science and technology:

HSU lab still pioneers fuel cell research

Schatz Energy Research Center teaches energy efficiency while its labs pave way for it

The Schatz Energy Research Center (SERC) began its energy pioneering in 1989 with a large donation from plastics mogul Louis Schatz as members of a miniscule movement, but SERC staff now find themselves in the middle of a nationwide scramble towards energy efficiency.

Many researchers have discovered that, though it is hard to produce and use hydrogen as a fuel, hydrogen fuel in combination with a less consumptive lifestyle, could be what saves this country from dependence on limited and polluting fossil fuels.

Past projects of SERC have received nationwide attention, such as the fuel cells they have built. They use their projects to advance alternative technologies, as well as to educate. For instance, their solar hydrogen project, a full-time, automated energy system demonstrates that hydrogen can store energy created from solar energy.

The system uses energy from the sun to power the compressor directly and to produce hydrogen that powers a compressor that aerates a fish pond when the sun is not available. Air then circulates so that the fish get bubbles all day.

The Schatz center is currently researching new fuel cell materials for the Department of Energy. With a materials testing center that Schatz built, they will be testing new membranes, flow fields and graphite. Their hope is to improve the cost and durability of fuel cells.

Schatz has been able to remain a part of the nation's fuel cell research despite a small budget, and a cramped lab. On an engineering 115 fieldtrip last semester, a student briefly passed out while listening to a presentation in the fuel cell testing room. The cramped quarters is the subject of much joking for the SERC staff.

Many automobile companies are also working to produce more efficient hydrogen fuel cell cars, running partly or entirely on the energy from hydrogen.

The Environmental Protection Agency announced last year Honda Motor Co.'s FCX as the first certified hydrogen fuel cell zero-emission vehicle for everyday use.

General Motors Corp., has developed three prototype fuel cell vehicles, two of which have been built for demonstration purposes.

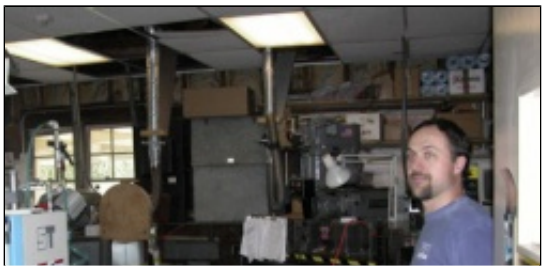
Working with The Dow Chemical Co., it also announced last month its use of hydrogen fuel cells to generate 75 kilowatts of electricity, enough to power 60 regular-sized houses in Texas.

Oil, used primarily in automobiles, and natural gas release toxins like carbon dioxide into the atmosphere and are not renewable. Peter Lehman, director of Schatz and professor at Humboldt State University, said that humans have to ease off them.

"The answer to our energy problems is to switch from the use of fossil fuels to renewable energy," Lehman said. "We need to be more energy conservative, also. We are too high on the hog."

Presently, according to the DOE, oil supplies more than 99 percent of the fuel used in automobiles in America and over 40 percent of our total energy demands. Together with natural gas, they supply more than 60 percent of our total energy demands.

Utilizing the energy capacity of hydrogen is not simple. Hydrogen must be produced through an energy-intensive process called electrolysis, in which water is split into its base elements, hydrogen and oxygen.



The current method by which most hydrogen is produced uses methanol, a fossil fuel. This process, called steam reformation, is extremely inefficient and releases carbon dioxides into the atmosphere.

Ideally, an electrolyzer will split water using the energy from the sun or other renewable energy sources. Out comes hydrogen and it is compressed and stored for later use or sent directly to a proton exchange membrane fuel cell. Because of its compact size, a hydrogen fuel cell can power automobiles or remote houses.

The fuel cell essentially reverses the process of the electrolyzer, combining the

compressed hydrogen with oxygen through a chemical reaction. The only products of this reaction are the useable energy, water vapor and heat.

“It may be 20, 50 or even 100 years before hydrogen becomes a substantial energy carrier,” Charles Chamberlin, co-director of Schatz and professor at HSU, said.

Chamberlin said the current setbacks preventing hydrogen fuel cells and hydrogen from becoming a much larger alternative to the petroleum-reliant internal combustion engine are primarily cost and durability.

A fuel cell engine about the size of an internal combustion engine costs $1,000 per kilowatt it produces. Most fuel-cell engines will produce 50 kilowatts, which means the cost of an engine is $50,000, Chamberlin said.

Along with the high cost, the engines last only thousands of hours, whereas an internal combustion engine can possibly run for years without needing to be replaced.

Many have also questioned the safety of using hydrogen in confined spaces, required for storage or transportation. The Hindenburg disaster has led to some fear of hydrogen.

When the Hindenburg went down in 1937 at an airfield in Lakehurst, N.Y., according to the DOE study, “All of the people who died in the disaster, died from falling to their death or burning to death from flaming, dripping diesel fuel.”

“There are some disadvantages in using hydrogen, but hydrogen is just as safe as using oil or natural gas,” Chamberlin said.

Hydrogen is lighter than air and when released into the at mosphere will rapidly dissipate, leaving only water, whereas gasoline can cause harm to the environment if spilled and has the potential of fueling an explosion.

Chamberlin said, there are many safety tests for hydrogen tanks and various safety requirements that are met before hydrogen is stored and transported.

Schatz is dedicated to educating others about the over-consumption of finite fossil fuels. One of the main concerns, whether or not a switch to hydrogen is made, is the over-consumptive lifestyle Americans now experience. The use of public transportation and carpooling, or turning off the lights in the house when they are not needed, would save a lot of energy, as was demonstrated in California during the power crisis two years ago.

Engineering students at HSU are trying to learn how to teach others as Schatz has done.

“We need to make a compromise,” Eric Stikes, an environmental resources engineering junior, said. “We need to learn how to use less energy in general.”

A tool that Schatz uses to explain the technology involved in fuel cells is its Stack-in-a-Box, which can supply enough power to operate most standard appliances.

Last summer, Nate Coleman, research engineer at Schatz, took the Stack-in-a-Box on the two-month Lollapalooza music tour. With over half a million people passing through his booth and with the assistance of Perry Farrell, lead singer for Jane’s Addiction, Coleman was able to spread the word of renewable energy importance across the nation.

Schatz has recently completed testing on a 1 kilowatt fuel cell, enough to power about four desktop computers. It can be used in remote areas where electricity is not always readily available or reliable.

The fuel cell was tested with the assistance of the University of Alaska under the assumption that it would be used there. But funding was not available and it is being shipped back to Schatz for possible use in the local area.

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