

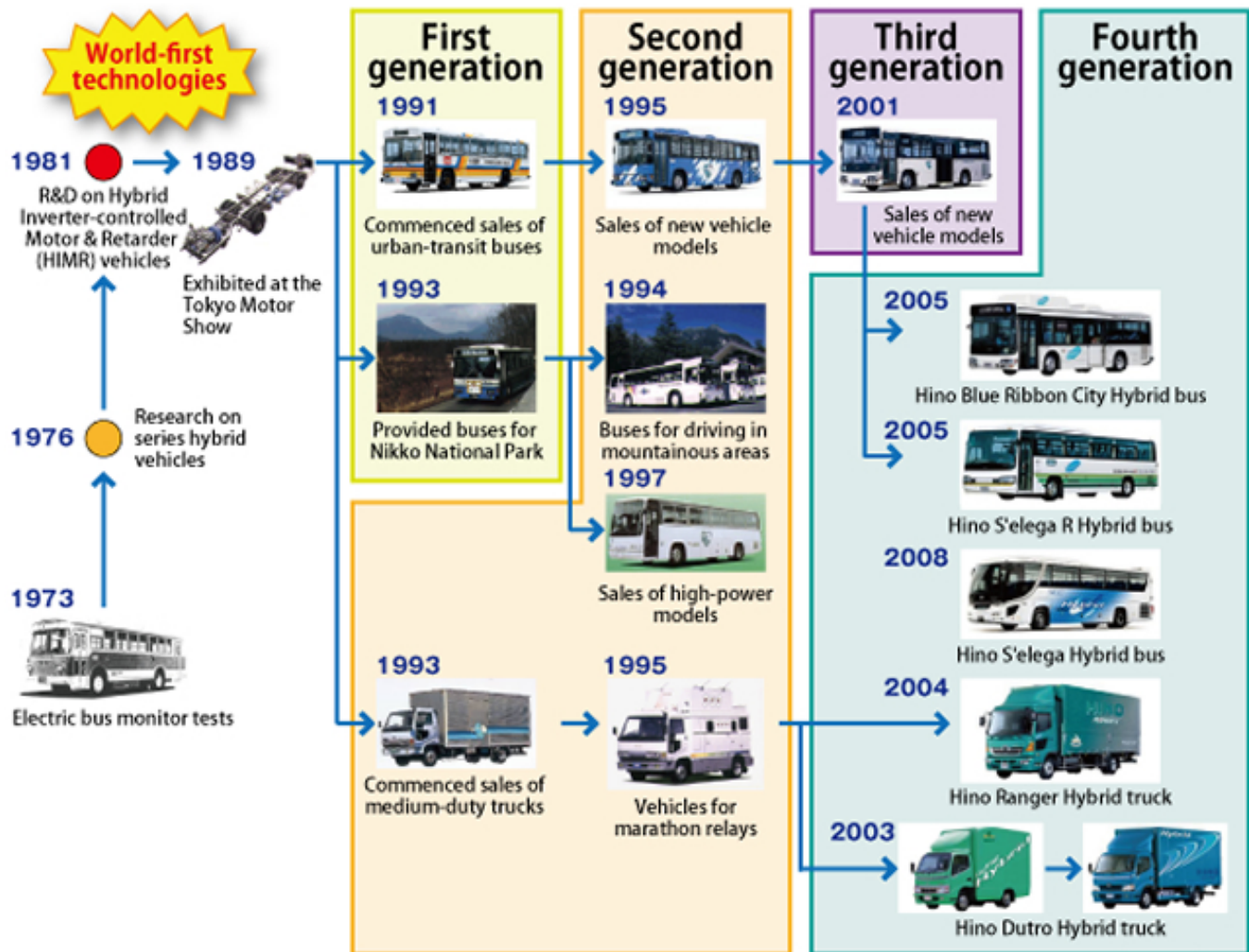
## Highlight: Hino Motors' Environmental Technologies



### Hino Motors - an environmental front-runner

Hino Motors is highly regarded for its commitment to offer vehicles that both save energy and feature environmentally friendly functions. While countless customers now appreciate the support they have received from the Company's hybrid vehicles, Hino Motors actually set out to create hybrid systems ahead of its competitors around the world in 1991.

## Hino Motors's history of hybrid technologies



### Leading the industry as a hybrid pioneer

Hino Motors commercialized and commenced sales of the world's first hybrid bus in 1991, and has remained the industry leader ever since.

In 1997, the Company launched sales of the Hino S'elega Hybrid bus, the first high-power, large-size tour bus in the world to feature a hybrid system. The model is used at national parks in Japan, where it is highly acclaimed for its environmental features and driving performance.

In July 2008, Hino Motors provided shuttle buses to the Group of Eight Hokkaido Toyako Summit, showcasing its buses on the world stage.

# Hybrid fifth-generation

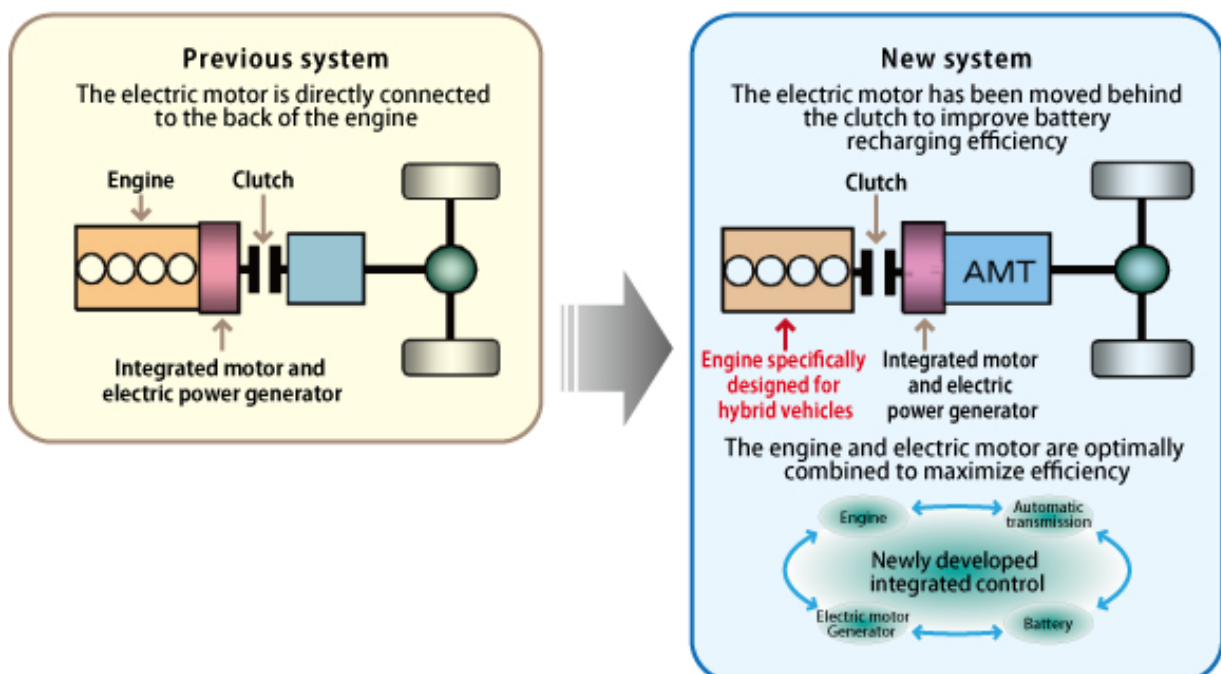


## Shifting to next-generation hybrid systems

As a pioneer in hybrid systems, Hino Motors has made major contributions to the development of hybrid vehicles manufactured by the Toyota Group, and is leading the industry in the application of hybrid technologies.

From its reservoir of accumulated expertise, Hino Motors has recently succeeded in developing its fifth-generation hybrid system after implementing additional improvements.

## Hino Motors's new hybrid system



## Aiming to further improve environmental performance

On June 15, 2011, Hino Motors announced plans to equip its new models of light-duty commercial vehicles

with the new hybrid system.

### **Special features of the new hybrid system**

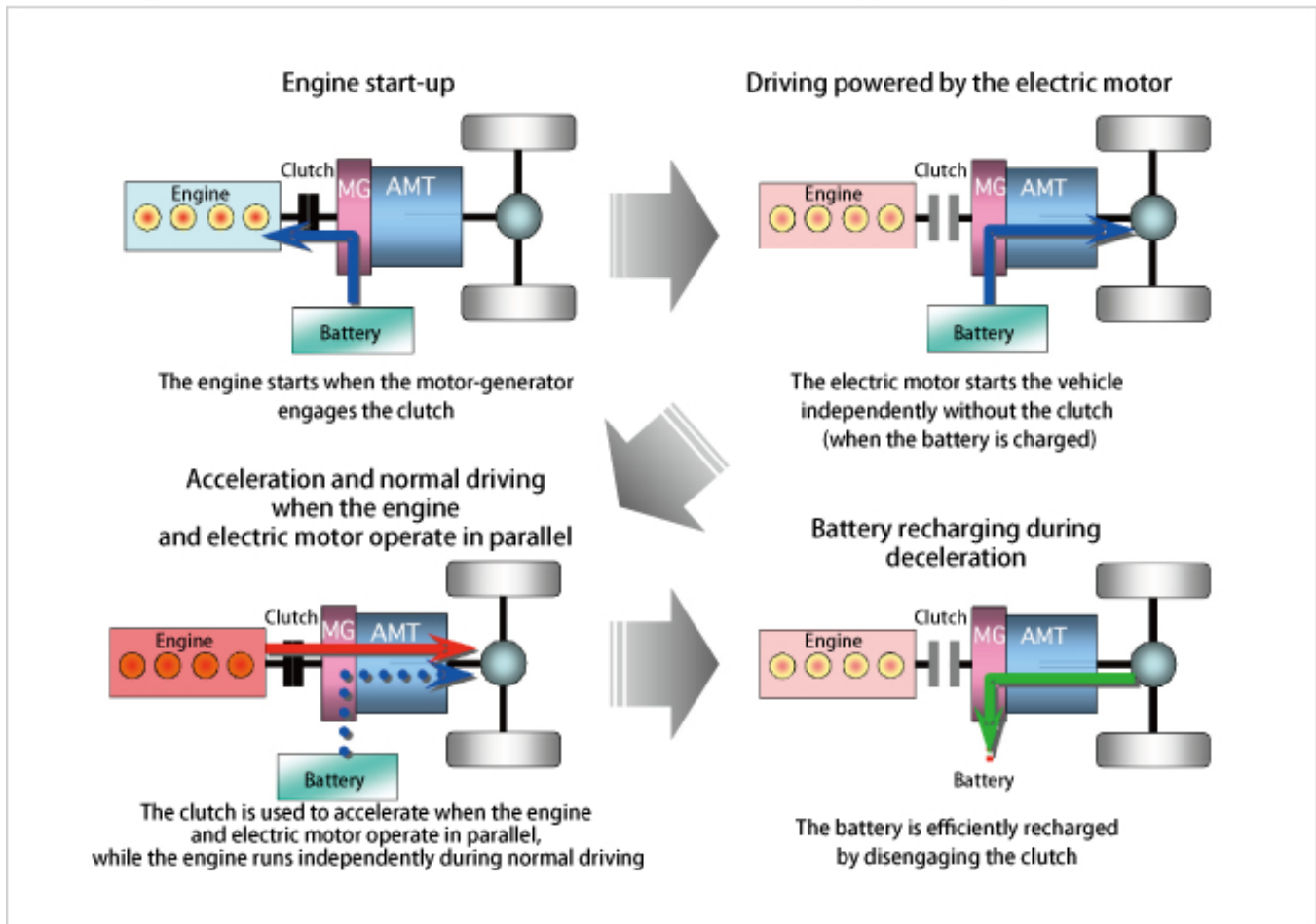
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- (1) The clutch is situated between the engine and electric motor, making it possible to run the electric motor independently when driving, thereby significantly improving battery recharging efficiency
- (2) The system employs a new adaptive control system that learns driving patterns to provide an optimal degree of driving assistance
- (3) Main components of the system have been made lighter and more compact
- (4) The engine and transmission have been newly developed especially for the hybrid system

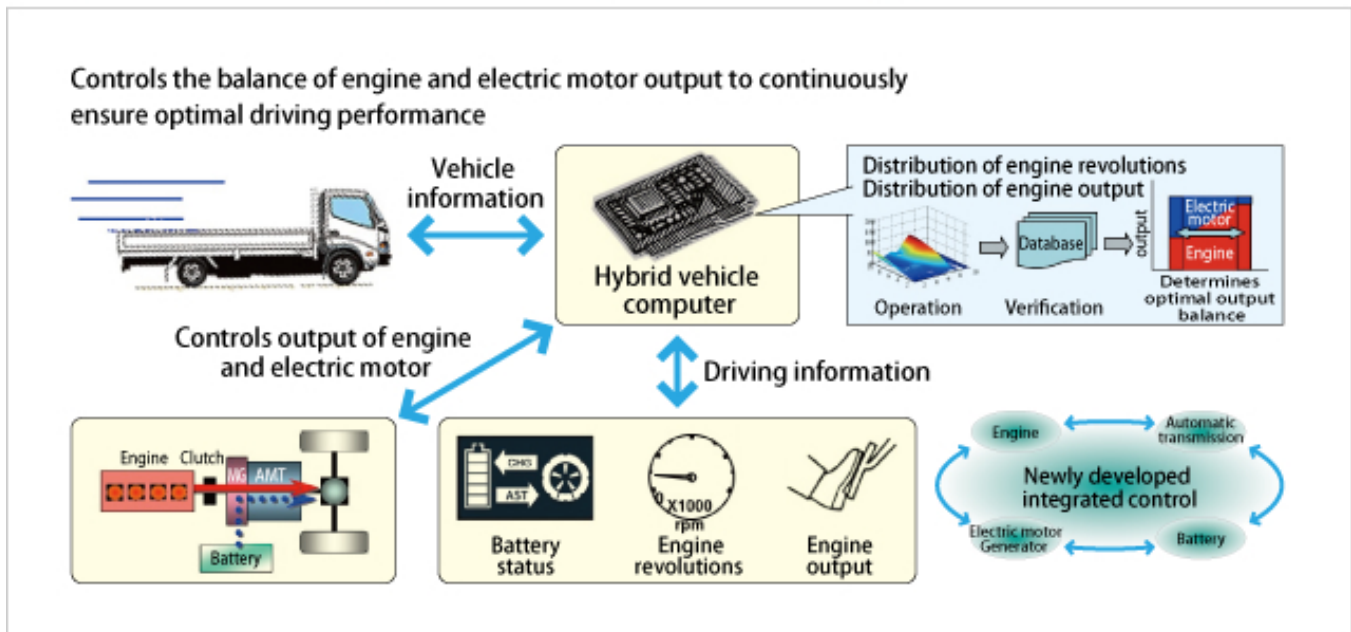
※ Hino Motors developed this highly effective hybrid system with the goal to improve the fuel efficiency of its hybrid vehicles by 50% relative to diesel vehicles of comparable size and type, under urban driving conditions where average vehicle speed is generally low due to frequent starts and stops.



## Driving performance of Hino Motors' new hybrid system



## Adaptive control system to optimize driving performance



## Fuel efficiency results of Hino Motors' new hybrid vehicles

### 1. Major improvements to fuel efficiency

- Consistent fuel efficiency results with little variation
- Significant fuel efficiency improvements achieved

### 2. Facilitates easier driving

- Realizes smooth and intuitive gear shifting
- Complies with drivers' licenses that only permit automatic transmissions

The new hybrid system features a newly developed dedicated engine that enhances thermal efficiency, and a newly developed dedicated transmission with higher efficiency. Along with other improvements, these innovations realize greatly improved fuel efficiency overall.

This, in turn, results in considerably lower emissions of CO<sub>2</sub> of the vehicle's life cycle. Hino Motors aims to reduce CO<sub>2</sub> emissions over the entire life cycle of its trucks and buses, from manufacturing, usage, and final disposal, by employing the life cycle assessment (LCA) approach

Source: Life Cycle Assessment (LCA) of new hybrid vehicle's CO<sub>2</sub> emissions compiled by Hino Motors

☞ Activities to reduce environmental impact using the LCA approach

## Staff Spotlight

### 01 Systems design



I hope to draw on my experience in analyzing data and incorporating feedback to help develop the next generation of hybrid systems.

Hybrid Vehicle Development Division  
Junya Kokon

My section is in charge of designing hybrid systems, which involves assessing vehicle operations and drivers' movements, and issues such as how to make the best use of electric motors, where to use the batteries, and how to connect the engine to the transmission.

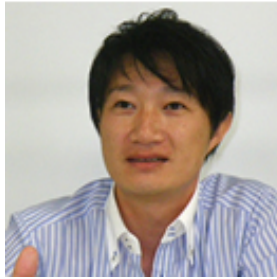
For the development of our fifth-generation hybrid system, we monitored the driving of many customers by equipping their vehicles with measuring devices that transmitted data to us daily. The broad array of data, which included information on fuel consumption and driving habits, was analyzed and incorporated as feedback in the development stage, enabling us to make numerous improvements to the system.

When our prototype models were test driven at local dealers, we were very happy to hear directly from the drivers that the vehicles were without a doubt easier to drive than previous models.

It is now three years since I joined my section as a new employee. As I am now involved with

designing Hino's next generation hybrid vehicles, I would like to draw on my experience thus far and channel my energies toward that end while taking into account the views of customers.

## 02 Control design



With a single-minded focus on improving fuel efficiency, we achieved our goal through everyone's combined strengths at Hino Motors.

Hybrid Vehicle Development Division  
Tomohiko Araki

My section is mainly responsible for designing control systems, and I have been engaged in this activity since the second generation of hybrid vehicles. Research for the newest hybrid system started six years ago, and culminated when the Company's president announced in 2009 that the system would enable Hino Motors' new vehicles to be 1.5 times more fuel-efficient than existing diesel vehicles.

Achieving fuel efficiency of 1.5 times that of diesel vehicles was an ambitious goal and a very impressive accomplishment. This target had been unreachable using previous methods for employing hybrid systems in existing vehicles. Nevertheless, we single-mindedly focused on improving fuel efficiency, and reviewed vehicles in their entirety, including the engine, transmission, tires, and every other aspect, while working together with engineers in a company-wide effort. Finally realizing the new system was undoubtedly a result of everyone's combined strengths. In this way, I think the way that Hino Motors carries out product development has changed from the ground up.

One thing that was special about the development of the fifth-generation system was how extensively we monitored our customers' vehicles. We talked with customers in a broad array of businesses engaged in urban transport, such as home delivery services and convenience store logistics, where stop-and-go driving is the norm. We collected data from six different companies, and held meetings with them to discuss topics such as fuel efficiency and vehicle usability. The customers were very interested in fuel efficiency and environmental initiatives. As they focused on evaluating the hybrid system, they gave their full cooperation with an attitude of "Let's develop the system together." This proved to be very useful for readying the system for commercial use in terms of both the engineering details and other functional aspects.

The engineers that participated in developing the system were on a mission to fully explore the merits of hybrid vehicles: environmentally friendliness and fuel efficiency. The new hybrid system is the best that Hino Motors has produced, making it another milestone in the Company's history. With this system, we are looking forward to making vehicles that our customers regard as essential for their business.

## 03 Unit design



Our mission - contributing to environment with hybrid system.

Hybrid Vehicle Development Division  
Hideki Okuno

I was involved in the unit design for the new fifth-generation hybrid system, specifically in charge of hybrid vehicle electronic control units. As a representative of the Hybrid Vehicle Development Division, I observed the assembly of vehicles, received requests from the Manufacturing Division, and was responsible for improving the assembly of power control units. It was challenging, however, to reduce costs for parts and make functions compatible with each other.

Hino Motors is serious about contributing to environmental protection by improving fuel efficiency through hybrid and other systems, while, of course, complying with exhaust gas emission regulations. We were successful in significantly improving fuel efficiency by overhauling the drivetrain of our new hybrid vehicles. For the next generation of hybrid vehicles, we intend to re-examine all existing models in areas such as vehicle construction, requirements for installing power control units, and other matters, to further improve fuel efficiency. Our overall aim is to create hybrid vehicles that are easier on the environment.

While the hybrid technologies that Hino Motors has accumulated thus far are very beneficial, other companies have also rapidly improved their environmental technologies, with hybrid vehicles and electric vehicles that can be charged by plugging them into a wall socket. Therefore, we will work to aggressively apply our new technologies so that Hino Motors can remain at the forefront of diesel-electric hybrid vehicle production ahead of its competitors.