TOYOTA MOTOR NORTH AMERICA, INC.
Product Regulatory Affairs
325 Seventh Street, NW #1000 Washington, DC 20004

September 16, 2019

Board of Public Utilities
State of New Jersey
EMP.Comments@BPU.NJ.gov

RE: Comments to the Draft 2019 Energy Master Plan

Dear Board of Public Utilities:

Toyota Motor North America, Inc., has reviewed the Draft 2019 New Jersey Energy Master Plan and applauds the Garden State's bold initiative to reduce climate emissions, increase efficiency, and reduce energy consumption across all sectors. As a world leader in transformative clean transportation, Toyota supports the move to reduce emissions and offers several products to accomplish these goals.

We do have two points which we believe the Draft Energy Master Plan can improve:

1) Hydrogen fuel cell electric vehicles should be pursued strongly by New Jersey, both in light *and* heavy-duty applications, as their characteristics make them a better option for many customers in all sectors. The Draft EMP references the potential of fuel cells in the heavy-duty sector but ignores the light-duty sector. To achieve the state's environmental targets, New Jersey must encourage the availably of *all* technologies.
2) Fuel cell electric vehicles are *as safe or safer than conventional and electric vehicles*. They meet the same U.S. and international safety and crash standards and pose no additional risk on bridges and in tunnels. The Draft EMP directs the formation of a task force to "monitor evolving fuel cell research" and address safety concerns. However, the time for "monitoring" has passed – safety concerns have all been addressed through design, testing, modeling, and demonstration, and the EMP should move forward with supporting this technology.

The performance, environmental benefits, and safety of these vehicles is demonstrated, and the State of New Jersey should move forward with adopting this promising option for its residents.

Hydrogen is Essential to New Jersey's Environmental Commitments

Fuel cell electric vehicles (FCEVs) are electric vehicles powered by hydrogen that generates electricity onboard. Like all electric vehicles, they are quiet, powerful, and smooth to drive. They also offer zero tailpipe emissions. They are an essential part of any state's climate goals because they offer consumers different attributes from other ZEV technologies, including:

- long range of over 300 miles per fill,
- rapid refueling of less than 5 minutes at a station just like a gas station, and
- scalability from forklifts to trains

These attributes make FCEVs more attractive to many customers for whom battery-electric vehicles are not a good fit; these include:

- residents of rentals and apartments or condos,
- street parkers,
- taxis,
- ambulances,
- police vehicles,
- long-haul trucks, and
- others who don't have their own parking space, need long range, and/or don't have long downtime between shifts.

We'd like to note that fuel cell electric vehicles are a *complement* – not a competitor – to battery electric vehicles. Because of their differing characteristics, both technologies should be offered for customers to choose based on their needs. Fuel cell vehicles are zero-emission vehicles that are independent of the grid and will not suffer with problems of outages or growing pains from transmission and distribution upgrades that will occur with the widescale transition to electrification. Hydrogen has many diverse, domestic, and clean sources including sewage and landfill gas,

and can be created from excess renewable electricity that would otherwise have to be curtailed.

Fuel Cell Electric Vehicles Large and Small are Here

Toyota sells a sedan called the Mirai that has been available in California since late 2015. Honda and Hyundai offer their own models, and other OEMs plan to follow. We're planning to expand sales to the Northeast in the near future, starting in Massachusetts and coming down through New Jersey. Roughly 8,600 Mirais have been sold worldwide, with over 6,000 in California, refueling at a network of 40 refueling stations and growing that is funded in part by the State. Before the Mirai, Toyota tested hundreds of FCEV prototypes over nearly three decades. FCEVs have safely driven millions of miles across multiple continents, and our customers use them as they would any traditional vehicle.

We also have recently introduced a fuel cell Class 8 tractor trailer, with the first of 10 now operating in Southern California. Fuel cells allow the combination for high power and long range with far less weight increase than batteries, and fast refueling to support multiple-shift operation.

It's clear: fuel cell electric vehicles are no longer an experiment; they are a *reality*.

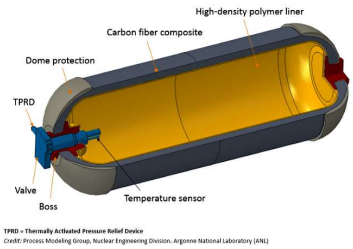
Fuel Cell Electric Vehicles are Designed for Safety

The Energy Master Plan mentions safety concerns with fuel cell electric vehicles, especially on bridges and in tunnels. The truth is that these vehicles are regulated, designed, and tested to meet all the safety requirements of gasoline and electric vehicles, plus additional standards for hydrogen.

Hydrogen Tanks are Well-Designed and Thoroughly Tested

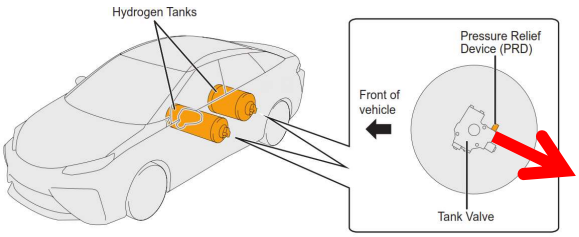
Toyota's Mirai has 2 high-pressure hydrogen tanks that hold the equivalent of 5 gallons of gasoline and are *wrapped with aerospace carbon fiber an inch thick*. These tanks are extremely strong. If a fuel cell electric vehicle is in an accident, it's most likely the hydrogen stays inside the tank.

Every tank is equipped with a safety valve called thermally-activated pressure relief device (TPRD) that will vent the hydrogen in the event of a fire so that the tank will not rupture.



TPRD = Thermally Activated Pressure Relief Device
Credit: Process Modeling Group, Nuclear Engineering Division, Argonne National Laboratory (ANL)

The tanks, TPRDs, and other components undergo rigorous testing, including:



- Filling/emptying 22,000 times (that's 20 times more than a typical vehicle would fill over 20 years)
- Over-pressurizing to 225% of operating pressure without rupture
- Single-point and whole-tank bonfire testing without rupture

Fuel Cell Vehicles are Well-Designed and Thoroughly Tested

Fuel cell electric vehicles must undergo the same NHTSA crash testing as any gasoline vehicle under US law, with additional requirements for the integrity of the tanks after the crash. After any accident, tanks are removed from the vehicle, re-tested, and replaced if necessary.

If a strong collision or fuel leak is detected, the vehicle shuts down power, closing the tank valves and isolating the hydrogen inside the tanks.

First responders undergo training to handle fire-fighting and passenger extrication for the unique properties of hydrogen vehicles, as they do with vehicles equipped with electric batteries, natural gas, air bags, seat belt pretensioners, and bumper struts.

Based on available data, Sandia National Laboratories calculated that the likelihood of an FCEV being involved in an accident resulting in hydrogen release and fire is *once per 374 million miles driven*. Even then, their modeling of Boston area tunnels showed the worst case of these scenarios poses no additional risk than a conventional vehicle, even when the tunnel's ventilation system is not operating. The fire causes no more than cosmetic damage to the tunnel infrastructure.

In summary, fuel cell electric vehicles are an essential tool to help New Jersey achieve its climate and energy goals with benefits including long range, fast refueling, and scalability to all sectors from passenger vehicles to forklifts to trucks and trains.

- Nearly nine thousand Toyota Mirai fuel cell electric vehicles are operating safely worldwide, including in bridges and tunnels. FCEVs are designed to operate safely and prove themselves through rigorous testing according to national and international standards and regulations.
- The environmental benefits of fuel cell electric vehicles make them a valuable tool to address New Jersey's climate goals, and their operating characteristics make them an important option for consumers.

Toyota urges the BPU to recognize there is no need to "monitor" this proven technology, but to embrace it. The Energy Master Plan should commit to funding hydrogen infrastructure and incentivizing the sale of fuel cell electric vehicles, both passenger and freight, to help fulfill the goals of the Garden State.

Attachments:

1) Toyota Mirai brochure
2) Project Portal fuel cell truck press release

THE TOYOTA

MIRAI

FUEL CELL VEHICLE

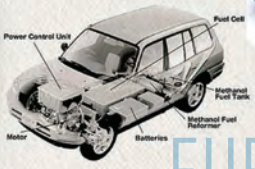
VEHICLE OF CHANGE

EVOLUTION OF TOYOTA ADVANCED TECHNOLOGY VEHICLES

Launched in 1997, the Prius was the world's first mass-produced hybrid vehicle. It was the birth of a visionary vehicle featuring a drive system that combines a gas/petrol engine and an electric motor.

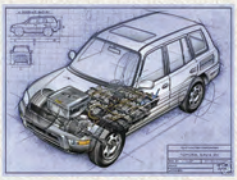
HYBRID

In 1996, Toyota develops FCEV (fuel cell electric vehicle) starting the comprehensive development of fuel cell technology in vehicles.



FUEL CELL

Toyota's first generation all-electric RAV4 SUV was leased from 1997 to 2003. The 95 amp-hour NiMH battery pack had a capacity of 27 kWh, charged inductively and proved to be very durable.



EV

Continuing its development from the FCEV, 2001-2002 showed vast improvements in Toyota's fuel cell stack technology, with increased power and better on-board hydrogen storage. Prototypes are marketed as FCHV (fuel cell hybrid vehicles) utlizing a Highlander platform.

In 2012 the 2nd gerneration all-electric RAV4 SUV featured a lithium ion battery pack with more usable energy and AC induction electric motor.

Launched in 2003, the 2nd generation Prius featured dramatic changes; a more aerodynaimic body, a smaller and lighter yet more powerfuel NiMH battery, a more enjoyable driving experience and the most sophisticated production hybrid system, Toyota Hybrid Synergy Drive (HSD).

HYBRID

FUEL CELL

The FCHV was further refined from 2005-2008, improving overall efficiency in the fuel cell stack, electric motors, and battery pack. The FCHV-adv went on a limited lease as part of demo test program in Japan, Germany, and United States, enduring over a millionn testing miles.

In 2013, the arrival of the iQ EV featured a newly developed high output lithium-ion battery which delivered an impressive electric power consumption rate of 104 Wh/km in an ultra-compact and lightweight package.

MIRAI

Fueled by years of innovation, the Mirai becomes the first mass produced fuel cell vehicle in the market for sale and lease.

WHY HYDROGEN FUEL CELLS? WHY NOW?

Mirai fuel cell technology is the result of extensive research, planning and innovation that began more than two decades ago. At the time, Toyota identified hybrid and fuel cell powertrains as the two roads that led to the future of alternative fuel vehicles. Due to existing technology, hybrid vehicles were developed as the logical first step while fuel cell technology was seen as a longer-term solution.

With Toyota's proven Hybrid Synergy Drive system, a hydrogen fuel cell can be substituted for the internal combustion engine to achieve zero emissions along with hybrid efficiency.

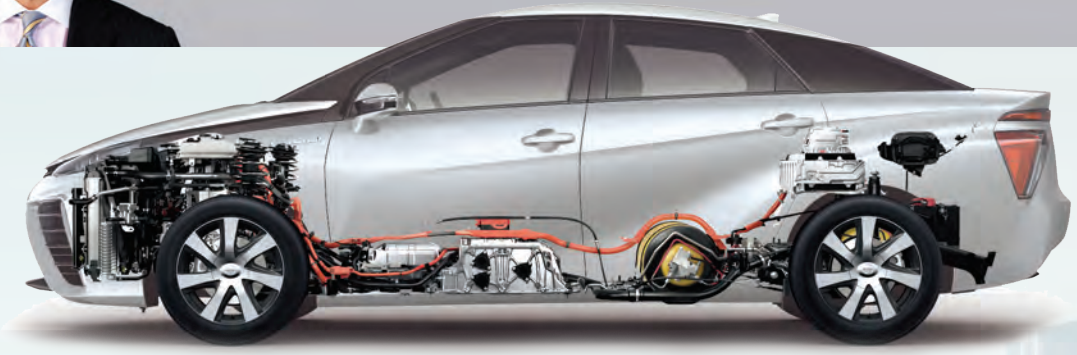
The mainstream acceptance of hybrid vehicles, newer technology and the success of the Prius Family indicate that now is the time to take the next step with the hydrogen fuel cell-powered Mirai.

Toyota Fuel Cell Strategy

Toyota believes that the hydrogen fuel cell technology used in Mirai has the potential to replace the internal combustion engine as the mainstream automobile powertrain for the next 100 years. Toyota's beliefs have led to a strong commitment in supporting the development of infrastructure and promoting public awareness for fuel cell technology and its advantages.

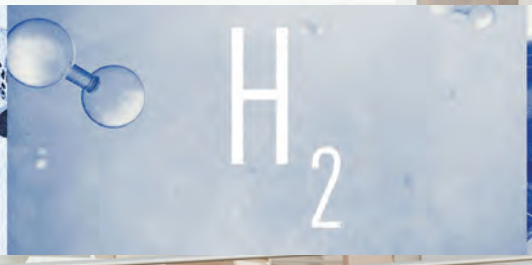
With the Mirai, Toyota's long-term vision becomes reality.

Yoshikazu Tanaka - Chief Engineer
Entered Toyota Motor Corporation in 1987. He first served as the development lead on automatic transmission and powertrain systems. He then transfered to the Product Planning Dept. in 2005. From then on, he has been in charge of coordinating Prius Plug-in Hybrid and Mirai projects as manager of development.



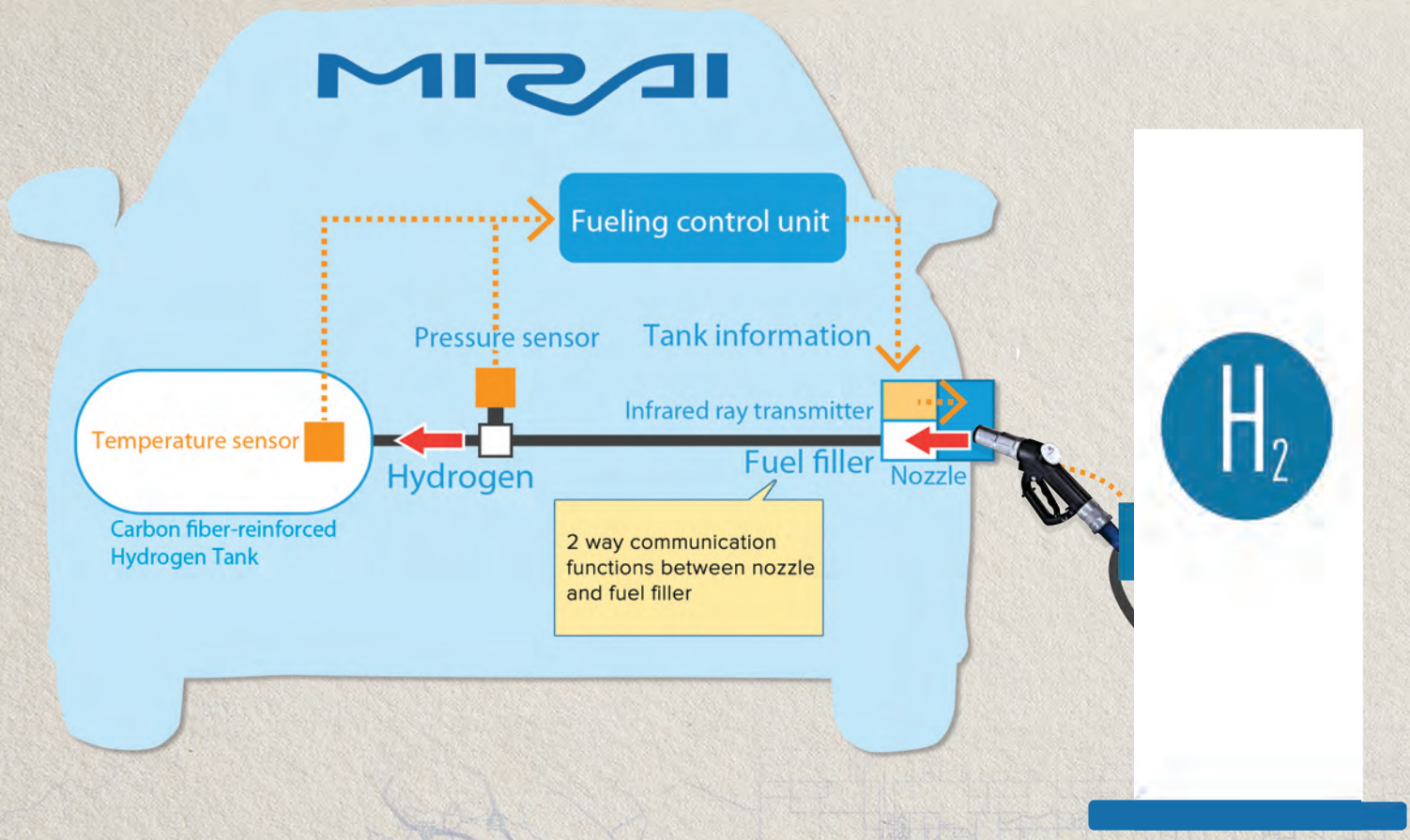
As Chief Engineer (CE), I decided on the vehicle concept slogan “H2 Pioneer for the Next Century” while developing the FCV. With a focus on the next 100 years of automobiles, Toyota has proceeded with the development of a vehicle that offers a new unique value, a pioneering vehicle that will help achieve an H2 energy society. In addition to its superior fuel cell technology and environment performance, I believe that the Mirai is a vehicle that you’ll want to keep on driving because it’s fun to drive, it has a futuristic design that clearly marks it as an FCV and it offers quiet and pleasant ride comfort.
- Product Planning Dept., Chief Engineer, Yoshikazu Tanaka

20+ YEARS OF FUEL CELL RESEARCH



HYDROGEN FUELING

Efforts to develop worldwide fueling standards uniformity in Japan, the US, and Europe, have resulted in rapid fueling times.*1 This is achieved through electronic communication between the station refueling pump and the Mirai vehicle.



*1: (Refueling devices) ISO 17268: Gaseous Hydrogen Land Vehicle Refueling Connection Devices
(Refueling methods) SAE J2601:Fueling Protocols for Light Duty Gaseous Hydrogen Surface Vehicles
(Communications fueling) SAE J2799:70 MPa Compressed Hydrogen Surface Vehicle Fueling Connection Device and Optional Vehicle to Station Communications
Toyota measurement under SAEJ2601 standards (ambient temperature: 20c; hydrogen tank pressure when fueled: 70 MPa). Fueling time varies with hydrogen fueling pressure and ambient temperature.

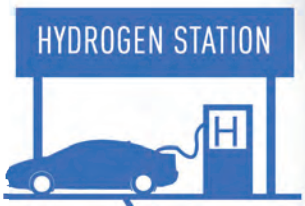
MAIN SYSTEM COMPONENTS - HOW IT WORKS

1

Air (oxygen) flows through the front intake grills and is supplied to the fuel cell stack.

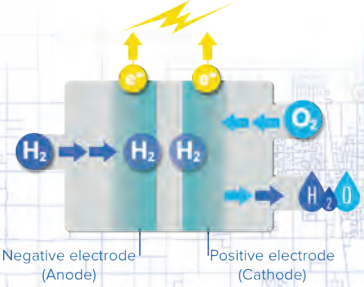
2

Hydrogen stored in the tanks is supplied to the fuel cell stack.



3

Hydrogen and Oxygen supplied to the fuel cell stack generate electricity and water through a chemical reaction.



4

The generated electricity is supplied to the electric motor.

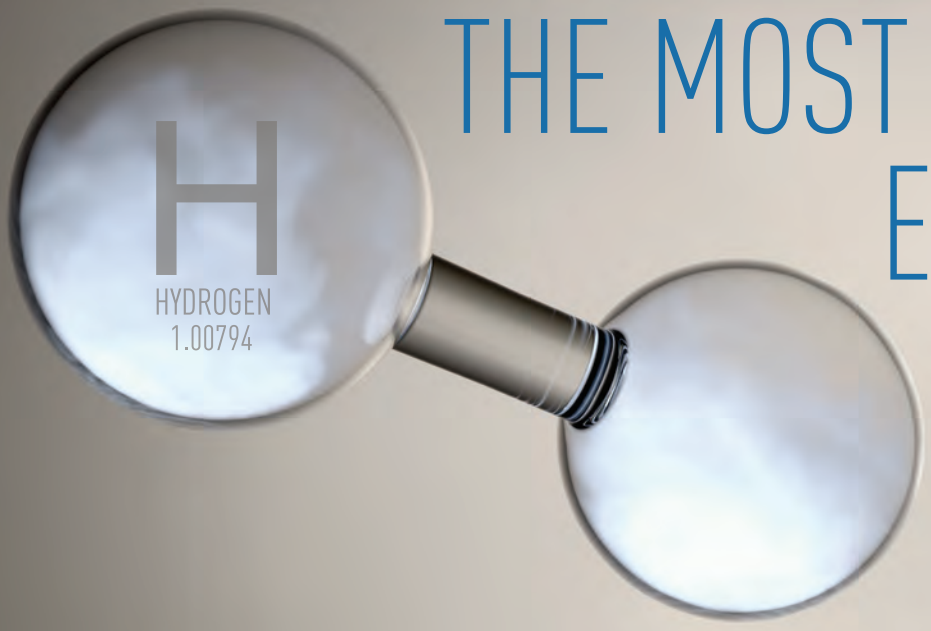
5

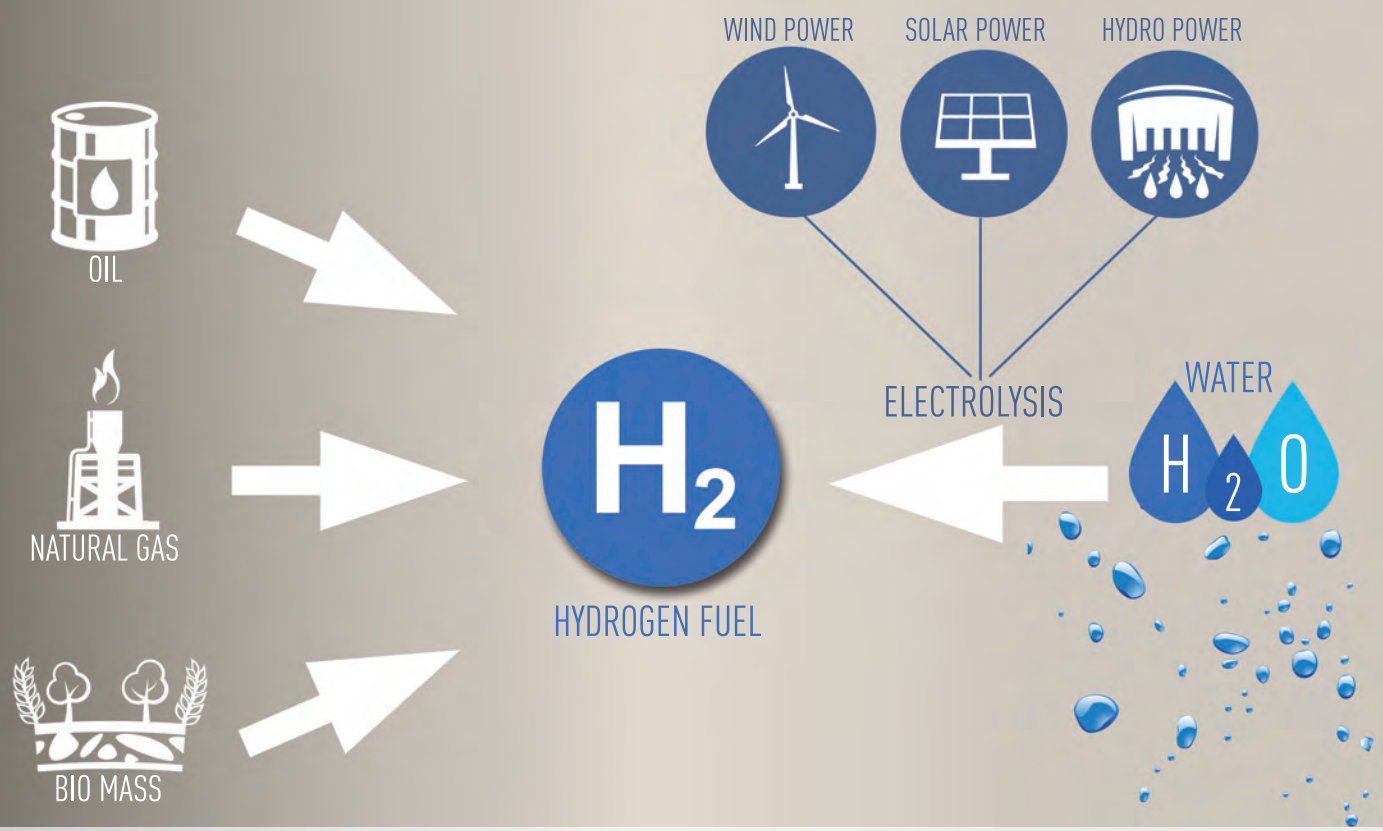
The motor uses electricity generated to propel the vehicle.

6

The only by-product of creating electricty in the fuel cell stack is water, which is emitted though the tailpipe.

THE MOST ABUNDANT ELEMENT IN THE UNIVERSE





- Non-toxic hydrogen is domestically and locally sourced.
- Hydrogen has the potential to be an environmentally friendly clean energy that converts to water when used in a fuel cell stack.
- It can be made from various raw materials such as natural gas, water and biomass.
- Hydrogen can be made via environmentally sustainable sources and have minimal CO2 impact (energy generated by solar cells, wind power, or hydro power for example).

DRIVING SPECIFICATIONS

0-60
nine seconds

67 MPGe*

247
LB-FT TORQUE

312
EPA-ESTIMATED*
DRIVING RANGE

*2016 EPA-estimated 67/67/67 city/hwy/combined mpge for Mirai and 312 mile driving range. Actual mileage will vary. Range measurement pursuant to SAEJ2601 standards (ambient temperature: 20c; hydrogen tank pressure when fueled: 70MPa). Fueling time varies with hydrogen fueling pressure and ambient temperature.

MIRAI SAFETY CONCEPT

Mirai prototypes endured many years and millions of miles of road and track evaluation, rigorous in-house crash testing, and more than 10,000 miles of extreme climate testing in the U.S.

Mirai's hydrogen fuel cell system has been tested for durability, safety and reliability.

Several factors contribute to safety when avoiding a collision (active safety) and in the event of a collision (passive safety).

TOYOTA STAR SAFETY SYSTEM ™

The Toyota Star Safety System™ is a suite of six safety systems designed to help when you are in harm's way. It centers on braking, stability and traction control systems, and is standard on all Toyota vehicles:

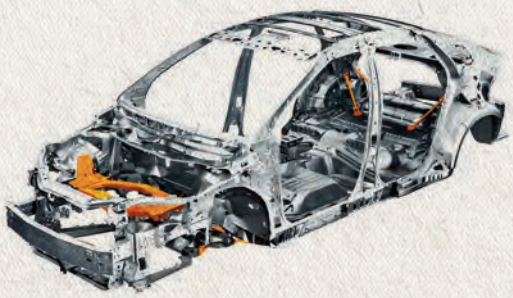
- Vehicle Stability Control (VSC)[1]
- Traction Control (TRAC)
- Anti-lock Brake System (ABS)
- Electronic Brake-force Distribution (EBD)
- Brake Assist (BA)[2]
- Smart Stop Technology® (SST)[3]

STAR™ SAFETY SYSTEM

PASSIVE SAFETY

Body Structure

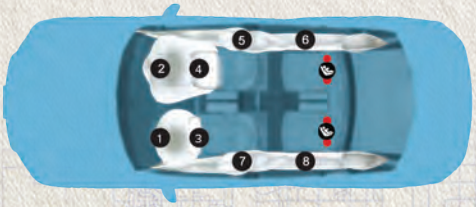
Mirai's body structure is designed to absorb collision energy and distribute it around the passenger compartment and fuel cell components:



- Mirai's frame helps to distribute crash forces efficiently throughout the vehicle frame and away from the occupants, which aims to minimize body deformation around the Fuel Cell stack and hydrogen tanks.
- Front and rear energy-absorbing crumple zones help protect vehicle occupants from crash forces.
- Side-impact door beams help provide additional occupant protection in a side collision.
- High-tensile strength and hot-stamped steels are used to strengthen the roof rail, center pillar and belt line.

Supplemental Restraint Systems: Eight Airbags[4]

Mirai features eight airbags that help protect occupants in a collision.



1. Vehicle Stability Control (VSC) is an electronic system designed to help the driver maintain vehicle control under adverse conditions. It is not a substitute for safe driving practices. Factors including speed, road conditions and driver steering input can all affect whether VSC will be effective in preventing a loss of control. Please see your Owner's Manual for further details. **2.** Brake Assist is designed to help the driver take full advantage of the benefits of ABS. It is not a substitute for safe driving practices. Braking effectiveness also depends on proper brake-system maintenance and tire and road conditions. **3.** Smart Stop Technology® operates only in the event of certain simultaneous brake and accelerator pedal applications. When engaged, the system will reduce power to help the brakes bring the vehicle to a stop. Factors including speed, road conditions and driver input can all impact stopping distance. Smart Stop Technology® is not a substitute for safe and attentive driving and does not guarantee instant stopping. Please see your Owner's Manual for further details. **4.** Disclaimer continued on next page 15.

TOYOTA HYDROGEN SAFETY

Toyota Hydrogen safety is an often-discussed topic among people considering a hydrogen FCV for the first time. Mirai is built to provide for fuel safety, guided by the following principles:

1. Hydrogen tanks are designed to prevent leaks.

– Materials used in tank construction were selected with consideration given to optimal structural design and to avoid hydrogen embrittlement.

– The high-pressure hydrogen tank and fuel cell stack are designed to be protected from body deformation even in the event of a collision

2. The flow of hydrogen will stop if a hydrogen leak is detected:

– Hydrogen detectors are installed in the cowl and rear underfloor.

– If a leak is detected, an alarm sounds, a warning light illuminates and the tank valves shut off automatically to prevent further leakage.

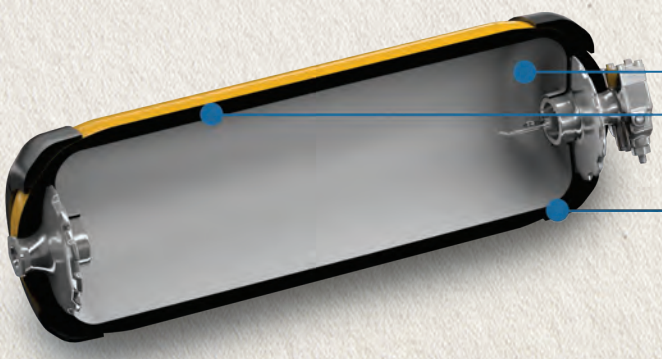
– If a severe collision is detected, the collision sensor instantly shuts off the tank valves.

3. Mirai's design helps ensure that any leaked hydrogen does not build up.

– All hydrogen-related parts are located outside the cabin.

– The body structure enables hydrogen to diffuse in the event of a leak.

Carbon fiber-reinforced hydrogen tanks are composed of a three layer structure:



1. Polymer inner layer holds the hydrogen.
2. Carbon fiber-reinforced polymer middle layer provides strength and structure.
3. Fiberglass surface layer helps to protect the tanks from damage.

4. All the airbag (AB) systems are Supplemental Restraint Systems. All ABs (if installed) are designed to inflate only under certain conditions and in certain types of severe collisions: frontal and knee ABs typically inflate in frontal collisions; side and side curtain ABs in side collisions; Roll-Sensing Curtain ABs at a severe tilt degree, roll or lateral G-force. In all other accidents, the ABs will not inflate. To decrease the risk of injury from an inflating AB, always wear seatbelts, sit upright in the middle of the seat as far back as possible and do not lean against the door. Do not put objects in front of an AB or around the seatback. Do not use a rearward-facing child seat in any front passenger seat. The force of an inflating AB may cause serious injury or death. See your Owner's Manual for further information/warnings.

MIRAI SPECIFICATIONS

WHEELBASE
109.44 in
(2,780 mm)

LENGTH
192.51 in
(4,890 mm)

WIDTH
71.45 in
(1,815 mm)

HEIGHT
60.43 in
(1,535 mm)

DIMENSIONS, WEIGHTS AND CAPACITES		
Exterior dimensions (in.)	Overall height (in.)	60.5
	Overall width (in.)	71.5
	Overall length (in.)	192.5
	Wheelbase (in.)	109.5
	Track-front/rear (in.)	60.5/61.0
	Minimum running ground clearance (in.)	5.1
	Coefficient of drag (in.)	0.29
Interior dimensions (in.)	Head room-front/rear (in.)	38.5/36.8
	Shoulder room-front/rear (in.)	54.3/53.52
	Hip room-front/rear (in.)	53.4/52.4
	Leg room-front/rear (in.)	42.5/30.1
Weights and capacities (in.)	Curb weight (lb.)	4075
	Seating capacity	4
	Cargo volume (cu. ft.)	12.8
FUEL ECONOMY		
MPGe*	Mileage estimates (EPA rated MPGe city/hwy/combined)*	67/67/67

* 2016 EPA-estimated 67/67/67 city/hwy/combined mpge for Mirai and 312 mile driving range. Actual mileage will vary. Range measurement pursuant to SAEJ2601 standards (ambient temperature: 20c; hydrogen tank pressure when fueled: 70MPa). Fueling time varies with hydrogen fueling pressure and ambient temperature.

VEHICLE		
Cruising range	EPA-estimated driving range of 312 miles*	S
0-60 acceleration / top track speed	9.0 seconds / 111 mph	S
Drivetrain	Front-wheel drive	S
Front Suspension	MacPherson strut with stabilizer bar	S
Rear Suspension	Torsion beam	S
Steering	Electric Power Steering (EPS); power-assisted rack-and-pinion	S
	Turning circle diameter-curb to curn (ft.)	18.7
	Steering wheel turns-lock to lock	2.81
Brakes	Power-assited ventilated front disc brakes (11.6-in. diameter); solid rear disc brakes (11.41-in. diameter) with integrated regenerative braking and Star Safety System; parking brake: drum style incorporated in rear disc rotor	S
Tires	215/55R17 94W	S
FUEL CELL		
Name	Toyota Fuel Cell stack	S
Type	Solid polymer electrolyte	S
Humidification method	Internal circulation form (humidifier-less) world first	S
Maximum power output	114 kW (153 hp or 4-cyl. equivalent)	S
Power density by volume	3.1 kW/L	S
Power density by weight	2.0 kW/kg	S
Volume	37 L	S
Weight	56 kg (123 lb.)	S
CELL		
Number of cells	370	S
Cell thickness	1.34 mm	S
Cell weight	102 g	S
Separator material	Titanium	S
Emission Rating	ZEV (Zero Emission Vehicle); EPA Class Sedan	S
ELECTRIC MOTOR		
Motor type	Permanent magnet AC synchronous motor	S
Maximum outout	113 kW (151 hp or 4-cyl. equivalent)	S
Torque	335N-m (247 ft.-lb. or 6-cyl. equivalent)	S
DRIVE BATTERY		
Type	Sealed Nickel-Metal Hydride (NI-MH), 34 cell modules	S
Nominal voltage	244.8 V (7.2 V x 34 cell modules)	S
HYDROGEN STORAGE		
Storage method	Carbon-fiber reinforced high-pressure tanks (2)	S
Type	Type-4	S
Normal operational pressure	70 MPa (700 bar or 10,000 psi)	S
Storage capacity	Approximately 5 kg	S
Internal volume	122.4 L (front tank: 60.0 L / rear tank: 62.4 L)	S
Refueling time	Approximately 5 minutes	S
Material	Inner layer: polymer liner; middle layer: carbon fiber-reinforced polymer; surface layer: fiberglass	S

*2016 EPA-estimated 67/67/67 city/hwy/combined mpge for Mirai and 312 mile driving range. Actual mileage will vary. Range measurement pursuant to SAEJ2601 standards (ambient temperature: 20c; hydrogen tank pressure when fueled: 70MPa). Fueling time varies with hydrogen fueling pressure and ambient temperature.

MIRAI FEATURES

1. Intelligent Touch controls for heated seats, heated steering wheel and windshield wiper deicer.
2. SofTex® 2-stage heated front seats with contrasting inserts and seatback pockets; 8-way power-adjustable driver's seat with 2-position memory function and power lumbar support; and 8-way power adjustable front passenger seat with power lumbar support.
3. Entune® Premium JBL® Audio with Navigation[1] and App Suite—including the Entune® Multimedia Bundle
4. Dual-zone automatic climate control with Intelligent Touch controls, air filter and individually controlled rear-seat vents.
5. TFT Multi-Information Display with Trip Performance Score, fuel consumption history, average fuel economy, fuel economy history, Fuel Cell stack power level, Lane Departure Alert, clock settings and trip history.
6. Acoustic noise-reducing glass for the windshield, driver-side and front-passenger windows.

1. Blind Spot Monitoring (BSM)[2] with rear cross-traffic alert[3]
2. Color-keyed outside door handles with touch-sensor lock/unlock feature
3. Color-keyed heated power auto-dimming outside mirrors with turn signal and blind spot warning indicators,[4] reverse tilt and power-folding features.
4. Color-keyed roof-mounted shark-fin antenna

1. Wide-angle fog lamps
2. LED low-and high-beam headlights with Automatic High Beam (AHB) feature and with auto on/off feature and LED Daytime Running Lights
3. Dynamic Radar Cruise Control[5]
4. Black sport front grille with color-keyed front bumpers with black inserts with chrome accents and color-keyed rear bumpers
5. Front and rear parking sonar

1. Be sure to obey traffic regulations and maintain awareness of road and traffic conditions at all times. Availability and accuracy of the information provided by the navigation system is dependent upon many factors. Use common sense when relying on information provided. Services and programming subject to change. Services not available in every city or roadway; updates may be available at an additional cost from your dealer. See your Navigation System Owner's Manual for details. **2.** Do not rely exclusively on the Blind Spot Monitor. Always look over your shoulder and use your turn signal. There are several limitations to the function, detection, range and clarity of the monitor. For a complete list of limitations and directions regarding use of the monitor, please see the Owner's Manual. **3.** Do not rely exclusively on the Rear Cross-Traffic Alert system. Always look over your shoulder and use your mirrors to confirm rear clearance. There are limitations to the function, detection, range and clarity of the system. To learn more, see your Owner's Manual. **4.** Do not rely exclusively on the blind spot mirrors. Always look over your shoulder and use your turn signal. There are limitations to the function, detection, range and clarity of the mirrors. To learn more, see your Owner's Manual. **5.** Dynamic Radar Cruise Control is designed to assist the driver and is not a substitute for safe and attentive driving practices. Please see your Owner's Manual for important instructions and cautions.

VEHICLE OF CHANGE

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The Future of Zero-Emission Trucking Takes Another Leap Forward

April 22, 2019

LOS ANGELES (April 22, 2019) – Toyota, Kenworth, the Port of Los Angeles and the California Air Resources Board (CARB) today took the next great leap towards the future of zero-emission trucking, unveiling the first of Toyota and Kenworth's jointly developed fuel cell electric heavy-duty trucks (FCET). The unveiling was before a crowd of media, government officials and industry and community leaders during a special event held at the Port of Los Angeles.

The new generation zero-emission truck expands on the capabilities of Toyota's first two Project Portal Proof of Concept trucks through enhanced capability, packaging, and performance; offering an estimated range of more than 300 miles per fill, twice that of a typical drayage trucks' average daily duty cycle. Toyota and Kenworth will deploy a total of 10 trucks as part of the Zero-and-Near-Zero Emission Freight Facilities Project (ZANZEFF), hauling cargo received at the Ports of Los Angeles and Long Beach, throughout the LA Basin.

"Toyota is committed to fuel cell electric technology as a powertrain for the future because it's a clean, scalable platform that can meet a broad range of mobility needs with zero emissions," said Bob Carter, Executive Vice President for Automotive Operations Toyota. "The ZANZEFF collaboration and the innovative 'Shore-to-Store'

project allow us to move Heavy-Duty Truck Fuel Cell Electric technology towards commercialization."

CARB has awarded $41 million dollars to the Port of Los Angeles for the ZANZEFF project as part of California Climate Investments, a California initiative that puts billions of cap-and-trade dollars to work reducing greenhouse gas emissions, strengthening the economy and improving public health and the environment, particularly in disadvantaged communities.

"This substantial climate investment by the state, matched by the project partners, will help speed up the number of zero-emission trucks in the California communities and neighborhoods where they are needed the most," said CARB Chair, Mary D. Nichols. "It will provide a real world at-work demonstration of innovative heavy-duty fuel cell electric technologies. The project offers a commercial solution to move cargo and freight around the state using zero-emission trucks and equipment that protect air quality and cut climate-changing emissions."

Since operations began in April 2017, the Project Portal "Alpha" and "Beta" Proof of Concept Class 8 trucks have logged more than 14,000 miles of testing and real-world drayage operations in and around the ports of Los Angeles and Long Beach while emitting nothing but water vapor. The first Kenworth/Toyota FCET under the ZANZEFF project will begin drayage operations in the fourth quarter, increasing the ports' zero emission trucking capacity and further reducing the environmental impact of drayage operations.

Expanding operations
The latest FCET utilizes the Kenworth T680 Class 8 model combined with Toyota's fuel cell electric technology and is part of the ZANZEFF project. Pioneered by the Port of Los Angeles with leading support from Toyota, Kenworth, and Shell, the trailblazing endeavor provides a large-scale "Shore-to-Store" plan and a hydrogen fuel cell electric technology framework for freight facilities to structure operations for future goods movement. The initiative will help reduce emissions by over 500 tons of greenhouse gas and 0.72 weighted tons of NOx, ROG and PM10.

"The collaboration between the Port of Los Angeles, Kenworth, Toyota and Shell is providing an excellent opportunity to demonstrate the viability of fuel cell electric technology in both drayage service and regional haul commercial vehicle applications operating in Southern California," said Mike Dozier, general manager of Kenworth Truck Company and PACCAR vice president. "The performance of the 10 Kenworth Class 8 trucks being developed under this program, the first of which debuted today, is targeted to meet or exceed that of a diesel-powered truck, while producing water as the only emissions byproduct."

The Port of Los Angeles, a global maritime leader with respect to zero-emission and near-zero emission technology testing and adoption, will develop the project in several phases, ultimately encompassing initiatives in Southern California, the Central Coast Area, and Merced County. The initial phase is designed to kick-start the leap to a new class of goods movement vehicles, while reducing emissions in designated disadvantaged communities.

"CARB's $41 million grant was instrumental in launching this project and putting this innovative technology into our rigorous environment," said Port of Los Angeles Executive Director Gene Seroka. "We're extremely proud of our role as a leading test lab for emerging green technology, helping to pave the way for next-generation, zero-emission technology."

The project phases will include:

- **Ten new zero-emissions fuel-cell-electric Kenworth/Toyota FCET** developed through a collaboration

between Kenworth and Toyota to move cargo from the Los Angeles and Long Beach ports throughout the Los Angeles area, the Inland Empire, the Port of Hueneme, and eventually to Merced. The trucks will be operated by Toyota Logistics Services (4), United Parcel Services (3), Total Transportation Services Inc. (2), and Southern Counties Express (1).

"It's an honor for UPS to be collaborating with Toyota, Shell and Kenworth on such a trail-blazing project," said Carlton Rose, president of global fleet maintenance and engineering for UPS. "As a company always looking for the next innovative technology to better serve our customers, UPS was very pleased to be selected as a demonstrating partner for the hydrogen fuel cell electric semi project. With more than 10,000 alternative fuel and advanced technology vehicles in our fleet today, UPS has a long history of pioneering and evaluating technologies that aid us in decreasing our environmental footprint."

- **Two new large-capacity heavy-duty hydrogen fueling stations** will be developed by Shell in Wilmington and Ontario, California. The two new stations will join three additional stations located at Toyota's Long Beach Logistics Services and Gardena R&D facilities to form an integrated, five station heavy-duty hydrogen fueling network for the Los Angeles basin. Together, these stations will provide multiple sources of hydrogen throughout the region, including over one ton of 100% renewable hydrogen per day at the Toyota Logistics Services station to be operated by Shell, and important research and development advances at a pair of stations operated by Air Liquide, all enabling zero-emissions freight transport.

- **Expanded use of zero-emissions technology in cargo terminal and warehouse environments,** including the first two zero-emissions yard tractors to be operated at the Port of Hueneme, as well as the expanded use of zero-emissions forklifts at Toyota's port warehouse.

A Drop of h_2 in the Bucket
Over 16,000 trucks serve the Los Angeles and Long Beach port complexes, North America's largest trade gateway for containerized cargo. That number is estimated to grow to 32,000 by 2030. Currently, more than 43,000 drayage trucks are in operation at ports across the United States.

More Than Just Trucks
This announcement is an extension of Toyota's Environmental Challenge 2050 efforts to eliminate CO2 emissions from its operations. Toyota has previously announced the construction of the Tri-Gen facility which will be the first megawatt-sized carbonate fuel cell power generation plant with hydrogen fueling in the world. The 100% renewable plant will use agricultural waste to generate water, electricity, and hydrogen to support Toyota Logistics Services' (TLS) operations at the Port of Long Beach.

In North America, Toyota will minimize environmental impacts, help protect the natural world and share its know-how with others to help create net-positive value for the benefit of the company and society. It will create net- positive value for carbon by engaging in and supporting efforts that generate renewable energy greater than 100% of the total amount of energy it uses. We recognize climate change presents an urgent and irreversible threat and we must be part of the solution. For more information, please click **here**.