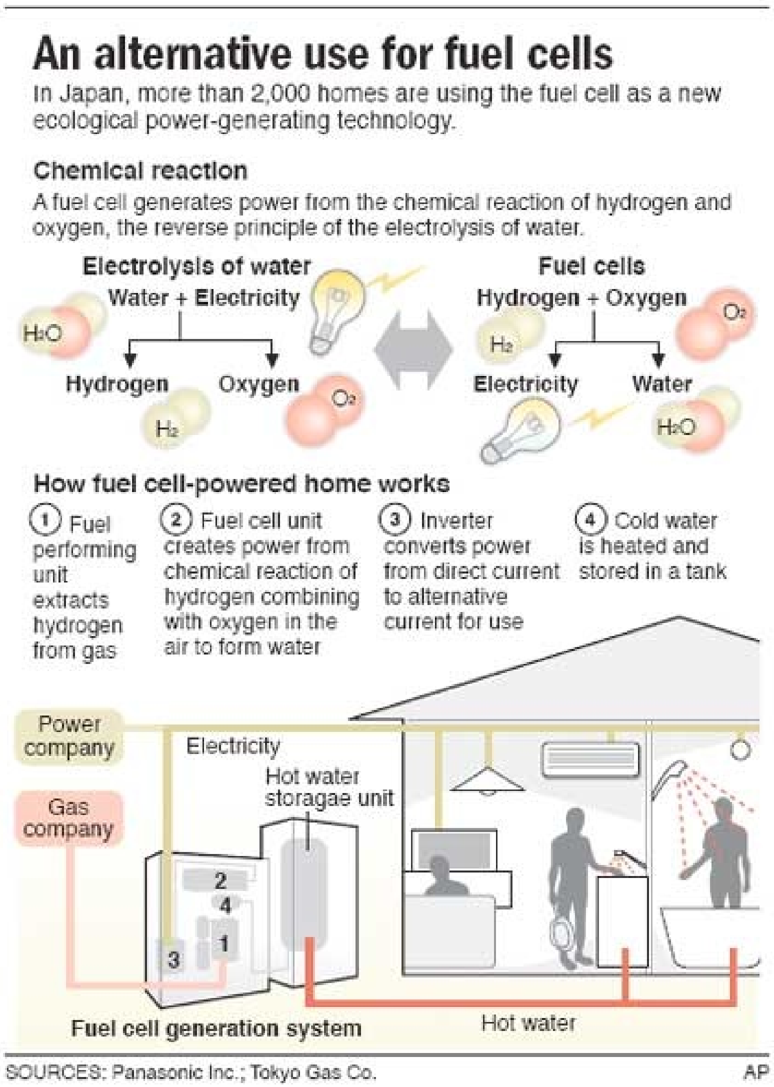
Bloom is backed by a number of high profile investors, including the omnipresent Kleiner Perkins Caulfield Byers, and has raised US$100 million in funding. According to Vinod Khosla, the company is currently building a "massive" facility in Mumbai, India.

One possible application for Bloom's fuel cells is in data centres, with the cells used to eliminate the need for uninterruptible power supplies (UPS's) and thus (in some cases) the need for additional disaster recovery (DR) facilities.

Japan

Japan has also seen trials of hydrogen fuel cells for CHP, with the hydrogen coming from reformed natural gas. The cells are [leased for 1 million yen] (US$9,500) for a 10-year period from Matsushita Electric Industrial Co. Toyota, Honda and Toshiba are all also working on fuel cells, usually as part of efforts to develop fuel cell vehicles.

The Japanese Government is spending 2.4 billion yen (US$310 million) per year on fuel cell development and plans for 10 million homes (25% of Japanese households) to be [powered by fuel cells by 2020].



The Air Car

One last note - a commenter on the "Air Car" articles noted that MDI's main business seems to be a [variable-fuel stationary power supply], so presumably they could be a vendor in this market at some point as well.

Crossposted from [Peak Energy]