

MICHIGAN

Michigan seeks aid for hydrogen power, but its climate friendliness is under fire

**Carol Thompson**

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The hydrogen-powered bus that transports Flint area residents has been a celebrity since it hit the road 12 years ago.

At first, the novelty of a hydrogen-powered machine drew people to the sidewalks to watch it pass by, said Ed Benning, general manager of Flint Mass Transportation Authority. Now, it serves as an example of how the fuel could play a role in reducing the greenhouse gas emissions causing climate change, especially after Gov. Gretchen Whitmer held a Wednesday press event to promote the Flint bus effort.

Michigan has thrown its weight behind two projects vying for federal funding to develop Midwest hydrogen fuel hubs. The hubs are supposed to accelerate the development and use of hydrogen and demonstrate how the fuel could be created, transported and used in the region.

While proponents say hydrogen could play a key role in meeting Michigan's goal to develop a carbon-neutral economy by 2050, others caution that hydrogen fuel can only be as green as the components that create it.

"In terms of hydrogen as a fuel and a feedstock, to do it cleanly, you'd need to produce it from electricity," said Greg Keoleian, director of the University of Michigan's Center for Sustainable Systems. "You actually use electricity to split water to create hydrogen and oxygen. If you use renewable energy or nuclear energy, you can do it essentially carbon-free."

But the creation of hydrogen fuel isn't carbon-free if the electricity used to split those water molecules comes from fossil fuels, although fossil fuel companies propose they could capture the carbon dioxide released during hydrogen production.

Although an established method, splitting water molecules to create hydrogen, a process called electrolysis, is rarely used, Keoleian said. It's expensive. Most hydrogen fuel produced today comes from natural gas, which is heated with steam and split into hydrogen and carbon dioxide.

That process releases "significant emissions," Keoleian said.

Michigan supports two hub proposals

The Michigan Infrastructure Office said the state supports two projects that have applied for the U.S. Department of Energy's Regional Clean Hydrogen Hubs program, which will put \$8 billion toward six to 10 regional clean hydrogen hubs. This means each hub recipient is likely to receive hundreds of millions of dollars and possibly over \$1 billion.

The proposed projects are the Midwest Alliance for Clean Energy, known as MachH₂, and the Great Lakes Clean Hydrogen Hub.

MachH₂ is supported by roughly 70 partners, including the Detroit/Wayne County Port Authority, Palisades nuclear power plant owner Holtec International, the Flint Mass Transportation Authority, ExxonMobil, area universities, energy companies, transportation providers and more.

Their proposal is to develop a hydrogen hub that serves Indiana, Illinois, Michigan, Wisconsin, Kentucky and Missouri. It would develop hydrogen primarily using electricity generated from nuclear power, plus some from renewable sources and some using fossil fuels and capturing the carbon emissions, Keoleian said.

In February, oil giant BP's vice president of hydrogen and carbon capture and storage voiced support for the MachH₂ project. Tomeka McLeod was quoted in a press release saying BP "continues to strengthen its ties to Indiana, and we are excited about the expanded Midwest consortium's potential to compete for Department of Energy funding as we work to accelerate the energy transition."

The Great Lakes Clean Hydrogen Hub would be centered in northern Ohio and southern Michigan. The hub primarily would be fueled by nuclear power and solar energy, according to the hub's website, which lists manufacturing companies, universities, transit groups and others as partners. The hub would produce hydrogen at Energy Harbor's Davis Besse Nuclear Power Station in Ohio or use nuclear-generated electricity to produce carbon on site at the facilities that use it.

Industrial facilities, including the Cleveland Cliffs steel plants in Toledo and Cleveland, oil refineries, glassmakers, solar panel producers and others, would be the Great Lakes hub's primary customers.

Michigan's interest in hydrogen fuel is primarily for powering heavy- and medium-duty vehicles like trucks, buses and ships, said Zachary Kolodin, Michigan's chief infrastructure officer.

If the MachH2 hub is funded, Michigan would help develop a network of truck stops where drivers could refuel hydrogen vehicles. The Great Lakes Clean Hydrogen Hub also has a mobility component, Kolodin said.

Developing a strong hydrogen fuel infrastructure system would require more than just one or two hubs.

"The goal is to grow the clean hydrogen fleets across Michigan, across the country, and if we're going to do that we're going to need even more hydrogen than is funded by these projects," Kolodin said.

Ideally, that hydrogen would be generated by energy sources that don't release carbon, such as solar power, he said.

"To be candid, that's the ideal way to produce hydrogen," Kolodin said. "To bring new zero-carbon energy sources online and produce hydrogen using that new zero-carbon energy."

Hydrogen pros and cons

A major strategy for reducing greenhouse gas emissions in the United States is to put electricity to more uses, like powering cars and heating homes, and produce that electricity with renewable sources like wind and solar, or nuclear energy, which produces little carbon but does create issues with nuclear waste disposal, transportation, safety and mining.

But not everything is easy to power with electricity, like heavy-duty trucks. It takes a huge battery to power a big truck a long distance. That's where hydrogen could come in, UM's Keoleian said. It's lighter and doesn't take hours to refuel, unlike charging a big battery.

Developing the infrastructure to support hydrogen vehicles is a challenge, he said.

"You need to produce it, you need to store it, you need to deliver it, and then with regard to transportation, you need the stations where you dispense it to the vehicles," Keoleian said.

Hydrogen also can be used in industrial processes like steelmaking, said Douglas Jester, managing partner at the Lansing-based clean energy consulting group 5 Lakes Energy. When used instead of carbon, hydrogen cuts carbon dioxide emissions from the chemical process required to make steel.

Hydrogen also could replace fossil fuels in glassmaking and other industries that require very high temperatures, Jester said.

Getting hydrogen to those facilities is not easy. Its molecules are small and more likely to leak through the pipelines already transporting things like oil and gas.

"We probably can't use our existing pipelines, just directly replace whatever is in them with hydrogen because of the leakage rates," Jester said. "So then you'd have to have new pipelines."

He predicted it would be easier to create hydrogen at the places it will be used than to transport hydrogen long distances.

Jester reiterated that the power source tapped to make hydrogen plays a huge role in whether hydrogen is climate-friendly. He said fossil fuel companies are betting on hydrogen.

"The people in the fossil fuel business are looking at it as their way of being able to continue to produce and sell fossil fuels and then use technology to produce hydrogen which will, in their view, burn cleanly in a lot of these uses," Jester said. "And they can, by producing hydrogen at some big facility, they can capture the carbon and manage it. That's their vision."

Companies would have a huge amount of carbon to manage if Americans started aggressively using hydrogen fuel created from fossil fuels, Jester said. It's hard to imagine how companies

could do it, he said.

Combusting hydrogen has consequences, too. It releases water as an emission, but it also can produce nitrogen oxides, which are greenhouse gasses, Jester said.

"It's better than burning natural gas, which also produces that nitrous oxide and carbon dioxide, but it's not free of greenhouse gases," he said. "It's just better."

The Michigan Environmental Justice Coalition opposes the use of hydrogen technology, which it says will continue polluting communities with indigenous, Black and low-income residents. Climate Justice Director Juan Jhong-Chung said it is an "oxymoron" to say hydrogen is clean when it is largely made with fossil fuels.

"Our communities don't need any more pipelines carrying a highly explosive gas," Jhong-Chung said. "Our planet cannot afford another industry scam masquerading as a climate solution. As we transition to a clean and just energy future, our government should not be giving more handouts to the gas industry."

Keoleian, who runs UM's Center for Sustainable Systems, said hydrogen could play a role in slowing emissions causing climate change, as long as its production doesn't lead to carbon emissions.

"We're not on track," Keoleian said. "The consequences of climate change are severe, and we're seeing those today. We need to pursue all of these technologies to address the climate crisis. We're using a lot of hydrogen today, and we need to shift that to a clean source, but then we'll see additional applications."

Flint MTA to expand hydrogen fuel use

Hydrogen has worked "extremely well" for the Flint MTA, Benning said.

Driving the hydrogen-powered bus is like driving a golf cart — quiet, with no sounds of gear shifting or an idling motor, and a braking system that regenerates the battery and prefers an easy foot. Refueling is fast, about 15 minutes.

The MTA makes hydrogen at a Grand Blanc alternative fuel facility using electricity from the grid to split water into hydrogen and oxygen. Benning said he hopes to someday power the process using solar panels. The facility can make enough hydrogen to power two buses.

The MTA plans to expand its hydrogen fleet and its hydrogen production. It has applied for grants that would fund the purchase of more than 50 new hydrogen vehicles, including up to 20 buses, an additional storage facility and a classroom for workforce development programs. The authority already plans to use a \$4.3 million federal grant to replace its last two diesel buses with hydrogen fuel cell versions and expand its fueling system.

Hydrogen buses are more expensive than diesel, Benning said. A standard diesel transit bus could start at \$500,000. An electric bus could cost between \$600,000 and \$800,000, and a hydrogen bus could cost between \$800,000 and \$1 million.

Benning said the upfront cost of hydrogen vehicles pays off because they are resilient machines, making them "extremely competitive" by the end of their lives.

The MTA started experimenting with alternative fuels in 2010, when gasoline and diesel prices were skyrocketing.

"We said: 'We're going a different direction. We're not going to put all our eggs in one basket,'" Benning said. "So we prepared for a future without diesel fuel."

The authority has a fleet of 300, including buses, mini-buses, cars and other vehicles. About half of those vehicles run on propane. Fifty buses and 30 large passenger buses run on compressed natural gas, while 20 vehicles run on diesel fuel.

The MTA has one hydrogen bus. It sold a second recently because parts were hard to come by, although it hopes to purchase more that were built in the United States so it's easier to find parts.

Using fuels that emit less pollution improves the air quality near roadways and in congested areas, Benning said.

"Hydrogen is a great opportunity and the interest is amazing," he said. "We have people call us (to learn about hydrogen fuel). I think we have three or four groups coming here in the next couple of weeks. People know we've been working on this for some time."

ckthompson@detroitnews.com