

# R esearch and D evelopment



Satoru Takeuchi  
Senior Managing Director

## Supporting customers' businesses through technology

With unusual weather conditions caused by global warming now a problem, the Kyoto Protocol to reduce greenhouse gases (GHG) in the earth's atmosphere went into effect in February 2005.

At the same time, exhaust emission regulations for trucks have been strengthened around the world and in Japan, new long-term diesel emissions regulation also were enforced in October 2005.

Based on such circumstances, as a truck and bus maker that supports daily life and economic activities, Nissan Diesel is progressing with the development of economical, stable, and appropriate truck production that is compatible with the global environment. The Company is also working to develop environment-friendly products based on preventing air pollution (greening of exhaust gases) and global warming (improved fuel efficiency).

Nissan Diesel also is working on the development of vehicles and communications systems products to provide total support for its customers' businesses.



The Quon

## Nissan Diesel's Urea SCR system technology

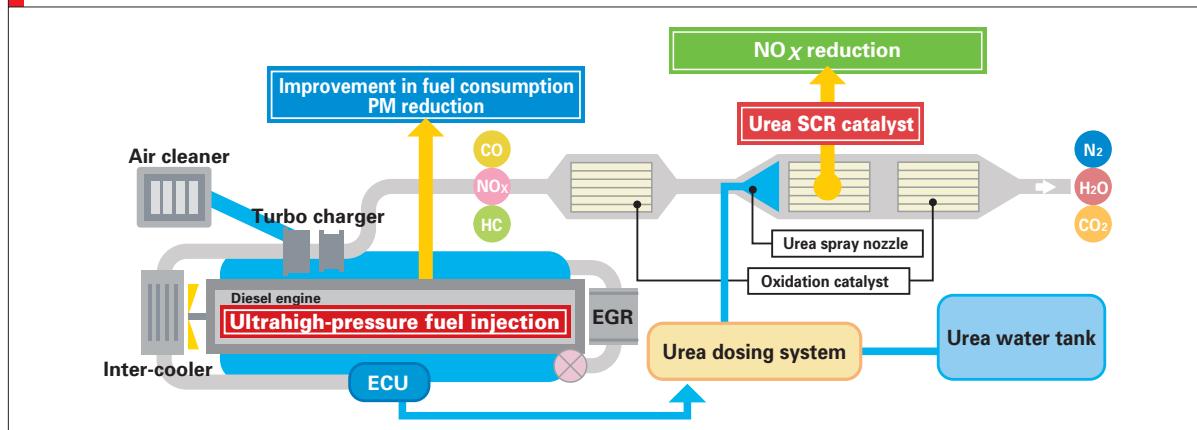
In November 2004, Nissan Diesel began selling its Quon heavy-duty trucks equipped with the Urea SCR system, and orders have been growing steadily since the full model line was completed in July 2005. The Company also has added buses that conform to the new long-term diesel emissions regulation.

The Urea SCR system uses a catalytic reduction between the NO<sub>x</sub> (nitrogen oxide) generated by combustion and urea, an odorless, harmless substance injected into the exhaust pipe, to substantially reduce particulate matter within the main engine by breaking the PM down into harmless water and nitrogen. Because the reduction of NO<sub>x</sub> (nitrogen oxide) occurs in the Urea SCR catalyst, the unique feature of this system is improved fuel efficiency resulting from maximized combustion efficiency within the main engine body. Furthermore, as environmental awareness increases -- whether the strengthening

of future regulations, including the obligation to reduce CO<sub>2</sub> emissions in accordance with ratification of the Kyoto Protocol, for example, or study of the introduction of fuel consumption regulations -- increasingly promising technologies are available. As global exhaust emissions standards are strengthened, the urea SCR system offers the most powerful technology for meeting this challenge, and even in Europe, various firms have begun to adopt this system. The urea SCR system has received high marks for contributing substantially to solving the environmental problems caused by large-scale commercial vehicles, and in 2005 the Society of Automotive Engineers of Japan awarded the system its Technical Development Award.

"AdBlue," the urea solution used with this system, currently is available at 1,080 truck stops and 192 Nissan Diesel locations throughout Japan.

### Urea SCR System Configuration



## Alliance with Mitsubishi Fuso Bus & Truck Corporation. to supply urea SCR system technology

Nissan Diesel has provided Mitsubishi Fuso Bus & Truck Corporation with the component technology patents and know-how for parts -- such as the urea solution injection system, urea solution tanks and catalysts -- and the two

companies have entered into an alliance to share parts. By reducing component development and manufacturing costs through this arrangement, both firms seek to provide customers with products at easy-to-purchase prices.

## Research and Development

### DME (dimethyl ether) truck research and development

Together with the CNG trucks and capacitor hybrid trucks on which Nissan Diesel has focused its efforts up to now, the Company also is conducting research and development on DME (dimethyl ether) trucks as an environment-friendly alternative.

DME is an alternative to petroleum-based fuels that can be produced from various carbon resources such as natural gas, coal, coal bed gas and biomass. It liquefies at a rather low pressure, contains no sulfur, and emits no black lead. Because of these properties, DME has been the focus of attention as a clean energy substitute for diesel. Nissan Diesel participated in the

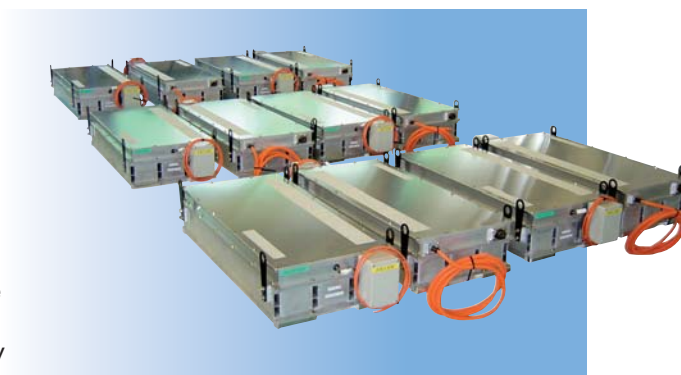
development project for the next generation of low-pollution vehicles sponsored by the Ministry of Land, Infrastructure and Transport, and through this program, and in conjunction with the National Traffic Safety and Environment Laboratory, developed the world's first large DME truck that achieved exhaust emission levels that are 10% of the standards set forth in the new long-term diesel emissions regulation or lower. Nissan Diesel exhibited this vehicle at the International Symposium held in Washington DC (in March 2006), creating extensive PR coverage for the Company's efforts with this project.



DME Truck

### Nissan Diesel launches sales of the Super Power Capacitor system for use with wind power generator stabilization devices

Nissan Diesel has developed its Super Power Capacitor system as a power storage facility (electrical storage device) for electric power stabilizers for wind power generation, which has attracted attention as an environment-friendly power generation alternative using natural energy, and delivered its first device to Fuji Electric Systems Co., Ltd. Under a technical cooperation agreement with Nissan Diesel, Fuji Electric Systems has combined the storage device with other equipment -- including an electric power stabilization system controller and two-way converter, to create an electric power stabilizer -- and has completed a performance study. This is



Super Power Capacitor system capacitor module for use in wind power generator electric power stabilization devices

the first time an electrical double layer capacitor has been adopted for an electric power stabilization device for an operational wind power generator anywhere in the world.

The Super Power Capacitor system sold to Fuji Electric Systems consists of the capacitor modules for six medium-duty hybrid trucks and a capacitor system controller developed for use as a wind power generator electric power stabilizer. The long-life design technology and control technology for continuously managing high-output electrical charging and discharging over an extended period were developed based on the technology Nissan Diesel has cultivated for its Super Power Capacitor

system for vehicle use. The new cells (2.7V, 2050F, 6.4Wh/kg) adopted for this system are a product Nissan Diesel has developed on its own.

Since achieving the world's first practical application of the Super Power Capacitor system for vehicle use in 2002, Nissan Diesel has sought to convert the technology, which it developed to contribute to conservation of the earth's environment, to practical applications other than vehicles. In the future, the Company will broaden its variations of the wind power generation electric power stabilization device and proceed to study utilization of electrical double layer capacitors in various fields.

### **Nissan Diesel and Komatsu to jointly develop a telematics system designed for commercial vehicles**

Nissan Diesel and Komatsu Ltd. agreed in July 2005 to collaborate on the joint development and commercialization of a telematics system, a comprehensive vehicle management tool incorporating an internal communication module, for commercial vehicles.

The two companies have decided to jointly develop a next-generation telematics system for commercial vehicles, based on the KOMTRAX telematics system Komatsu has installed on its construction equipment, and utilizing the technology of the NENPIOH system, which Nissan Diesel has commercialized for vehicle management. Through this collaboration, Nissan Diesel will seek to shorten the development period and reduce component development and manufacturing costs. The pursuit of these benefits will enable Nissan Diesel to provide this telematics product to its customers more quickly,

and at more affordable prices, as an advanced response to needs such as efficient fleet management and a reduction of vehicle operation and maintenance costs, including fuel costs.

In addition to real-time voice guidance provided by NENPIOH during vehicle operation, the system applications will include a digital tachograph, GPS positioning capability, a vehicle data collection function and other capabilities. By implementing this telematics system, businesses that oversee fleet operations will gain the advantage of being able to manage a variety of information collectively in real time.

Nissan Diesel will adopt the telematics system for commercial vehicle use for its trucks sold in Japan, and also is considering selling the system as a separate component.