

# Energy Systems

## Others

¥161.6 billion

Key products and services

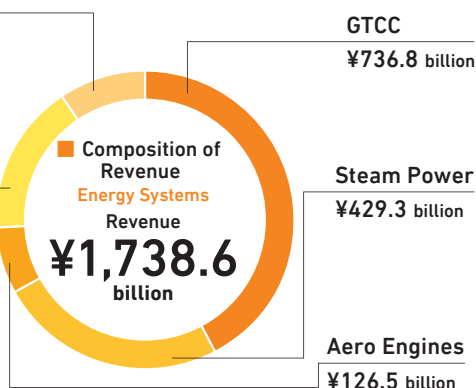
- Wind power systems
- Compressors
- Air quality control systems (AQCS)
- Marine machinery, etc.

## Nuclear Power Systems

¥284.4 billion

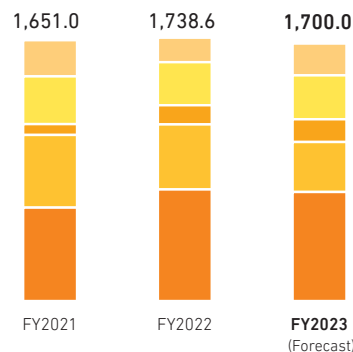
Key products and services

- Light water reactors
- Decommissioning
- Fuel cycle
- Future reactors
- New fields



## Revenue

(Billions of yen)



## Overview of FY2022 and Key Strategies in the Medium to Long Term

### Business Environment

The movement towards decarbonization is accelerating, centered on Europe and the United States, amid rising interest in achieving Carbon Neutrality and energy security.

The European Union is seeing a wider reevaluation of nuclear power and natural gas, with a decision to include nuclear power and natural gas in the EU taxonomy, which defines sustainable economic activities.

In Japan, the cabinet approved the basic policy on green transformation in February 2023. The policy clearly lays out the country's direction on both responding to climate change and ensuring a stable supply of energy, mainly by promoting action on decarbonization, such as rigorous energy conservation and switching to decarbonized sources of electricity that help to increase the country's energy self-sufficiency, such as nuclear power and hydrogen. MHI Group is actively promoting an Energy Transition grounded in reality through a wide range of solutions including gas & steam power systems, such as high efficiency gas turbines, hydrogen-firing gas turbines, and biomass boilers, as well as nuclear power systems.

### Status of Business

In fiscal 2022, consolidated orders received were up year on year to ¥1,791.7 billion, mainly reflecting brisk activity in the global GTCC market as well as growth in orders for aero engines as demand recovered from the COVID-19 pandemic, along with solid activity in nuclear power systems. Revenue totaled ¥1,738.6 billion, a year-on-year increase, mainly due to increases in GTCC, nuclear power systems, and aero engines. Profit from business activities was level with the previous fiscal year at ¥85.1 billion.

### Gas & Steam Power Business

Gas turbines saw a steady buildup of orders received from Hong Kong, Uzbekistan, Singapore, and the United States, among others, atop firm demand for gas-fired thermal power, which has a lower environmental impact than coal-fired thermal power. The Company's gas turbines are highly regarded for offering the world's highest level of efficiency and output capacity. Gas turbines achieved the world's top market share in 2022. This is due to the high product reliability of the J-type gas turbine, which has a cumulative operating time of over 2 million hours, and the future extensibility such as installation of CO<sub>2</sub> capture equipment and conversion to hydrogen-firing. The Company succeeded in a demonstration trial using a 20% hydrogen mix fuel at an existing power station operating in the United States. We will contribute to the decarbonization of the world in the field of building a value chain for the production, storage, transportation, and utilization of hydrogen. For example, a project to build the world's largest green hydrogen production and storage facility, which our company is participating in, was selected as a loan by the U.S. Department of Energy, and the company is working to start operations in 2025.

Although the steam power market is shrinking, there are growing needs for modification of existing facilities, for example to enable mixed combustion of biomass, and the Company has signed multiple MOUs for investigating the use of decarbonization fuels at existing thermal power plants. We are also promoting CO<sub>2</sub> emissions reduction in our service operations, by making proposals for maintenance and innovation projects to increase efficiency, for example.

## Nuclear Power Business

In the nuclear power business, we are working with electric utilities to restart existing light water reactor plants, installing severe accident management facilities (Specialized Security Facilities), and preparing for completion of a fuel cycle facility's construction. In FY2022, we completed work on five Specialized Security Facilities, including Kansai Electric Power Mihama Unit 3, and contributed to stable and low-cost supply of electric power through the stable operation of 10 PWR\*<sup>1</sup> plants. Recently, based on our track record in restarting PWR plants and installing Specialized Security Facilities, we have received a number of requests from BWR\*<sup>2</sup> electric utilities for support in regard to restarting and Specialized Security Facilities. In addition, with a view to contributing to the realization of Carbon Neutrality and stable energy supply, we have been working with four PWR electric utilities\*<sup>3</sup> on joint development and design of the Advanced Light Water Reactor SRZ-1200, which will achieve the world's highest standards of safety, aiming for practical implementation in the mid-2030s. We are currently working on a target of completing around 80% of the basic design. Furthermore, to enable us to respond to diversifying social needs in the future, we are proceeding with development of technologies including small light water reactors as distributed power sources, high temperature gas-cooled reactors that can contribute to large-scale stable hydrogen production, and fast reactors that contribute to a reduction in the volume and toxicity of radioactive waste. With government assistance, we are aiming for practical implementation of these technologies around 2040. In the area of high

\*1 PWR: Pressurized Water Reactor

\*2 BWR: Boiling Water Reactor

\*3 Hokkaido Electric Power Company, Kansai Electric Power Company, Shikoku Electric Power Company, and Kyushu Electric Power Company

\*4 MRO: Maintenance, Repair & Overhaul

temperature gas-cooled reactors, in FY2022 we decided to participate in a hydrogen production demonstration project using a High Temperature Engineering Test Reactor (HTTR) with the Japan Atomic Energy Agency. In FY2023, MHI was selected as the core company for design and development of a demonstration fast reactor and a high-temperature gas-cooled demonstration reactor, both promoted by the Japanese government.

## Aero Engines/Compressors/Marine Machinery

Aero engines saw growth in demand for new builds and maintenance as air travel demand continues to recover following the relaxation of travel restrictions. To keep pace with the expected growth in MRO\*<sup>4</sup> demand, we completed expansion work on our aero engine maintenance plant in Komaki, Aichi Prefecture. We are also proceeding with expansion of our Nagasaki plant, aiming to integrate production of combustors and achieve further productivity gains, with plans to start operation in stages from FY2023.

In compressors, we will actively respond to demand for use in decarbonization-oriented ethylene, ammonia, and LNG plants, mainly in North America and the Middle East, backed by our strong track record in supplying compressors for oil and gas and petrochemical plants. In addition, we will proceed with product development to address new needs related to CCS and hydrogen. In marine machinery, we achieved record high sales in services, and in new shipbuilding projects, we significantly expanded our market share in turbochargers for two-stroke engines. In light of movements such as the Marine Environment Protection Committee's recent decision to move forward its net zero greenhouse gas emissions target, we will enhance our partnership with international decarbonization technology R&D institutes as well as our own technology and product development efforts.

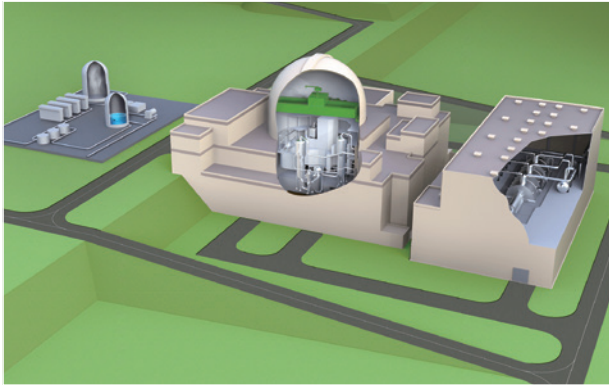
### FOCUS

## Contributing to Carbon Neutrality and Stable Energy Supply with the Advanced Light Water Reactor SRZ-1200

Nuclear power is a carbon-free, large-scale, stable power source and an important base load power source from an energy-security perspective. We consider it a crucial tool for achieving Carbon Neutrality in Japan by 2050. The cabinet of the Japanese government has approved the basic policy on green transformation, which calls for the use of nuclear power to the fullest extent, and green transfor-

mation strategy, which calls for rebuilding nuclear power stations with next-generation innovative reactors.

Against this backdrop, MHI is working with four PWR electricity utilities on the basic design of the advanced light water reactor SRZ-1200, which will offer even better safety than conventional PWRs. We now intend to work on the basic designs and detailed designs for individual plants,



Advanced light water reactor SRZ-1200

aiming for practical implementation in the mid-2030s.

The SRZ-1200 has a dramatically improved safety profile. Proven technologies are used to enhance safety features, including strengthening resistance to natural hazards, such as tsunamis and earthquakes, increasing the redundancy and diversity of safety equipment, and bolstering anti-terrorism countermeasures with the use of reinforced containment vessels. On top of these, the SRZ-1200 also incorporates new safety mechanisms. One of these new safety mechanisms is the installation of the world's most advanced core catchers (equipment that securely holds and cools melted debris inside the containment vessel) as a countermeasure for a core melt. Furthermore, we are also designing systems

to reduce the release of radioactive material in the unlikely event of a major accident and limit the impact to within the site of the plant. The SRZ-1200 is being designed not only for safety, but also for high economic viability. Using the advantages of new plant construction, we aim to realize a highly economical design for the SRZ-1200 by conducting rational design and planning, factoring in new safety countermeasures and other features from the design stage to reduce construction costs, and increasing the capacity utilization rate through measures such as long-cycle operation and reducing the time for periodic inspections. Moreover, we are also examining the potential for improving flexible operation in response to fluctuation in other power sources, such as renewables, and suitability for production of hydrogen.

MHI has accumulated technologies and experience through the construction and maintenance of 24 PWRs in Japan. We will use these technologies and experience to restart existing plants and achieve safe and stable operations after restart. Throughout this process, we will strive continuously to improve safety, while also promoting the development and implementation of the advanced light water reactor SRZ-1200, which will realize the world's highest level of safety. Through these efforts, we will contribute to the realization of Carbon Neutrality and stable energy supply.

### ▶ Stakeholder Voices



**Mr. Hitoshi Mizuta**  
Vice President, Representative  
Executive Officer  
Kansai Electric Power Company

#### Contributing to zero-carbon society with the advanced light water reactor SRZ-1200

The Kansai Electric Power Group is promoting initiatives to make full use of nuclear power, with safety as the utmost priority, aiming to achieve a zero-carbon society by 2050. We are working to optimize the operation of our existing nuclear power plants, while examining options such as advanced light water reactors for new construction or replacement.

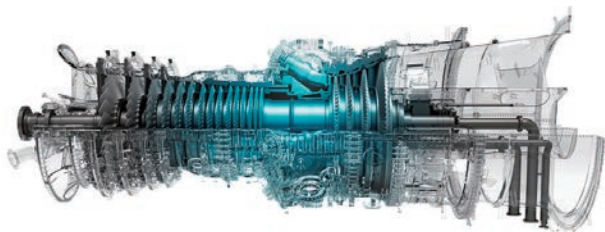
Together with Hokkaido Electric Power, Shikoku Electric Power, Kyushu Electric Power, and MHI, we have been jointly examining a basic design for the Advance Light Water Reactor SRZ-1200, which offers safety and economy improvements over conventional pressurized water reactors. MHI's press release of September 2022 had great significance for disseminating information about the nuclear industry's initiatives towards constructing new plants, and also for the maintenance of technological capabilities, supply chains, and the motivation of young technicians.

MHI has supported us in the restarting of our existing plants and also by providing maintenance work that contributes to their stable and safe operation. With its high level of technological ability and project execution know-how backed by a strong track record in nuclear power plants in Japan, I expect MHI to provide strong leaderships in our joint development of the SRZ-1200.

By working together to develop advanced light water reactor technology, I hope that Kansai Electric Power and MHI can contribute to the stable provision of energy and the realization of a zero-carbon society.

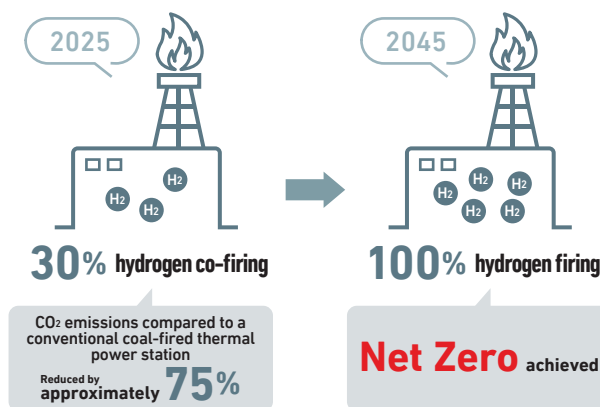
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## A Project for Generating Electricity Only with Green Hydrogen



Hydrogen turbine (illustration)

### CO<sub>2</sub> reduction due to hydrogen power generation



In the State of Utah, United States, we have started work on a project to create a power station that has zero CO<sub>2</sub> emissions. MHI received an order in 2020 for a GTCC power generation project using hydrogen, with a total output capacity of 840 MW, planned by the Intermountain Power Agency (IPA) of Utah. IPA owns the Intermountain Power Plant, which supplies electricity to six states, including fast-growing south California. The major portion of the plant's output is transmitted to California.

In response to California State's approval of a proposed law stating that all electricity in the state must be from non-CO<sub>2</sub>-emitting sources by 2045, IPA announced that it

would cease coal-fired generation by 2025 and switch to natural gas-based generation that is able to use hydrogen fuel. We aim to begin operation of this project with a 30% mix of hydrogen (ratio by volume) by 2025, increasing to 100% hydrogen by 2045. The hydrogen used in this power generation facility is to be carbon-free green hydrogen, created through electrolysis of water using renewable energy such as solar or wind power. MHI Group will continue to contribute to the realization of a hydrogen-based society that is carbon free and enjoys a stable supply of electricity by utilizing the world's most advanced hydrogen combustion technologies.

### Stakeholder Voices



**Mr. Cameron Cowan**  
General Manager  
Intermountain Power Agency

#### Providing highly reliable, low-cost clean electricity using advanced technology

Our mission is to use carbon-free energy to provide a highly reliable supply of electricity at a low price. This project is an opportunity that can provide an ideal model for achieving our mission with our existing local energy infrastructure.

By using MHI Group's gas turbines, with their highly flexible operation, this project has pointed the way for innovation, opening up new pathways as a power source that can adjust the electricity demand and supply gaps arising from the spread of clean, renewable energy.