FUEL CELLS

ROBERT WILDER

We Need Clean Hydrogen Soon

At last, a long-overlooked technology promises to transform much of society, including the construction industry. Offering clean and abundant power, fuel cells may end our reliance on oil and help minimize pollution and global-warming gases. But to take full advantage of this 161-year-old technology, we need to find ways to produce hydrogen cleanly, economically and plentifully.

In the past few months, investment analysts and others have begun paying a great deal of attention to a vision of a world powered by fuel cells with little or no pollution. Yet fuel cells are not new. Invented in 1839 by William Grove, a British amateur physicist, the fuel cell was once viewed as a novelty. Until recently, fuel cells were used only sporadically, where cost is not the overriding issue such as in spacecraft. But sooner than most in the construction industry might realize, professionals such as architects, engineers and contractors may begin working with fuel cells on a regular basis.

PROGRESS Cost-cutting technological strides are being made in producing power from fuel cells at costs that may soon be low enough to meet or beat all competitors, even oil, the priceleader. Consider the progress by FuelCell Energy Inc., Danbury, Conn.: In an upcoming field test with fuel cells, the firm expects to demonstrate a reduction in electricity cost to 17¢ per kilowatt-hour (kwh), for an installed cost of $8,000 per kilowatt—much less than the $20,000 per kw achieved in a 1996 trial.

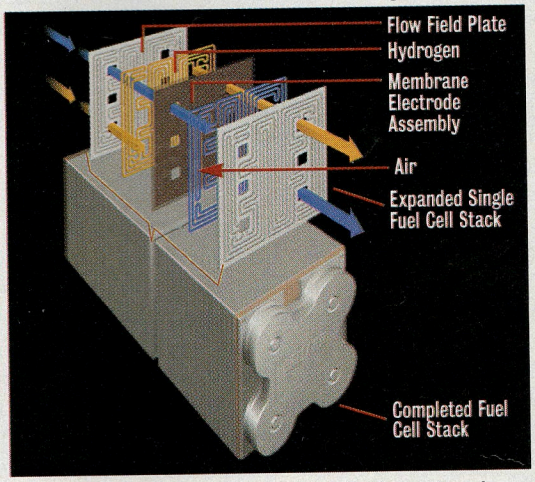
Within five years, FuelCell Energy seeks to achieve installed costs—including fuel—of just $1,200 per kw, for an electricity cost of about 5¢ per kwh. That compares favorably to energy prices nationwide, which typically range from more than 10¢ in New York to about 4¢ per kwh in the Pacific Northwest.

To make electricity, fuel cells require just hydrogen, plus oxygen easily taken from air. A catalyst in the fuel cell splits each hydrogen atom into a proton and an electron, the protons pass through a membrane to combine with oxygen and the reaction produces water. At the same time, the membrane forces electrons to take an external circuit to the other side of the membrane. In doing so they make power.

Five main types of fuel cells, with different electrolytes and operating temperatures ranging from 80°C to 800°C, lend themselves to all types of applications. Obvious uses involve buildings, which consume two-thirds of the nation's electricity. Besides generating power, fuel cells produce high-quality waste heat that can be used for heating and refrigeration.

When compared to oil or coal-fired powerplants where energy is wasted at the source by dirty combustion—and fails to reach customers—fuel cells start out with a big advantage. Additionally, they are scalable from room-temperature micro to high-temperature massive applications, making them well suited to provide decentralized power close to where needed. They already make economic sense where the existing power grid is fully loaded and expansion is costly, such as in rural areas where there is no power grid, or where high-quality assured power is a necessity. Generating power where needed further eliminates huge costs associated with putting in miles of expensive wires on the grid. Using fuel cells to generate decentralized power also minimizes transmission losses and delivery costs. Nationwide, the cost of delivering electricity from all sources runs about 2.4¢ per kwh.

So why aren't fuel cells already powering our homes, offices, cell phones or cars? Because, until very recently, their costs were far too high. Each fuel cell had to be handbuilt by highly trained Ph.Ds. Many fuel cells also required gobs of pricey catalysts such as platinum. But remarkably, cost reductions will become evident soon as more and more fuel cell companies build new manufacturing facilities. For the first time, economies of scale and mass production will allow considerable reductions in the costs.



FUEL CELL It works electrochemically—cleanly.

In the near-term, ecologically less desirable options than hydrogen or natural gas will be used, because of the existing infrastructure for hydrocarbons such as oil and coal. For instance, FuelCell Energy announced plans last month to build a $34-million, 2-Mw plant in Kentucky as part of the nation's Clean Coal Technology Program. The plant, 50% funded by the U.S. Dept. of Energy, is one approach for fuel cells.

NEW ECONOMY In the long run, it makes sense to create a new "hydrogen economy" without foolishly relying on hydrocarbons such as gasoline to obtain hydrogen. Given the scant demand for hydrogen so far, sparse attention has been paid to how to release this most attractive of fuels from, for instance, water. Currently, about 95% of all hydrogen production utilizes reformulated natural gas.

But to adopt fuel cells widely, we should produce hydrogen cleanly. Possibilities include use of solar or wind power to split hydrogen from water. We could produce regenerative fuel cells that use—and make—water. Equally exciting possibilities include the use of green algae to produce hydrogen biologically. Ecological sensibilities demand that we keep our eye on the prize with fuel cells. It is hydrogen fuel that renders them amazing, and no other fuel will do.

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