

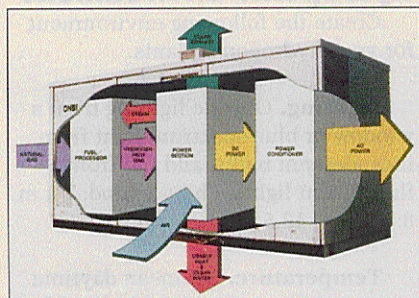
technology TODAY

Alan Pierce

Technology.Today@worldnet.att.net

Zero Pollution

It is very difficult to find a person on our planet who lacks some knowledge of modern technology. In fact, most inhabitants of Third World countries hope to achieve a reasonable standard of living in the near future. This includes owning modern technological devices.



Yet, the world's nations are already hard-pressed to meet current demands for electricity. The question is, will we be able to produce the extra 10 trillion kilowatt-hours of electricity that will be needed over the next 20 years? One hopes that world leaders in 2020 will be able to applaud our farsightedness in building power systems that could meet their electricity needs without further polluting their environments. One thing is clear: if we don't increase our electricity production or greatly reduce our demand, we will soon tumble into an energy crisis on par with the scariest scenarios of science fiction books and movies.

The dilemma is how to build the infrastructure needed to produce more electricity when the very idea of building new nuclear and fossil-fuel burning plants is under attack for safety and environmental reasons. The solution is to embrace alternative, nonpolluting systems to generate the electricity.

The fuel cell is a nonpolluting way to generate electricity through a chemical reaction that combines hydrogen and oxygen. NASA first used this technology in the Gemini space capsules in the 1960s. Until recently, here on earth, fuel cells have been impractical for generating electricity, because of their cost.

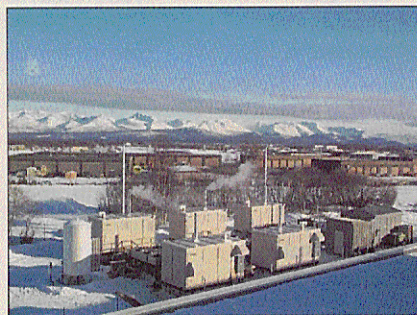
At this time new designs, new materials, and new methods of manufactur-

ing are all uniting to provide economy-of-scale savings that will even allow the placement of fuel-cell power stations in the backyards of single-family homes.

In June 1998, Plug Power, a Latham, NY, company (www.plugpower.com) started testing a refrigerator-size residential system that generates electricity from natural gas. The system provided all the needed electricity for their "proof of concept" home, at a cost of 7¢ to 10¢ per kilowatt-hour. A Plug Power System designed for residential or small business use will go on sale in 2001.

The illustration shows a schematic of International Fuel Cells' (www.internationalfuelcells.com/index_fl.htm) model PC25 Fuel Cell. Fuel cells built today can acquire their hydrogen directly from hydrogen gas, natural gas, propane gas, methanol, and gasoline. The fuel that powers a system enters the system's fuel processing unit, where a catalytic membrane splits the fuel's hydrogen molecules into electrons and protons. If the fuel isn't a pure source of hydrogen, the chemical reaction also produces some carbon monoxide, which is further processed into small quantities of carbon dioxide and water.


In the power section, the protons react with air to form water. The electrons pass out of the power section as direct current (dc) electricity. The power conditioner section converts the dc electricity into alternating current (ac). This entire chemical reaction



takes place without combustion.

If the system runs on hydrogen gas, the system will only produce electricity and hot water. Regardless of the fuel used, the process is extremely efficient

and the fuel cell itself has no moving parts to wear out. To produce the needed electricity, fuel cells are stacked together much as dry-cell batteries are stacked. The photo shows a gang of five PC25 200kW fuel cells that supply electricity to a UPS mail distribution center.

The Holy Grail of fuel cells would work using water as its fuel and oxidizer. An experimental system developed by Volvo actually uses an electrolyzer to break down water into its basic elements, hydrogen and oxygen. The car Volvo built only runs on the fuel produced by this electrolyzer until the engine's catalytic converter reached operating temperature. When it becomes economically feasible for fuel cells to get their hydrogen and oxygen from water, we will no longer need to rely on fossil fuels to run our machines or produce our electricity. 

Recalling the Facts

1. Explain how a fuel cell works.
2. Why are people reluctant to build new fossil and atomic power plants to meet future demands for electricity?
3. When economically feasible, water would be the ideal fuel for fuel cells. Why?

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