Special Feature 2

Contributing to a Zero CO_2 Emissions Society through Environmental Technologies

Reducing CO_2 emissions is an urgent task in curbing global warming that has a significant impact on the natural environment and people's lives. As such, environmental initiatives of companies are becoming ever more important. At Toyota Industries, we have provided products with excellent environmental performance as an effort toward the realization of a zero CO_2 emissions society. In this Special Feature, we turn our attention to our next-generation environmental technologies, which we have been developing to help reduce global warming by leveraging our electrification and other elemental technologies.

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(As of March 31, 2018)

Global Environmental Commitment	Aspirations in 2050
Establishing a Low-Carbon Emission Society	Globally take on challenge of establishing a zero CO_2 emissions society
Establishing a Recycling-Based Society	Take on challenge of minimizing the use of resources
Reducing Environmental Risk and Establishing a Society in Harmony with Nature	Exert a positive influence on biodiversity
Promoting Environmental Management	Enhance consolidated environmental management and promote enlightenment activities

Positioning of Environmental Technologies

As one tenet under its Basic Philosophy, Toyota Industries works to contribute to regional living conditions and social prosperity and also strives to offer products and services that are clean, safe and of high quality. Accordingly, we have established the Global Environmental Commitment, a specific environmental action guideline, and defined our aspirations in 2050 to promote the four action themes specified in the Commitment. Our Sixth Environmental Action Plan for the period from fiscal 2017 to 2021 serves as a milestone toward achieving our aspirations in 2050, and we have been undertaking technology development accordingly.

Among the four action themes, we attach the greatest importance to the establishment of a low-carbon emission society, and have been undertaking initiatives in various fields from vehicle electrification to the development of fuel-efficient engines in our efforts to globally realize a zero CO_2 emissions society in 2050.

This Special Feature presents two examples of our initiatives in the field of electrification, which is one of the effective means of reducing CO_2 emissions. In these examples, we are utilizing our elemental technologies in seeking to provide innovative products and services.

Eco-Conscious Products Utilizing Our Strengths in Electrification Technologies

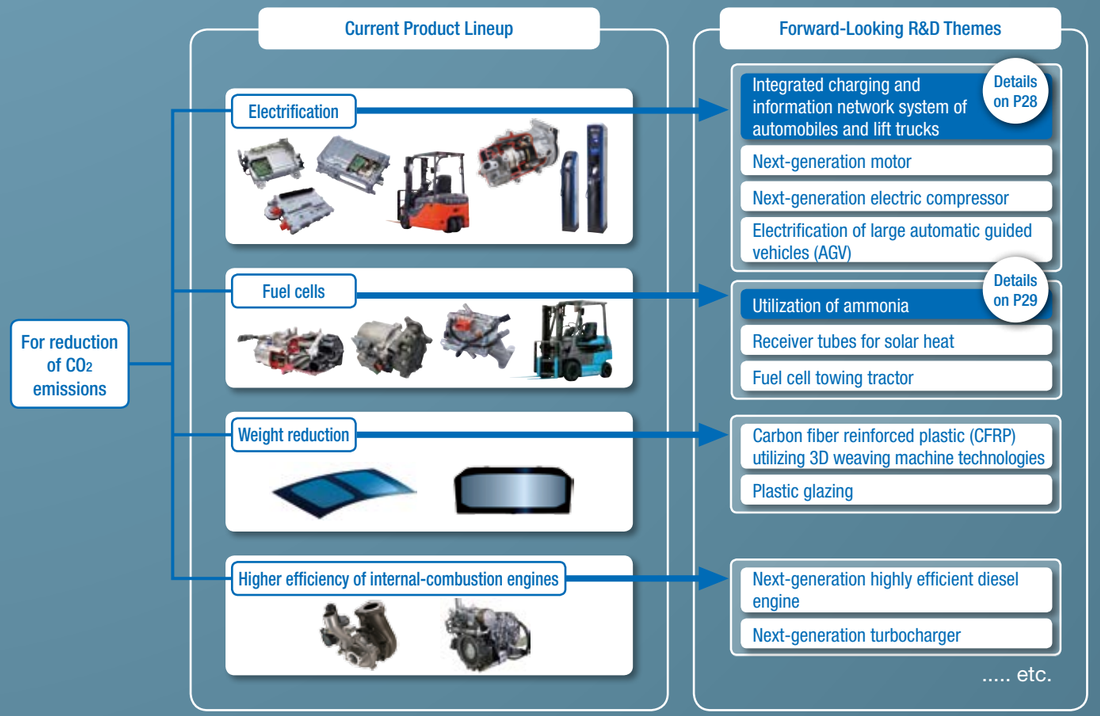
In the Materials Handling Equipment Business, we started developing electric lift trucks as early as in the 1970s. In recent years, we have developed and provided to customers lift trucks equipped with lithium-ion batteries and fuel cells. In the automobile-related businesses, we develop and manufacture a broad range of devices for electric-powered vehicles, including hybrid vehicles (HVs), plug-in hybrid vehicles (PHVs), electric vehicles (EVs) and fuel cell vehicles (FCVs), and have global top share*1 products in the fields of car air-conditioning compressors and electronics devices.

As seen herein, we have shared and advanced our technologies and know-how between the Materials Handling Equipment and automobile-related businesses. Departments carrying out research on material and other basic technologies also collaborate with each business division. We believe that this approach has enabled us to improve our technological prowess and conduct development in an efficient manner.

*1: Survey by Toyota Industries Corporation

[Examples of Existing Products]

- **Electric lift trucks**
  Our electric lift trucks utilize a range of elemental technologies, including power source technologies to improve power efficiency and environmental performance as well as control technologies to operate lift trucks in optimum condition.
- **Hybrid unit for construction machinery**
  We developed our first hybrid unit for construction machinery by leveraging our engine and power electronics technologies accumulated in the fields of materials handling equipment and automobiles. The unit has been mounted in a hybrid hydraulic excavator of Hitachi Construction Machinery Co., Ltd.
- **Electric compressors**
  Our electric compressors also utilize various elemental technologies, including technologies to enable weight reduction of materials, surface processing technologies and power source technologies related to motors and inverters to improve power efficiency.



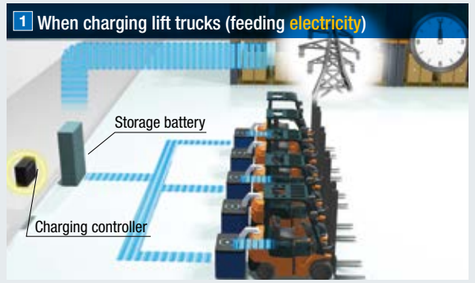
We strive to raise the competitiveness and expand the lineup of our products that utilize electrification technologies. At the same time, we seek further evolution and fusing of our elemental technologies to create an array of next-generation environmental technologies. This Special Feature presents two examples of such technologies.

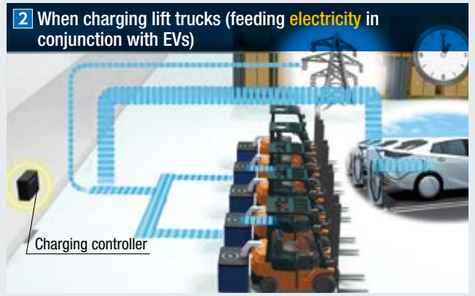
Application of Technologies Used in Existing Products

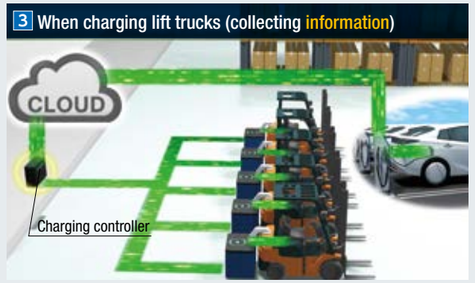
Integrated Charging and Information Network System of Automobiles and Lift Trucks

Overview / Advantages

1. In a factory operating multiple lift trucks, electricity costs can be reduced by charging just an appropriate amount of electricity to individual lift trucks based on their remaining battery charges and their operation plan, thereby enabling the control of the peak power consumption.
2. A considerable reduction in electricity consumption will be possible by charging electricity to lift trucks from PHVs, EVs and other similar vehicles based on these vehicles' operation plan.
3. It will also be possible to promote preventive maintenance by collecting information on all lift trucks running within a factory using Internet of Things (IoT) technology and conducting analysis of their operational status, thus contributing to reducing maintenance costs.







Utilization of Toyota Industries' Technologies

We will apply our technologies related to on-board chargers and charging stands for automobiles to charge lift trucks. Energy saving and preventive maintenance are made possible by utilizing our know-how in the operational management of lift trucks.

Future Plan

For commercialization of the technology, we plan to initiate feasibility tests in fiscal 2019 in an environment in which lift trucks are actually used. After experimenting with multiple lift trucks running simultaneously, we aim to put the technology into practical use in the mid-2020s.

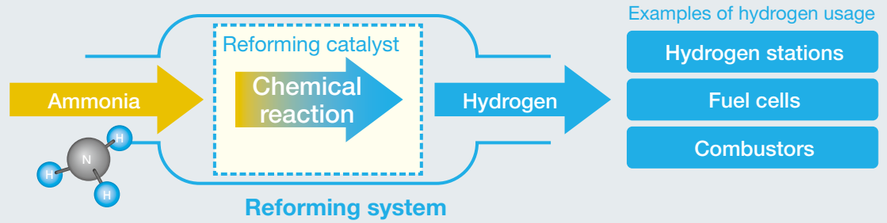
Development of a New Product Using Elemental Technologies

System to Use Ammonia to Generate Reformed Hydrogen for Fuel Cell Systems

The next example is a project aimed at reducing CO_2 emissions, promoted under the Cross-ministerial Strategic Innovation Promotion Program (SIP), an industry-government-academia program led by the Japanese government. Toyota Industries participates in the project as a joint research member.

Several automakers have been engaging in the development of FCVs in addition to EVs. The Japanese government regards FCVs as an effective means of reducing CO_2 emissions into the future and is promoting an SIP project, which includes production of hydrogen for use in fuel cell systems.

One theme of the project is energy carriers, and they include a program to develop a more efficient method through liquefaction and other processes to store and transport hydrogen, which is otherwise inefficient to do so in its gaseous state. We are carrying out the development of such a method by utilizing our pool of technologies.



Overview / Advantages

This reforming system uses ammonia to generate hydrogen for fuel cell systems. As ammonia goes through the system, it chemically reacts with a reforming catalyst inside and produces hydrogen.

There are many challenges involved in fully utilizing hydrogen in fuel cell systems. One of them is that hydrogen in a gaseous state is inefficient to store and transport.

If this system can be put to practical use, it will enable the use of ammonia, which is suitable for storage and transportation, as a hydrogen carrier and allow on-site supply of hydrogen at hydrogen stations. It can ultimately evolve into a hydrogen supply system for fuel cells used for various purposes, and is expected to contribute to the realization of a society in which hydrogen is readily available.

Utilization of Toyota Industries' Technologies

Preparing itself for the era of electrification, Toyota Industries has engaged in the development of catalyst and other elemental technologies for generating reformed hydrogen from ammonia for 10 years. Now, these elemental technologies have reached a level at which their practical use is a reality.

Future Plan

Our future efforts will be to increase the safety of the system further and at the same time make the system more compact.

Technologies for generating reformed hydrogen from ammonia are a key technology in establishing a hydrogen-based society. We recognize that it is our responsibility to accelerate our development efforts in this area in order to curb global warming and realize a zero CO_2 emissions society.

The projects presented in this Special Feature are only a few examples of our ongoing development efforts. Going forward, we will continue to work toward contributing to environmental conservation and providing cutting-edge products and services tailored to changes in the social structure and customer needs, along with improving the environmental performance of our existing products.