

**Capps lauds hydrogen fuel cells**  
**Hydrogen Highway: Oxnard site tests BMW dual-fuel vehicles**  
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The hydrogen-powered BMW in the rearview mirror might be closer than it appears.

The next big thing in "clean" cars is currently tooling around Oxnard as part of its testing at the BMW of North America Engineering and Emission Test Center, located a couple of miles from the Port of Hueneme.

The center has been charged with testing two BMW Hydrogen 7 prototypes, which run on both hydrogen and gasoline, using a dual-fuel engine and two separate fuel tanks.

Hydrogen is a source of energy that emits vapor as a byproduct, making it a clean alternative to fossil fuels that emit carbon dioxide and other pollutants.

BMW announced this month that the BMW Hydrogen 7 would be the first hydrogen-powered luxury car. In 2007, the company plans to build a limited series of the cars in Europe and hand them out to U.S. decision makers, movers and shakers to build support for hydrogen technology.

It becomes a chicken-and-egg situation - the lack of hydrogen filling stations will delay the introduction of cars and a lack of hydrogen cars will delay the creation of filling stations, said Andreas Klugescheid, corporate communications director for BMW's western operations.

The company is hoping prominent leaders will convince the public to build a hydrogen infrastructure to support new hydrogen vehicles.

"The No. 1 criteria for getting it to selected users is whether it will have a significant impact on public opinion," he said.

Support in high-profile circles is already evident. President Bush has called for more hydrogen research and Gov. Arnold Schwarzenegger has pushed for hydrogen filling stations along California's highways. Other auto manufacturers also are experimenting with hydrogen vehicles.

The prototypes at the Oxnard center look similar to their gasoline-only brethren, the BMW 7 Series.

The car has a 260-horsepower, 12-cylinder engine and goes from zero to 62 mph in 9.5 seconds. It is electronically limited to a top speed of 143 mph.

Only a few things distinguish the prototypes in external appearance, such as a slightly raised ridge in the hood to accommodate the hydrogen part of the engine, which sits on top of the gas-powered engine. The hydrogen tank is located in the back behind the seats, creating a slightly smaller trunk space than in traditional models. And there are two fuel doors on the passenger side.

Inside, buttons on the steering wheel allow the driver to switch between hydrogen and gasoline. An "H2" appears when hydrogen is being used, with a gauge showing how much fuel is left in both tanks. When the hydrogen runs out, the gasoline kicks in automatically.

The car starts up automatically in hydrogen mode to minimize emissions as it warms up. The car's engine makes a slightly different noise depending on which fuel is being used.

The BMW center in Oxnard is tied to operations at the Port of Hueneme. The company imports 33 percent of all the cars it sells in the United States through the port. Last year, that included 79,100 BMW, Mini Cooper and Rolls-Royce vehicles. About 86,000 are expected this year, said Will Berg, the port's director of marketing.

The hydrogen car was developed under BMW's regular production process. It is the culmination of the company's research into hydrogen-powered cars that dates back to 1978. BMW produced its first hydrogen-powered concept car in 1979.

The next step will be releasing a hydrogen model for sale.

Even as they put the prototype cars through their paces - driving out to Death Valley to test the coolant and air conditioning systems, hitting the stop-and-go traffic in Las Vegas or driving through Oxnard - officials at the test center are beginning to show the car to people they want in their corner.

"What we need to enhance is the political will and understanding we need to move forward," Klugescheid said.

Last Monday, Congresswoman Lois Capps was visiting the Port of Hueneme. It provided an opportunity for the BMW center's General Manager Werner Lehner, Senior Project Engineer Thomas Korn and Klugescheid to show her one of the hydrogen prototypes. They took her on a short drive to the test center to see how liquid hydrogen is used to fill the car's hydrogen tank.

As Korn extended the arm of the hydrogen pump and locked it onto the car's tank, Capps stood back until she was waved forward.

"Is it dangerous?" she asked of the filling process.

"No, not at all," Lehner replied.

Capps looked at the small pump attached to a large tank of liquid hydrogen and several other gas canisters.

"These are expensive, right?" she asked, referring to the filling station.

Lehner said it cost about \$1 million, though that was because it was a prototype filling station. Development of more stations would improve the economies of scale, reducing the price. There are only two liquid hydrogen stations in the U.S. The other one is located in Washington, D.C.

There is a station in Berlin that offers a mix of fueling options, including gasoline, liquid hydrogen and gaseous hydrogen. Klugescheid said that could be a model for stations in the future.

Capps said hydrogen is a fuel source that is useful for many industries.

"The role of government is to give incentives," she said, "but the private sector is capable of doing it if it's of value."

BMW's efforts are in one area of hydrogen car research - that which uses the internal combustion engine, technology that has run cars for a hundred years.

Through this approach, hydrogen is introduced to the engine with a mix of air and burned to make the car move.

The use of liquid hydrogen in an internal combustion engine makes sense for BMW, Lehner said.

Liquid hydrogen has a higher energy density than hydrogen gas, he said. And that allows powering bigger vehicles and more mileage to a tank.

Other research is being done in hydrogen fuel cell technology. Fuel cells combine hydrogen with oxygen to create a reaction that powers the car.

There are pros and cons to both technologies.

Fuel cells offer high efficiency, said Keith Wipke, senior engineer with the U.S. Department of Energy's National Renewable Energy Laboratory.

Fuel cells also create zero tailpipe emissions.

With hydrogen combustion, there is still the possibility of emissions, so the company has to design for low emissions, Wipke said. Also, the efficiency is lower than fuel cells, though it is still high.

"The biggest reason I believe people are working on hydrogen combustion engines now is the near-term nature of the technology being used," he said.

Because the combustion engine has been around so long, companies have found ways over the years to keep the costs down.

Wipke said the cost of producing the hardware in a combustion engine is about \$30 per kilowatt of power produced. The cost of producing fuel cells if they were made in large-scale production would be about \$120 per kilowatt, he said.

The California Fuel Cell Partnership is bringing together car companies, energy producers and others for a common goal: to have 300 hydrogen fuel cell cars being demonstrated and tested on California's highways by the end of 2007.

The partnership now has about 137 fuel cell cars on the road, said Executive Director Catherine Dunwoody.

Now that the technology has been proved, the big push is to get hydrogen cars and fueling stations in place, she said. The state's "Hydrogen Highway" plan calls for 150 to 200 hydrogen stations stretching through California by 2010.

Hydrogen fuel cell cars should be on the market for sale by 2010 or 2012, Dunwoody said, though those sales may only be for fleet vehicles, not in the local dealership.

"I believe there's a growing awareness about the options that are out there," she said. "We believe very strongly that all of these alternative fuels are important. It isn't a matter of one versus another."

Wipke predicts a mix of alternative fuel cars in the future, such as biodiesel, plug-in hybrid electric cars, hydrogen cars and other hybrids.

In the end, it all comes down to the market, he said.

"One decision makes sense for some people, another decision makes sense for others," he said. "Because of the free market society, it's going to be a mix."

Bifuel vehicles such as the BMW Hydrogen 7 are part of the transition, Lehner said.

"It has to be practical for a customer," Lehner said, adding that drivers don't want radical change in their cars.

Lehner sees a day when hydrogen will be more readily available at stations so cars no longer have to rely on gasoline.

