

Toyota really believes hydrogen fuel cells are the future: Here's why

Hydrogen is an efficient storage medium for energy, Mirai chief engineer Yoshikazu Tanaka says.

By [Mark Vaughn](#) Dec 4, 2019



Tim Sutton

The fuel cell is the future, Toyota believes, and the Mirai is its flagship. We at Autoweek are in the middle of [a year-long loan of a long-term first-gen Mirai](#) test car, so in that sense we are driving the future, or at least what Toyota believes the future will be. With a newly styled and possibly even [fun-to-drive Mirai coming next year](#), talk of fuel-celled buses and semis on the horizon, and with no signs of Toyota letting up on the fuel cell throttle, we sat down for a few drinks with chief engineer Yoshikazu Tanaka to get details about Toyota's fuel-cell philosophy.

AW: So I have a [Toyota Mirai fuel-cell vehicle](#) for a one-year loan to see what it's like to live with a fuel-cell vehicle. Tell me about the well-to-wheel efficiency of hydrogen versus electricity.

Tanaka: Right now there are many different ways of producing [hydrogen](#), so the well-to-wheel efficiency will change in the future. Up until now the most cost-efficient method (of making hydrogen) has been using natural gas to reclaim the hydrogen. However, the key in the future is how to create hydrogen with the least amount of CO2 emission, and that's the really important factor. (Making) that process (cleaner) is very important, even in Japan. Using solar energy and wind power and wind-generated energy, to make hydrogen using electrolysis, essentially using electricity to extract hydrogen from water. So that kind of research and development is proceeding on a national level, a government level. One of the world's largest electrolysis water-producing hydrogen plants is located in Fukushima, Japan, right now. (The Fukushima Hydrogen Energy Research Field will open in spring, with a 10,000-kW hydrogen production facility that uses solar panels to make several hundred tons of hydrogen a year through electrolysis.) And if you use that kind of process, the well-to-wheel should be better than the current method.

AW: A fuel-cell vehicle is essentially an [electric vehicle](#). What are the advantages of having a [fuel-cell vehicle](#) powered by hydrogen over an electric vehicle?

Tanaka: The first obvious benefit is the fact that you can use hydrogen. Not only can you produce it from all kinds of methods, hydrogen itself is an energy carrier. So for example, solar energy, wind energy, even if you increase the amount of it, you can't stop the core refineries and other kinds of energy plants. It won't replace that. The reason is electricity, wind-powered solar energy is very clean, but they're greatly affected by natural

environmental changes (such as calm days for wind power and cloudy days for solar). They can't produce consistent energy yet. So if you use solar-powered energy and you take that directly and apply it to EV charging and driving, of course that's the best, that's the most efficient.

AW: I have an electric car, a [Mitsubishi iMiEV](#), and I charge it with solar panels on the roof of my house.

Tanaka: That's the best kind of system. You can use your car as a battery, the car itself as a battery. It's very efficient, yes, it's very good. However, when you start thinking on a larger scale, you're trying to get sustainable energy on a mass scale, you have to store the energy somewhere. You're going to have to store that energy. The amount of density that batteries can store energy, that level is low. Changing that energy into hydrogen as a storage medium, you can store it efficiently in multiple places. And that's a very important factor. By using fuel cells in these vehicles, just like you said, the well-to-wheel issue and topic does come to the surface. So we have to figure out first how to make the hydrogen using clean methods, and that conversation debate is right on the table right now as we speak. And I believe that's a really good thing.

Advertisement - Continue Reading Below

AW: So we are at the dawn of the hydrogen era?

Tanaka: Absolutely.

AW: So Toyota believes that hydrogen is the future for this reason.

Tanaka: So first, if you use it as a propulsion fuel the charging times are extremely short and the density of the energy storage is very high. So let's say we have a huge semitruck, or a bus, so fuel cells are great to run those

vehicles at zero emissions, and that has a great potential. And, of course, passenger vehicles with long-distance extended ranges even for those kind of applications, it's very light, short charge times, extended ranges—there's a lot of practical applications for it.

AW: The new Toyota Mirai, the one coming in a year, has a very nice shape. It's a very nice-looking car. What other changes did you make when making the new Mirai?

Tanaka: The fuel-cell unit and the system's completely reengineered and different. What I actually changed is, I did my best work at the time on the version that you are driving now (the first-generation Mirai). But that fuel-cell system there is only a production capacity of 3,000 annual units for that. If we can increase that production volume, we can proliferate fuel cells into the mass public. In order to do this we need to make sure that we have 10 times the production capacity of the current model. So that's why we changed the configuration to be able to increase production.

AW: In my fuel-cell car, the back seat has a fixed armrest. Is that part of the fuel cell, or storage or is there a structural reason for that?

Tanaka: You have limited rear legroom space and your feet won't fit under (the front seats), so the interior, the comfort isn't as good as it could be, so they took a step to make it a four-seater.

AW: So the middle seat would not have been comfortable?

Tanaka: Even if you had that middle seat your feet wouldn't fit under (the front seats).

AW: I have a carpool. Sometimes I take four students, and I cannot take my beloved Mirai. I have to take another car that is not as good and not as

technically advanced.

Tanaka: The next one! The next one has five seats. Driving range in the new Mirai is over 400 miles.

AW: Over 400? Wow. The one I have is officially 312 miles range.

Tanaka: Thirty percent increase.

AW: I don't get 312. I get maybe 260.

Tanaka: So it's a 30 percent increase.

AW: How did you get that increase?

Tanaka: Bigger hydrogen storage space. The efficiency of each fuel cell was increased, as well. And the hybrid system, the efficiency was improved, as well.

AW: My first-gen Mirai has two hydrogen storage tanks. Is it the same in the new car?

Tanaka: No. Three tanks. But the layout, including the motors, everything is completely reengineered. The second row, the foot room, you can completely put your feet in and you have a lot of legroom. The proportion of the car is a lower stance. And then we put the motor in the rear now. By making it rear-wheel drive ...

AW: So it's like a sports car? AE86? Hachiroku?

Tanaka: Not quite Hachiroku, but it's a much more fun-to-drive car. The looks, as well. When you drive it, now you're going to have fun driving it, as well. Everything was from scratch: the layout, we had to make the maximum amount of hydrogen that we could carry on that chassis, and making the

shape good, the proportion, with good interior room cabin space.

AW: Domo arigato. Hai!

Tanaka: Thank you! Hai!