

# Environmental Performance

The world's population, which was 7.3 billion in 2015, is projected to grow to 9.7 billion by 2050 and to 11.2 billion by 2100.\* Global GDP is also continuing to expand, aggravating a host of environmental problems, including global warming caused by higher CO<sub>2</sub> emissions from fossil fuel consumption, the depletion of resources due to increased demand, and ecosystem destruction. Global-scale efforts are being made to develop approaches that lighten the burden on the environment so that a prosperous planet can be passed on to future generations.

Hitachi strives to achieve a more sustainable society by addressing environmental problems, which pose a major challenge for society, based on its corporate mission of contributing to society through the development of superior, original technology and products.

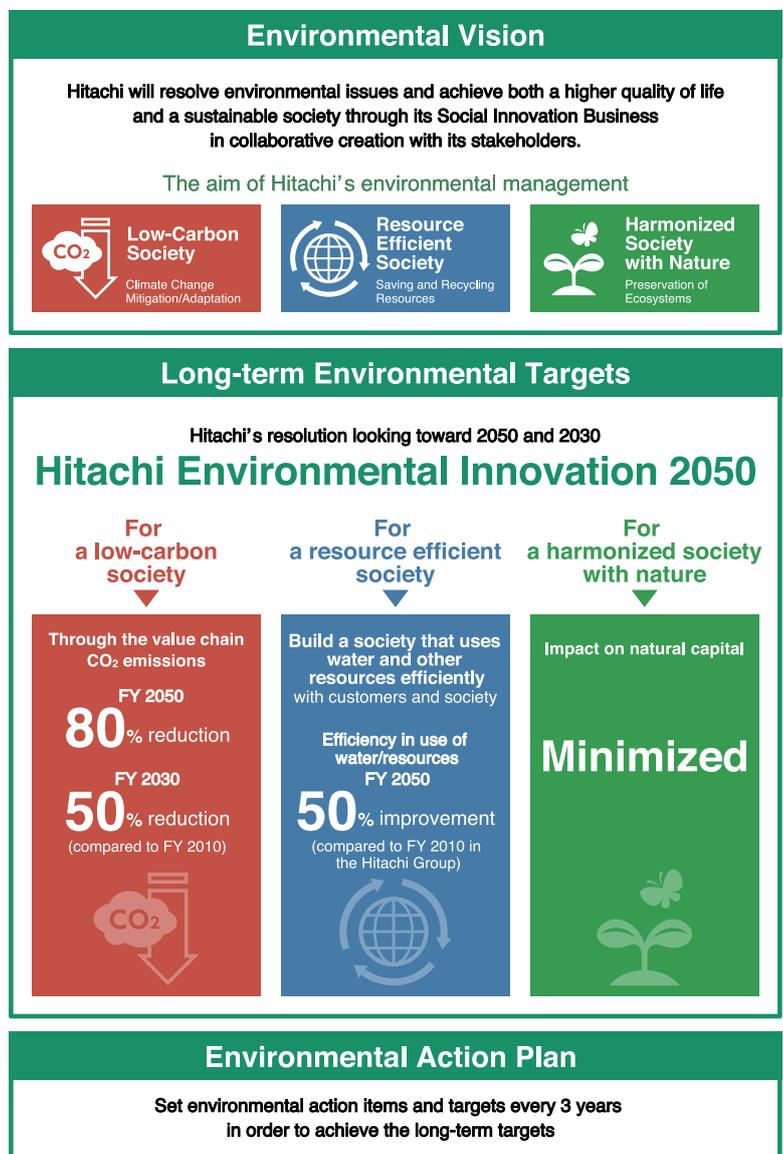
\* According to *World Population Prospects: The 2015 Revision*, published by the United Nations.

## The Environmental Vision and Hitachi Environmental Innovation 2050

As global warming, resource depletion, ecosystem destruction, and other environmental issues grow more serious, companies face increasing demands and expectations to reduce the environmental burden of their business activities.

The Intergovernmental Panel on Climate Change (IPCC) concluded that limiting global warming “below 2°C relative to pre-industrial levels” would require “40 to 70% global anthropogenic GHG emissions reductions by 2050 compared to 2010.” The Paris Agreement adopted in December 2015 at the 21st Conference of the Parties (COP21) to the United Nations Framework Convention on Climate Change—and which came into force in November 2016—set ambitious targets, including a global long-term target of keeping global warming to below 2°C and efforts to limit the increase to 1.5°C. Environmental targets have also been set in the Sustainable Development Goals (SDGs)—the centerpiece of the 2030 Agenda for Sustainable Development, adopted by the United Nations in 2015—whose Goal 13 reads: “Take urgent action to combat climate change and its impacts.”

In the light of these global trends and our own management policy, we created an Environmental Vision to better define the kind of society that Hitachi envisions from a long-term perspective. Our Environmental Vision envisions a low-carbon society; a resource efficient society; a harmonized society with nature. To achieve such a sustainable society, we established a set of long-term environmental targets called Hitachi Environmental Innovation 2050.



Hitachi Environmental Innovation 2050  
<http://www.hitachi.com/environment/vision/innovation2050.html>

# Toward a Low-Carbon Society

We seek to reduce CO<sub>2</sub> emissions by 80% compared to fiscal 2010 levels by fiscal 2050 to realize the drop in global anthropogenic GHG emissions that was deemed necessary in the IPCC's *Fifth Assessment Report*. We will attain this target throughout our value chain. First, this will be achieved by decreasing emissions during the *usage* stage of our products and solutions, which account for a substantial share of emissions in the value chain. We will contribute to our customers and to society by developing innovative technologies and solutions, as well as enhancing the efficiency of our products and supplying low-carbon energy. At the same time, we will also work to cut down on emissions at the *production* stage of our business activities.

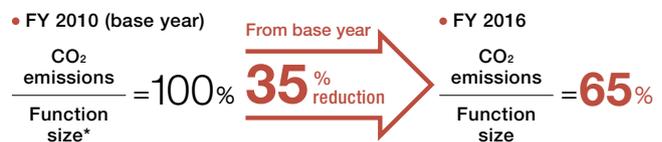
## Reduction of CO<sub>2</sub> Emissions During Use

### Improved Environmental Performance in Products and Services

Hitachi is improving the environmental performance of its products and services with the hope of contributing to the resolution of environmental challenges through the development and popularization of products and services with high environmental value. We strike a balance between improving functionality and reducing the environmental burden by using, as our index, the reduction rate per product and service function of CO<sub>2</sub> emissions during usage and of the volume of resources used during the life cycle. The group of products that demonstrate a high level of potential in solving environmental issues are the targets of a plan to achieve a 40% reduction in CO<sub>2</sub> emissions by fiscal 2018 (compared to fiscal 2010 products). In fiscal 2016, we attained a

35% CO<sub>2</sub> emissions reduction rate by promoting environmentally conscious designs and expanding sales of products and services with high energy-saving functions.

### Reduction in CO<sub>2</sub> Emissions



\* Major functions of products correlated to CO<sub>2</sub> emissions.

### Environmentally Conscious Design Assessments

We conduct Environmentally Conscious Design Assessments for all products and services involving a design process to ensure environmentally conscious design and development. Thirty environment-related areas are assessed for their impact on climate change, resource depletion, and environmental pollution (ecosystem degradation) at each stage of the product life cycle with a view to reducing the environmental burden. To meet the IEC 62430\* criteria for environmentally conscious design, in addition to implementing these assessments, we are advancing environmentally conscious design and development by integrating this process into our existing management system, such as by

keeping abreast of environmental regulations and ascertaining the environment-related needs of our stakeholders. We conduct life cycle assessments focusing on our main, priority products to quantitatively evaluate their burden on the global environment in such areas as the consumption of mineral resources, fossil fuels, and water resources, as well as their impact on global warming and air pollution. The results of such life cycle assessments are disclosed to our stakeholders and utilized in improving the design of next-generation products.

\* The standard developed by the International Electrotechnical Commission concerning environmentally conscious design for electrical and electronic products.

## Products and Solutions that Help Create a Low-Carbon Society

### Reducing CO<sub>2</sub> Emissions Through Energy Savings Amorphous Transformers

Transformers convert the high-voltage electricity produced at power plants into low-voltage electricity that can be used more safely. Since voltage is applied to the coil where electricity is flowing so that electricity can be used at any time, the occurrence of no-load loss (standby power) in which power is lost even when electricity is not being used cannot be avoided. Decreasing the no-load loss of transformers that operate 24 hours a day, 365 days a year, over a mean lifespan of about 25 years could lead to huge energy savings.

Hitachi Industrial Equipment Systems Co., Ltd. uses an amorphous alloy with outstanding magnetic properties in the iron cores around which coils are wound. This has resulted in an annual reduction of about one-fifth in no-load loss compared with previous silicon steel transformers\* and an annual reduction of 26 MWh in total loss, including load loss, during use.



An oil-immersed transformer (left) and molded transformer.



\* Comparison of loss between Hitachi's silicon steel transformer and amorphous transformer (3,000 kVA capacity, 22 kV/6.6 kV, 50 Hz models at 40% load factor).

## Reducing CO<sub>2</sub> Emissions with Renewable Energy Down-wind Turbine System

Hitachi has installed 162 wind turbines in Japan (as of February 28, 2017) and is actively developing this business to contribute to the growth of the renewable energy sector. In Hitachi's original down-wind system, the rotor is on the downwind side of the tower. The system's weather vane effect enables turbines to switch to the free-yaw operation mode in blackout conditions, such as during storms, preventing the dangers posed by cross wind. The characteristic makes the down-wind system very safe. Down-wind turbines also generate energy efficiently by capturing upward blowing winds in mountainous and hilly areas.

At a new wind power plant of the Aoyama-Kogen Wind Farm Corporation, located on the Aoyama plateau in Mie Prefecture, Hitachi supplied 40 down-wind turbines. The output is 80 MW, the largest in Japan.\*1 Hitachi is also taking part in research for the Fukushima Floating Offshore Wind Farm Demonstration Project of the Agency for Natural Resources and Energy, Ministry of Economy, Trade, and Industry.



A 5 MW floating wind turbine  
(courtesy of the Fukushima Offshore Wind Consortium).

CO<sub>2</sub> emissions reduction amount → **330 kt-CO<sub>2</sub>/year\*2**  
(amount for the 162 wind power turbines installed by Hitachi)

- \*1 According to a list of wind power generation facilities installed in Japan (as of March 31, 2016), compiled by the New Energy and Industrial Technology Development Organization (NEDO).
- \*2 Comparison with LNG thermal power generation. Calculated from the life cycle CO<sub>2</sub> emissions for each type of power generation listed in the Evaluation of Life Cycle CO<sub>2</sub> Emissions of Power Generation Technologies, published by the Central Research Institute of Electric Power Industry (July 2010).

## Reducing CO<sub>2</sub> Emissions During Transport Railway Systems

Among the various modes of transportation, railways have among the lowest CO<sub>2</sub> emissions. As a comprehensive railway systems integrator, Hitachi is a global provider of railcar and transport systems, including signaling and train management systems, and will continue to deliver total railway systems for greater efficiency and environmental consciousness.

Hitachi's aluminum A-train rolling stock is lighter than stainless steel rolling stock, for example, enabling trains to run at high speeds with less energy. Outside of Japan, A-train production has also begun in a UK plant and additional orders have been received for 63 AT-300 cars for a railway in southwest England. Together with an order received in July 2015, the total is for 236 cars (36 trains).

The use of silicon carbide (SiC) in carriage inverters reduces energy loss during operation and cuts mass and volume by 40%. Energy savings are achieved through both lower electrical energy use and the contribution of these inverters to lighter rolling stock.



An AT-300 train for a UK railway company.

CO<sub>2</sub> emissions per transport unit (passenger) → Railway emissions are about  $\frac{1}{7}$  those of automobiles\*

- \* From Ministry of Land, Infrastructure, Transport, and Tourism data on CO<sub>2</sub> emissions in the transportation sector.

## Reducing CO<sub>2</sub> Emissions by Improving Automobile Fuel Efficiency Lithium-Ion Battery Packs

Automobile CO<sub>2</sub> emissions are a major environmental issue, and fuel efficiency is being improved through various technologies.

Hitachi Automotive Systems, Ltd. has developed a 48V lithium-ion battery pack for mild hybrid vehicles. An output density 1.5 times existing levels has been achieved by improving the material composition of the positive and negative electrodes and increasing the amount of lithium that can be stored per unit of weight. This not only enhances the motor's torque performance for assisting acceleration but also enables the recovery of substantial regenerative energy when decelerating and reduces energy loss.

Hitachi contributes to reduced CO<sub>2</sub> emissions through improved automobile fuel efficiency by providing storage batteries and other energy-saving automobile parts.



A 48V lithium-ion battery pack for mild hybrid vehicles.

48V lithium-ion battery pack energy density → **1.5 times previous product**

## Reducing CO<sub>2</sub> Emissions Through Greater Efficiency with IoT Building Eco-Factories with Lumada

Hitachi Construction Machinery Co., Ltd. uses a network of Japanese and international affiliates centered on four main plants in Japan to produce construction machinery and its principal components. Together with energy reductions during use as these products switch to electric or hybrid power, efforts throughout the network are also being made to reduce energy consumption in the manufacturing stage.

The entire Hitachi Construction Machinery Group continues to implement energy-saving measures and promote greater efficiency in plant and office lighting and air-conditioning. Several locations have also introduced IoT technology to further reduce energy consumption and raise productivity. Specifically, by adopting the Energy and Equipment Management Service, a key solution concept under Hitachi's Lumada IoT platform to comprehensively control energy data and equipment across multiple business facilities, they are able to efficiently analyze and manage electric power data gathered from equipment at each plant. Energy usage by the machine tools, robots, and other production equipment used in plants is finely controlled, reducing standby power and increasing energy efficiency.

With these efforts the energy use per unit has been decreased 32% compared with fiscal 2010 at the company's main plants in Ibaraki Prefecture, contributing to a significant reduction in electric power costs.



Tsuchiura Works East Building and the Hitachi UH03 hydraulic excavator, which is included in the list of Japan's Mechanical Engineering Heritage.

Energy use per unit → **32% reduction compared with fiscal 2010**

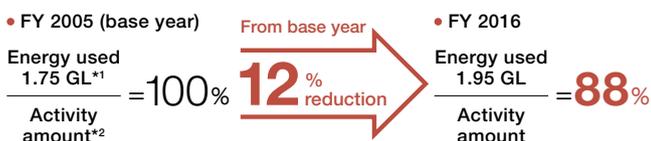
## Reduction of CO<sub>2</sub> Emissions During the Production Stage

We are working to reduce energy use per unit—an indicator of energy efficiency—by systematically improving efficiency, such as by installing high-efficiency equipment and devices, from LED lighting to inverter air conditioners, at each facility. In fiscal 2016, we achieved an improvement of 12% (from a base year of fiscal 2005), against a target of 15%. Part of the reason for not hitting the target was because of a decline in sales in energy intensive business divisions, which contracted the denominator in calculating energy use per unit.

The increase in the total volume of CO<sub>2</sub> emissions was due to the fact that a materials company in the Americas newly became a member of the consolidated Hitachi Group in fiscal 2016. There was a general decline in regions other than the Americas.

We will continue to harness our expertise in control and IT technologies to actively pursue energy conservation measures at our factories and offices and promote the efficient use of energy.

### Reduction in Energy Use per Unit



\*1 Energy volume used both in and outside the organization (SCOPE 1 and 2).

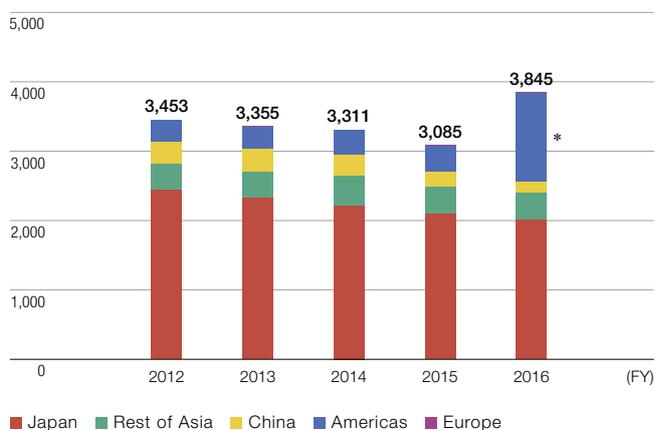
\*2 A value closely related to the emission factor numerators (environmental burden) of energy use from business activities (for example, production quantity, output, building floor space, and number of employees).

### Introducing Renewable Energy

We are promoting the use of solar, wind, and other forms of renewable energy. During the 2016 fiscal year, Hitachi produced 2,925 MWh of renewable energy for its own use. Hitachi Computer Products (America), Inc. proactively uses renewable energy to power its factory, purchasing 8,769 MWh during fiscal 2016. In Japan, we contracted for 1,000 MWh/year of Green Power through Japan Natural Energy Co., Ltd. to provide power for offices, showrooms, and exhibitions.

### CO<sub>2</sub> Emissions

(kt-CO<sub>2</sub>/year)



\* Includes 958 kt-CO<sub>2</sub>/year emitted by a materials company that became a consolidated member of the Hitachi Group in fiscal 2016.

#### Notes:

- The CO<sub>2</sub> electrical power conversion factor uses the 2005 emission coefficients for individual countries published by the International Energy Agency (IEA) in the 2010 edition of *CO<sub>2</sub> Emissions from Fuel Combustion*.
- Energy-related CO<sub>2</sub> emissions were 1,296 kt-CO<sub>2</sub> (SCOPE 1) and 2,549 kt-CO<sub>2</sub> (SCOPE 2).

# Realization of a Resource Efficient Society

Together with our customers and society, Hitachi will do its utmost through its business operations to help build a society that uses water and other resources efficiently. We will expand circulative uses of water by further advancing the entire range of water treatment technologies involved in water use from seawater desalination and other forms of fresh water generation to sewage treatment.

We also aim to improve our usage efficiency of water and other resources by 50% compared to fiscal 2010 levels by fiscal 2050. To achieve this target, we will create products that last longer and use less resources, make thoroughgoing efforts to collect and recycle used products, reduce the volume of water used in the production process such as through purification and reuse, and engage in other efforts.

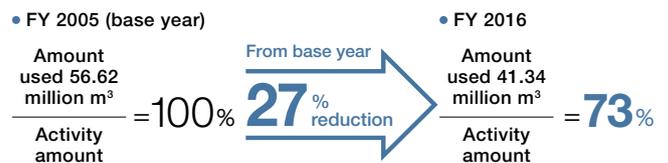
## Improving Usage Efficiency of Water and Other Resources

### Water Conservation

Hitachi uses water in such production processes as cleaning, cooling, and painting. To reduce water usage through greater efficiency, we are enhancing our level of water management by installing flow meters at more locations, introducing wastewater treatment devices to increase the use of recycled water, and upgrading water supply facilities at our business sites.

Different countries and regions are affected by water-related issues in different ways, so we devise appropriate countermeasures for each region. Our business sites in China, India, and the Philippines, for example, are striving to reduce the volume of water used by strengthening measures against water leakage.

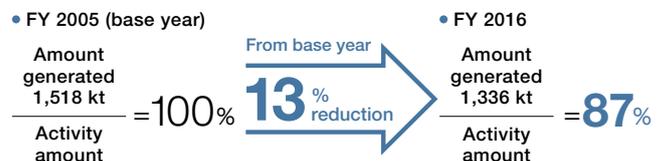
### Reduction in Water Usage per Unit



### Reducing Waste Volume

For fiscal 2016, we set a target of a 12% reduction (from a base year of fiscal 2005) for waste and valuables generated per unit, bettering this by achieving a 13% reduction. Every business site is reducing waste through onsite recycling of byproducts and scrap from the production process and efforts to curb use of packing materials during transport. Under the Zero Emission initiative, which seeks to minimize landfill disposal, 98 business sites achieved their zero emission goal\* as of fiscal 2016.

### Reduction in Waste and Valuables Generated per Unit



\* Defined as a final disposal rate (landfill disposal/waste and valuables) of less than 0.5% in any given fiscal year.

Zero Emission Sites

<http://www.hitachi.com/environment/activities/data/zeroemission.html>

## Creating a Resource Efficient Society Through Business

### Water Solutions to Protect Global Water Resources

Water covers 70% of the earth's surface, but only 0.01% of it is potable. Demand for water, however, is on the rise globally, with more than 40% of the world's population expected to face severe water shortages by 2050.

Hitachi has acquired an extensive record in the water business as it strives to become a comprehensive water service provider. We have supplied equipment to around 700 water purification plants and 900 sewage treatment plants in Japan, and over 200 sites in some 40 countries and regions around the world. We continue building on this experience to provide a variety of water infrastructure globally.

We are currently moving forward on IoT-based, optimized, and highly efficient water business solution offerings, including water supply and sewage systems and seawater desalination plants. For example, our energy-

efficient seawater desalination plant dilutes seawater with treated sewage to lower the salt concentration, reducing the pump pressure required for the desalination process and cutting energy consumption by approximately 30%.



# Harmonized Society with Nature

We strive to minimize Hitachi's impact on natural capital, which bestows the benefits of nature on humankind by assessing ecosystem impact and advancing measures to minimize the burden at each stage of Hitachi's value chain. Moreover, we are preserving the ecosystem through our products and services, such as our air and water purification systems and environmental monitoring systems. We also endeavor to minimize the environmental burden of our factories and offices.

## Ecosystem Assessments and Their Implementation

In fiscal 2016 Hitachi created an Ecosystem Preservation Activities Menu citing the specific activities to be undertaken to promote the preservation of the ecosystem. We are encouraging each business site to advance their own initiatives. This menu was created by adding the pioneering activities of other corporations and organizations to the list of items that had already been subject to assessment since 2010. It consists of 116 items covering all aspects of our business operations, including the value chain. Each business site selects those activities it plans to launch from the menu, and the total number of initiatives becomes Hitachi's target for ecosystem preservation. In fiscal 2016, 144 new initiatives were launched, far in excess of our initial goal of 30.

In the long term, we seek to minimize the impact on natural capital and realize a harmonized society with nature by minimizing

the burden (negative impact) on the ecosystem caused by business activities and maximizing the positive impact, such as by undertaking social contribution activities to protect nature and providing products and services that preserve the ecosystem.

Regarding impact and other ecosystem preservation assessments, we are deliberating the matter not only within the Group but also through our participation in activities outside the company, such as the biodiversity working group of four Japanese electrical and electronic industry associations\* and the Japan Business Initiative for Biodiversity (JBIB).

\* The Japan Electrical Manufacturers' Association (JEMA), Japan Electronics and Information Technology Industries Association (JEITA), Communications and Information Network Association of Japan (CIAJ), and Japan Business Machine and Information System Industries Association (JBMIA).

## Efforts Toward Building a Harmonized Society with Nature

### Hitachi Group Forestation Activities

Working together with employees and their families, the Hitachi Group participates in the Japanese Forestry Agency's Corporate Forest Program to preserve forests in several locations.

The Group has been conducting tree-planting activities since 2007 in the Yuyu Forest in Ibaraki Prefecture. Each year employees and their families gather to plant trees, clear underbrush, prune, and perform other forest maintenance activities. They also take part in activities including environmental education and handicraft classes using pruned materials.

The Hitachi High-Tech Yasato Forest embarked on a 60-year plan in 2005 to cultivate trees. Employees and their families participate in the work of pruning and thinning to grow a healthy forest.



Hitachi Power Solutions Co., Ltd. employees at the Yuyu Forest.



Hitachi High-Technologies Corporation employees at the Yasato Forest.

## Appropriate Management of Chemical Substances

Working closely with suppliers and customers, we gather and make available information on chemical substances across the supply chain via the Integrated Management System for Chemical Substances Contained in Products, which has been in operation since fiscal 2005. As of March 31, 2017, chemical substance information for more than 1.31 million parts and products was registered under this integrated management system. In fiscal 2016, we upgraded our system to respond to the shared information transmission scheme (chemSHERPA) on chemical substances contained in products.

### Integrated Management System for Chemical Substances Contained in Products

