

## WHY USE HYDROGEN?

Hydrogen is a versatile fuel. It can be used as a transportation fuel for cars, trucks, and planes. It can be burned to produce heat for cooking and heating in homes and for process heat in industries, just as we now use natural gas. It can also produce electricity via a fuel cell, as it is doing here.

Hydrogen is easily transported in pipelines and can be shipped from sunshine-rich areas to the rest of the country. Solar hydrogen produced in the United States would provide us with an abundant, secure, and domestic energy source.

Perhaps best of all, hydrogen produced from solar energy is a renewable, clean fuel. The only combustion product is water. Hydrogen combustion does not contribute to global warming, acid rain, or air pollution.

## IS IT SAFE?

As with any fuel, there are dangers associated with using hydrogen. But overall, hydrogen is safer than natural gas, gasoline, and propane, fuels we are accustomed to using. Numerous industrial hydrogen systems have been in use for many years and have excellent safety records.

## HOW MUCH DOES IT COST?

The capital costs for this system are very high because it contains specialty components and employs new technologies. However, operating costs are minimal, and the fuel, sunlight, is free. Eventually, as more solar hydrogen systems are installed, the capital costs will decline substantially. We expect that solar hydrogen will one day be cost-competitive with gasoline, especially when the environmental consequences and insecurity associated with petroleum use are taken into consideration.

## THE SCHATZ SOLAR HYDROGEN PROJECT

The Schatz Solar Hydrogen Project began in the fall of 1989. Its goal is to demonstrate that solar hydrogen is a reliable and abundant energy source for our society. It is funded through a generous grant from Dr. L.W. Schatz, former president of General Plastics Manufacturing Company of Tacoma, WA. When he founded the project, Dr. Schatz wrote: "I look forward to a successful research effort and hope that eventually it can solve many of the world's energy and pollution problems."

*The project is managed by*

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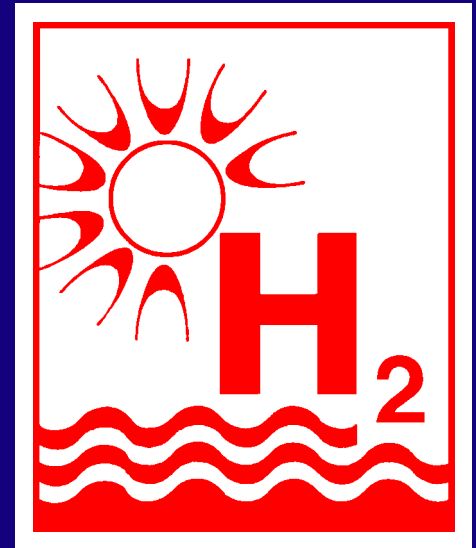
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**CLEAN ENERGY  
FROM THE  
SUN**



**Schatz  
Solar  
Hydrogen  
Project**

**Humboldt  
State University**

## THE SOLAR HYDROGEN CYCLE

In the solar hydrogen cycle, solar energy provides the electricity to remove hydrogen from ordinary water by the process of electrolysis. The hydrogen can then be stored or transported. When hydrogen is recombined with oxygen, usable energy results. No resources are consumed and the only byproduct is pure water. In this cycle hydrogen is an energy carrier; it allows us to store and transport solar energy in large quantities.

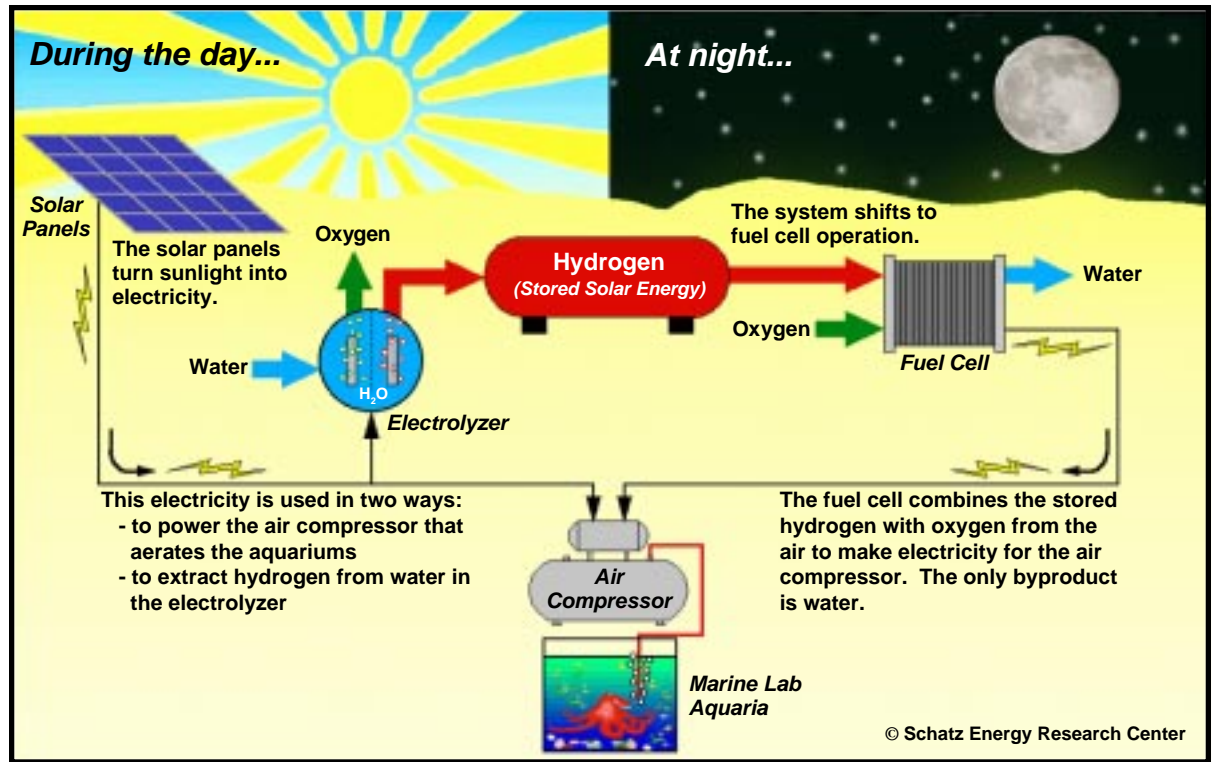
### POWER GENERATION

This solar hydrogen energy system captures energy from the sun using solar electric panels. The array of 192 panels transforms solar energy directly to electricity. When the sun is shining brightly, the array produces about 6 kilowatts of power.

### GAS GENERATION AND STORAGE

The electrolyzer uses electricity to split water into hydrogen ( $H_2$ ) and oxygen ( $O_2$ ). The hydrogen gas is collected and stored at a pressure of 100 pounds per square inch in three 500-gallon tanks behind the lab. The oxygen gas is vented to the atmosphere. At peak production, the electrolyzer consumes one liter of water and produces 4.3 kWh of hydrogen (stored solar energy) every hour.

## HOW DOES IT WORK?



### REGENERATION

At night or on very cloudy days, the system automatically shifts to fuel cell operation. The fuel cell directly converts chemical energy into electrical energy by combining the stored hydrogen with oxygen from the air.

A fuel cell is similar to a battery in that it converts chemical energy directly into electrical energy, but a battery requires recharging when it runs down. The fuel cell continues to produce power as long as it is supplied with hydrogen and air.

### APPLICATION

Electricity from this system powers the air compressor that aerates the aquaria in the Telonicher Marine Laboratory. Except on the darkest of days, the solar array produces more than enough electricity during daylight hours to run the compressor directly. Any extra power is used to run the electrolyzer.

In this way water and sunlight, both natural and abundant, are used in a cycle to produce power. Hydrogen stores solar energy, so the power is available whenever it is needed.