

Sep. 24, 2012

## **TMC Announces Status of Its Environmental Technology Development, Future Plans** **21 Hybrids to be Launched by End of 2015, Newly Developed "eQ" EV Revealed**

Toyota City, Japan, September 24, 2012—Toyota Motor Corporation (TMC) announces the progress of development of environmental technologies as well as its vehicle deployment plans through 2015. TMC is developing environmental technologies with the aims of conserving energy by improving fuel efficiency and reducing emissions, and of diversifying fuel sources by encouraging the use of electricity, hydrogen and other alternative energies. TMC also announces plans to launch 21<sup>1</sup> new hybrid vehicles models from now until the end of 2015.

In the area of energy conservation, TMC has developed a gasoline engine that achieves maximum thermal efficiency at the world's highest<sup>2</sup> levels, a high-performance clean diesel engine and a high efficiency transmission.

In the area of fuel diversification, a newly developed Toyota electric vehicle (EV) boasts the world's best<sup>2</sup> electric power consumption rate<sup>3</sup>. In the field of fuel cells, which use hydrogen to generate electricity, the latest version of the Toyota FC Stack achieves the world's highest power output density. TMC plans to launch a new fuel cell bus (FC bus) currently in development with Hino Motors, Ltd. (Hino).

TMC, knowing that revolutionary advances in the performance of next-generation batteries are vital, has developed—at a special-purpose in-house research division—new battery cells that offer substantially improved output density over all-solid-state batteries. TMC is also working on wireless battery charging, which will enhance the charging convenience of plug-in hybrid vehicles (PHVs) and EVs.

### 1) Initiatives for Energy Conservation

#### *Gasoline engines*

An enhanced engine for use in hybrid vehicles, based on the 2.5-liter AR gasoline engine, adopts the Atkinson cycle and D-4S<sup>4</sup> system. The enhanced engine achieves the world's highest<sup>2</sup> maximum thermal efficiency<sup>5</sup> of 38.5 percent, realizing both high fuel efficiency and high output. Hybrid vehicle models equipped with the engine will be launched starting 2013.

Starting 2014, TMC plans to launch a vehicle with a new 2.0-liter, turbo-charged AR engine, also based on the 2.5-liter AR gasoline engine. The new engine's smaller displacement will provide higher fuel efficiency while the turbocharger will improve output.

#### *Diesel engines*

Improvements such as an increase in fuel injection system pressure and the adoption of a compact, high-efficiency turbocharger have allowed the 1.4-liter ND diesel engine for passenger cars to achieve both high fuel efficiency and high driving performance. Furthermore, the adoption of newly developed exhaust gas cleaning technology enabled the engine to pass the Euro 6, one of the most stringent exhaust emission standards in the world. Vehicles equipped with the new diesel engine are planned for launch starting 2015.

The 3.0-liter KD diesel engine for commercial vehicles uses i-ART<sup>6</sup>, the world's first<sup>2</sup> injection system to maintain a high level of injection precision at high pressure, achieving high fuel efficiency and low emissions. TMC first installed the engine in the "Hilux" pickup truck for the Brazilian market in April 2012.

## *Transmissions*

TMC's newly developed continuously variable transmission, Super CVT-i, has achieved both superior fuel efficiency and smooth acceleration due to its unsurpassed transmission efficiency, improved integrated engine control and reductions in both size and weight. The transmission, first installed on the Corolla for the Japanese market in June 2012, is planned for use on additional models, particularly in the compact segment.

A new front-wheel-drive eight-speed, automatic transmission—as compact and lightweight as a six-speed automatic transmission—provides smooth and highly receptive acceleration with highly responsive gear shifting, as well as superior fuel efficiency. The new transmission was first installed on the Lexus "RX 350 F Sport" SUV for the Northern American market in August 2012.

## *Hybrid Vehicles*

TMC expects global sales of its hybrid vehicles to well surpass 1 million units in 2012. With its plan to launch 21 new hybrid models between now and the end of 2015, TMC expects to maintain this level of sales, forecasting global sales of its hybrid vehicles to be at least 1 million units a year from 2013 to 2015.

### 2) Initiatives for Fuel Diversification

#### *Plug-in Hybrid Vehicles*

TMC plans to enhance the appeal of the "Prius PHV" plug-in hybrid vehicle (launched in January of 2012) by expanding available vehicle grades and by offering an accessory outlet designed to use the hybrid system as a power supply that can also be used in times of emergency.

#### *Electric Vehicles*

TMC's newly developed high-performance, compact electric vehicle—the "eQ"<sup>7</sup>—features a new high-output lithium-ion battery that uses a minimum amount of space and boasts improved electric power consumption rate—the world's best<sup>2</sup>—of 104 Wh/km. Despite its small capacity of 12 kWh, the battery enables a driving range of 100 km<sup>8</sup> on a single charge and a top speed of 125 km/h. With an AC 200 V power source, the battery can be fully charged in approximately three hours. Starting December 2012, TMC plans to offer the eQ to local governments and selected users in Japan and the U.S. on a limited basis.

#### *Fuel Cell Vehicles*

After steady advances in development, TMC's proprietary FC stack—for use in the sedan-type FCV scheduled for launch around 2015—boasts the world's highest<sup>2</sup> FC power output density of 3 kW/L, which is more than twice the density of the FC stack currently used in the "FCHV-adv" fuel-cell hybrid prototype, but is approximately half the size and weight.

TMC has also developed a high-efficiency boost converter. Increasing the voltage has made it possible to reduce the size of the motor and the number of FC cells, leading to a smaller FC system with enhanced performance at reduced cost.

TMC and its subsidiary Hino Motors are accelerating joint development of a new FC bus, with the goal of a launch in 2016.

#### *Future Electrification Technologies*

##### *—Next-Generation Batteries*

In the area of all-solid batteries, TMC has developed a new solid electrolyte with the world's highest<sup>2</sup> performance level. Through this, TMC succeeded in improving ion flow, boosting output density by a factor of five (compared to TMC's existing batteries).

## *Wireless Battery Charging*

TMC is developing wireless battery charging technology that transmits electric power using resonance resulting from changes in magnetic field intensity between two coils. TMC will conduct a verification test in Toyota City, Aichi Prefecture in 2013 to evaluate performance in a real world environment.

Hybrid technology, capable of both high levels of fuel efficiency and driving performance, can be easily combined with various types of fuel and also includes core technologies necessary for developing many types of "eco-cars". TMC, believing that eco-cars can only contribute to society through their widespread use, will continue to refine conventional engine fuel efficiency while placing hybrid technology as key to further improving the performance of eco-cars, reducing their cost and improving the overall TMC product lineup.

<sup>1</sup>Total passenger car models consisting of additional (new) models and fully redesigned existing models

<sup>2</sup>As of August 2012, according to TMC

<sup>3</sup>Electric energy (Wh) required for driving a vehicle over a distance of one kilometer. AC power consumption rate, based on a test under the JC08 test cycle outlined by the Ministry of Land, Infrastructure, Transport and Tourism

<sup>4</sup>Direct injection 4-stroke gasoline engine superior version

<sup>5</sup>Calorific value effectively utilized for generating motive force (i.e., fuel that was used for actually moving the vehicle) as a percentage of the thermal energy provided to drive the engine (i.e., fuel used). Increasing this percentage leads to higher fuel efficiency.

<sup>6</sup>Stands for "Intelligent Accuracy Refinement Technology", which autonomously compensates for injection characteristics

<sup>7</sup>A name given to allude to the words *electric*, *quality*, *cue* (to a new way to live) and *cubic*

<sup>8</sup>In the JC08 test cycle of the Japanese Ministry of Land, Infrastructure, Transport and Tourism

Supplementary information

Overview of the "eQ" Electric Vehicle



Major Features

- High performance electric vehicle designed for daily commutes, shopping and other short distance travel; provides efficient energy use with a compact battery space and vehicle body that affords easy-to-handle, light and brisk driving.
- Boasts the world's best<sup>1</sup> electric power consumption rate of 104 Wh/km, a driving range of 100 km<sup>2</sup> on a single charge and a top speed of 125 km/h.
- Battery can be fully charged in approximately three hours with an AC 200 V power source.
- A compact body in a highly efficient package with an advanced and refined design.

**Main specifications (Japanese specifications) and other information**

Vehicle	Length/width/height	3,115/1,680/1,535 mm
	Wheelbase	2,000 mm
	Track (front/rear)	1,475/1,460 mm
	Minimum turning radius	4.1 m
	Seating capacity	4
	Driveline	Front-wheel drive
	Curb weight	1,080 kg
	Tire size	175/65R15
Performance	AC electric power consumption rate (JC08 test cycle)	104 Wh/km
	Driving range on a single charge (JC08 test cycle)	100 km
	Maximum speed	125 km/h
Motor	Type	Permanent magnet electric motor
	Maximum output	47 kW
	Maximum torque	163 N-m

Battery	Type	Lithium-ion	
	Total voltage	277.5 V	
	Capacity	12 kWh	
	Charging time	Normal charge (AC 200 V)	Approx. 3 h
Normal charge (AC 100 V)		Approx. 8 h	
DC quick charge		80%: Approx. 15 min	
Production		Takaoka Plant, Toyota City	
Vehicle base price		3,600,000 yen (including consumption tax)	

<sup>1</sup>As of August 2012, according to TMC

<sup>2</sup>In the JC08 test cycle of the Japanese Ministry of Land, Infrastructure, Transport and Tourism.

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