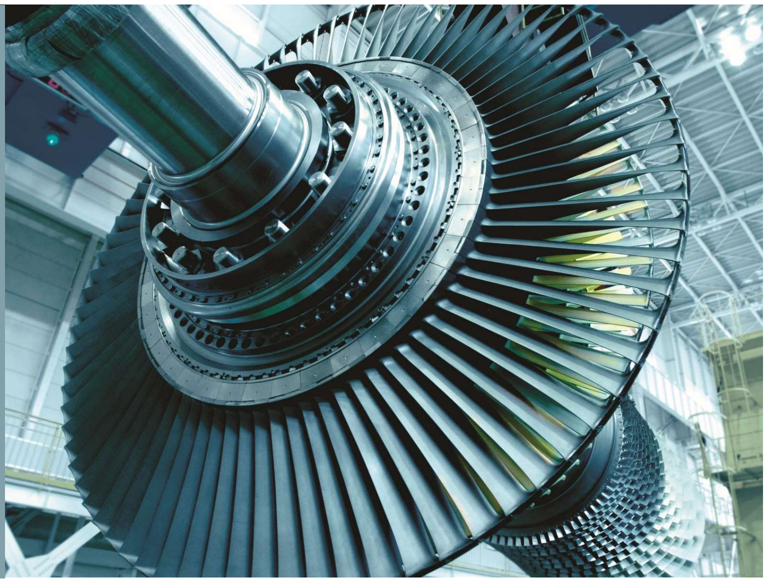
MOVE THE WORLD FORWARD MITSUBISHI HEAVY INDUSTRIES GROUP

Mitsubishi Heavy Industries, Ltd. GTCC Business Briefing



2025/10/7

Mitsubishi Heavy Industries, Ltd.

Good morning. I am Takao Tsukui, Director of the Sales Strategy Department in Energy Systems, and President and CEO of Mitsubishi Power, Ltd.

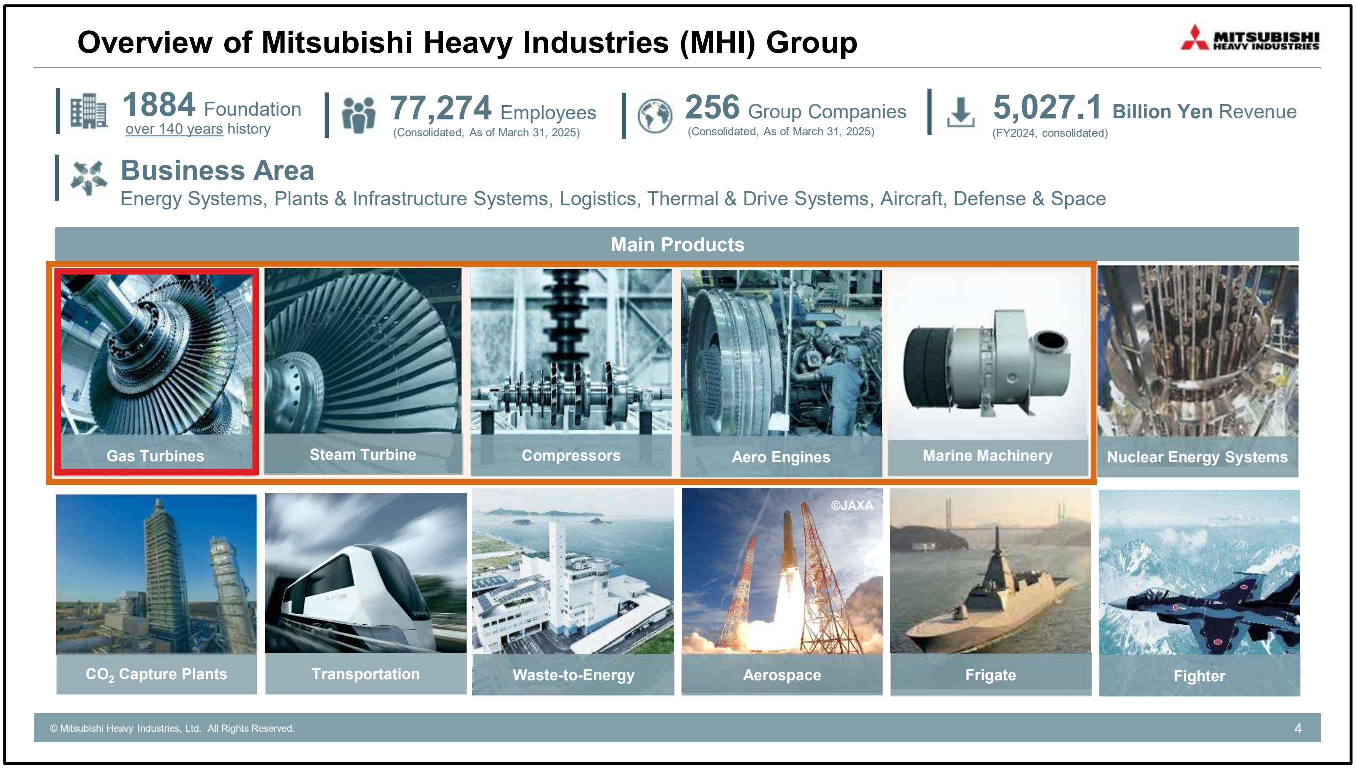
Agenda

1. MHI Gas Turbine Business
2. MHI Gas Turbine Technology
3. MHI Energy Transition Initiatives

Today's presentation will cover the three items shown here

1. MHI Gas Turbine Business

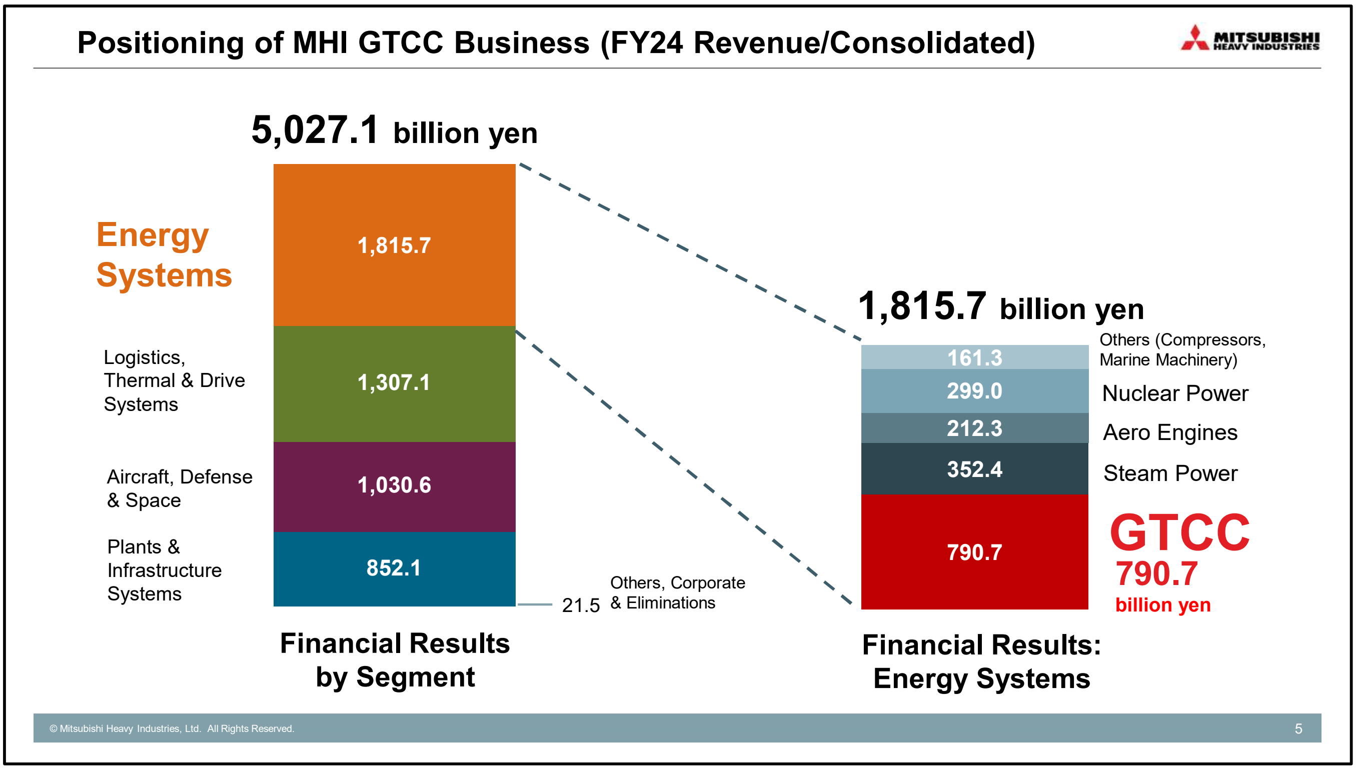
First, I would like to provide an overview of our Gas Turbine Combined Cycle (GTCC) business.



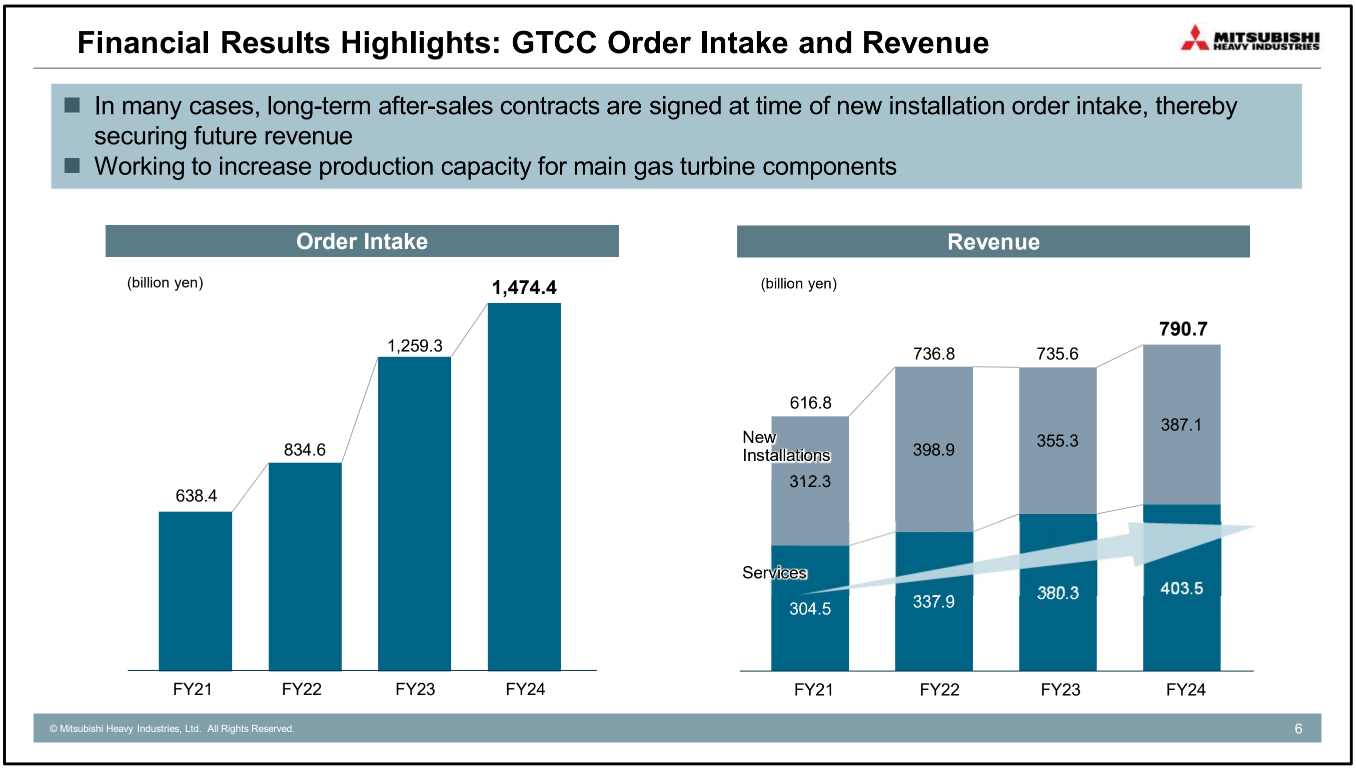
MHI was established in 1884 and currently employs approximately 77,000 people. Consolidated revenue in FY2024 was 5,027.1 billion yen.

The products shown within the orange box represent our main offerings in Energy Systems, including gas turbines, steam turbines, compressors, aero engines, and marine machinery.

Additionally, our company is involved in other business areas such as nuclear power, CO2 capture plants, and transportation systems.



In FY2024, the Group's total revenue amounted to approximately 5 trillion yen, of which around 1.8 trillion yen was generated by the Energy Systems segment. Of that, approximately 800 billion yen came from the GTCC business.



Order intake for GTCC has been growing steadily since FY2021, with orders in FY2024 totaling 1,474.4 billion yen. Revenue has been strong, reaching approximately 800 billion yen in FY2024 compared to around 600 billion yen in FY2021.

It should be noted that order intake includes long-term maintenance contracts, which can reach up to 20 to 25 years in duration. This can result in a significant gap between order intake and revenue, as observed in FY2024. However, these long-term service contracts are the source of future revenue, which will be recognized over the long term.

Regarding the breakdown of revenues, both new installations and services each account for approximately 50% of total revenue. Currently, the proportion of services within total revenue is slightly higher, but given the strong order intake for new installations, we expect revenue from original equipment to increase going forward. We believe maintaining a balanced relationship between new installations revenue and service revenue is extremely important.

Gas Turbine Contract Backlog

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Large Frame Gas Turbine Order Intake and Contract Backlog (units)

	FY2023	FY2024	Q1 FY24	Q1 FY25
Americas	7	11	4	6
Asia	9	5	2	2
EMEA	-	9	-	-
Other Regions	1	-	-	-
Order Intake Total	17	25	6	8
Contract Backlog	36	48	38	53

(Reference) China Licensee Order Intake

	FY2023	FY2024	Q1 FY24	Q1 FY25
Order Intake	21	7	-	3

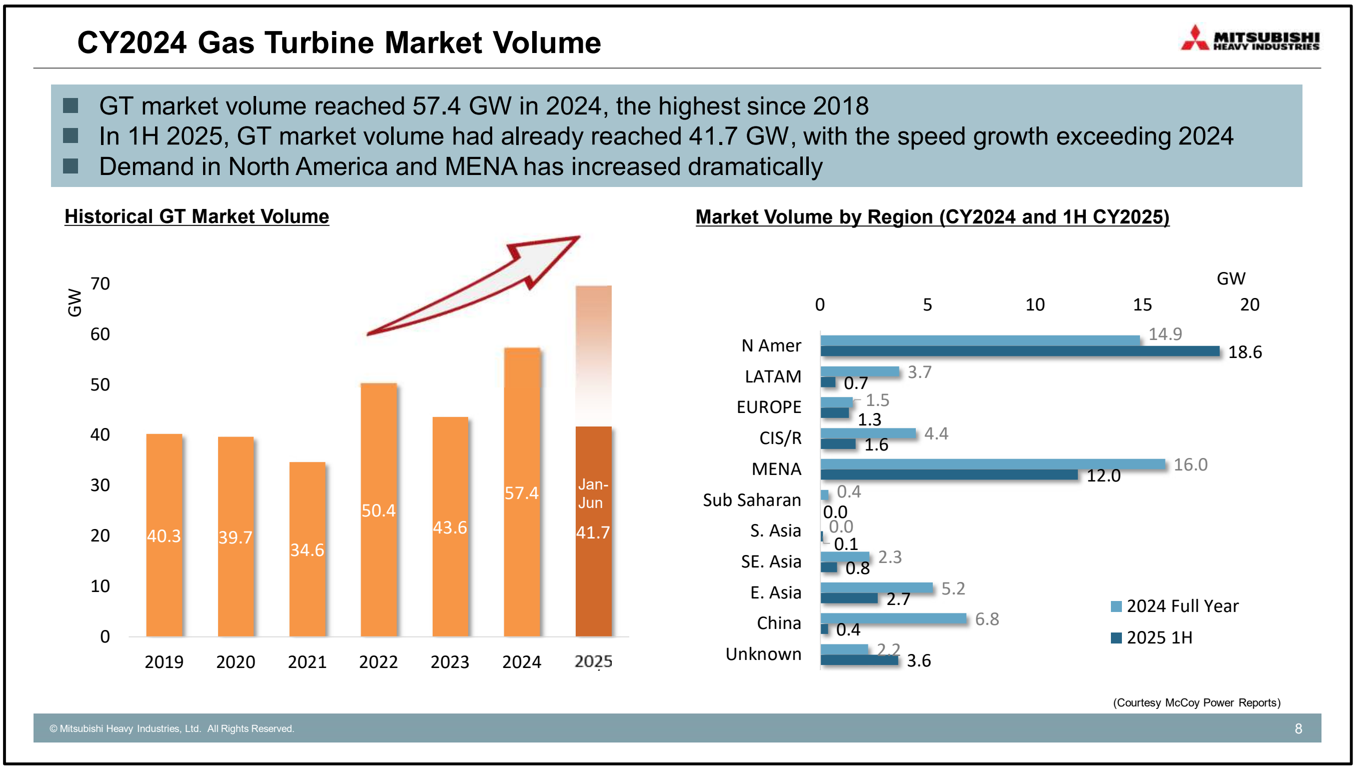
Next, I will explain the order backlog for gas turbines.

Demand has been very strong recently, with orders for 25 units booked in FY2024. This page shows a breakdown of order intake by region, and we believe it is important to maintain a certain amount of balance between the Americas and other regions.

The contract backlog increased from 36 units at the end of FY2023 to 48 units at the end of FY2024.

In Q1 FY2025, we booked orders for six units in the Americas and two units in Asia, totaling eight units.

While there was very strong demand in China during FY2022 and FY2023, demand has recently settled down, with our China licensee booking orders for seven units in FY2024 and three units in Q1 FY2025.



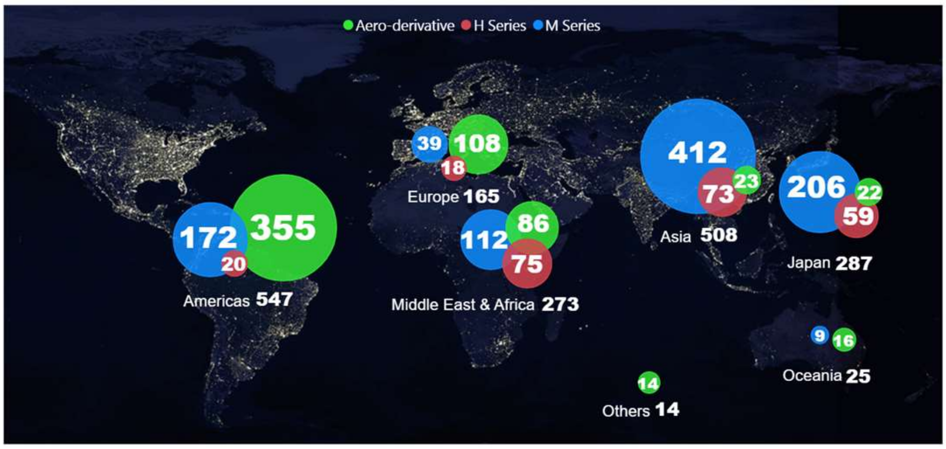
Next, I will explain the size of the gas turbine market.

According to McCoy Power Reports, the annual order volume for gas turbines was approximately 40 GW in both CY2019 and CY2020, increasing to 57.4 GW in CY2024. In CY2025, orders totaling 41.7 GW were booked in the first half of the year (January to June), and the annual order volume is expected to reach around 70 GW.

In graph on the right, the light blue bars represent order volume in CY2024, while the dark blue bars indicate order volume for the first half of CY2025. For instance, in North America, order volume in the first half of this year was 18.6 GW, surpassing last year's total of 14.9 GW. In the Middle East and North Africa, another significant market, order volume was 16 GW last year, and it has already reached 12 GW in the first half of this year.

Demand is also emerging in East Asia and Southeast Asia, but currently, North America and the Middle East are the primary drivers of market growth.

MHI's Gas Turbine Orders



Model	Units
H-100	33
H-15	6
H-25	206
Total	**245**

Model	Units
M501D	26
M701D	109
Total	**135**

Model	Units
M501F	80
M701F	257
Total	**337**

Model	Units
M501G	91
M701G	11
Total	**102**

Model	Units
M501J	114
M701J	58
Total	**172**

Model	Units
FT4000	14
FT8	610
Total	**624**

Grand Total

1,819 Units

Including GT manufactured by licensee and awarded PJ

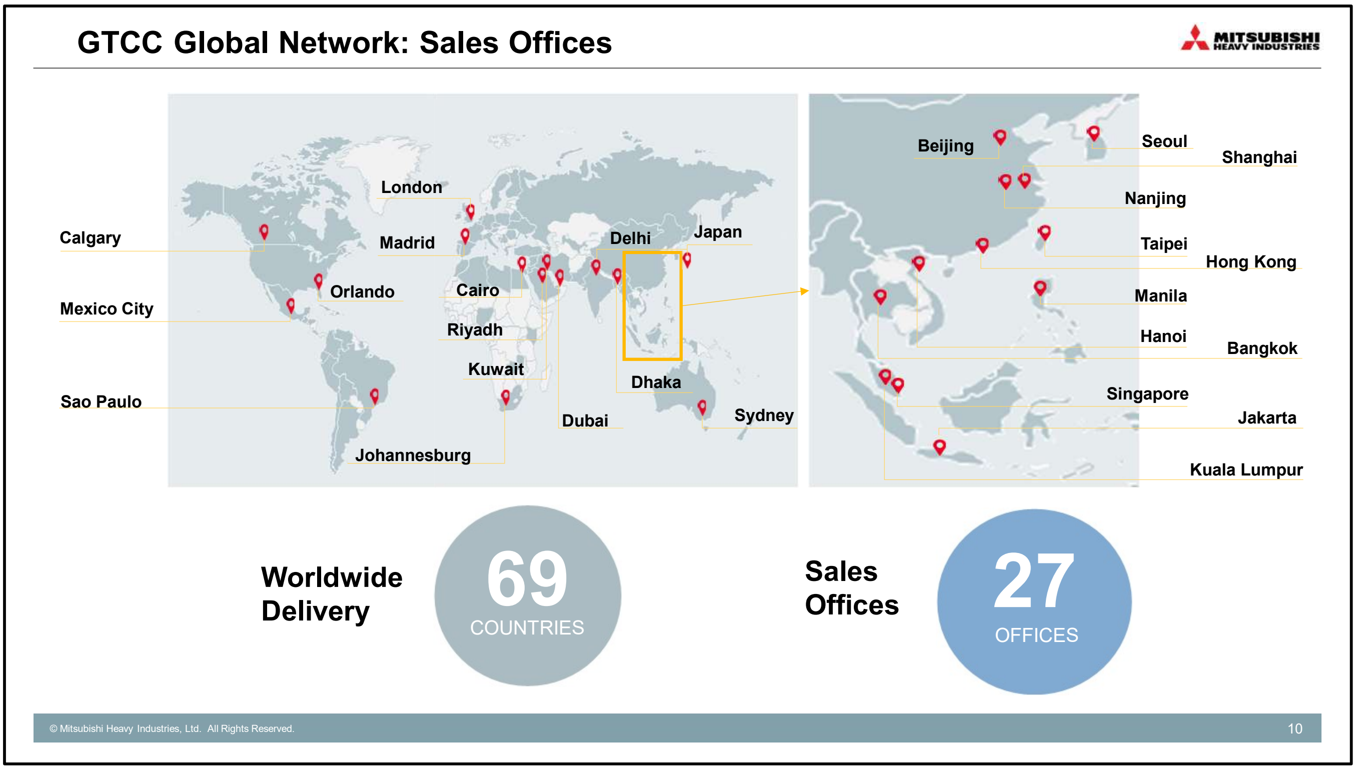
In addition, 204 units of M series Mid&Small Class GTs.

As of August 31, 2025

This map shows the number of gas turbine orders our company has booked by region.

Blue circles represent large frame gas turbines, red circles indicate mid- and small-size gas turbines, and green circles correspond to aero-derivative gas turbines.

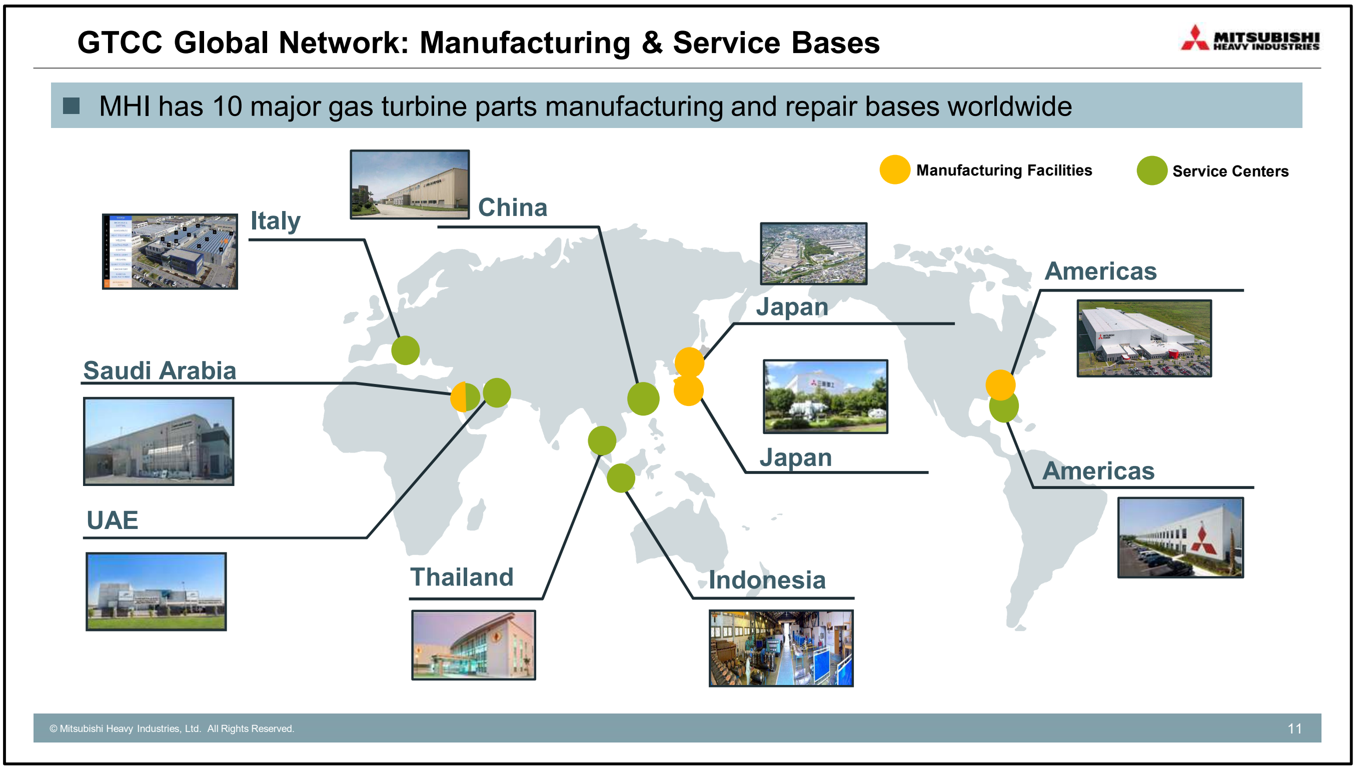
We believe it is important to supply gas turbines in a balanced manner, with particular focus on the United States, the Middle East, and Asia.



Our sales offices are primarily focused on these three regions: North America, the Middle East, and Asia.

Our key bases are located in Orlando (North America), Dubai (Middle East), and Singapore (Asia), with additional sales offices in neighboring countries.

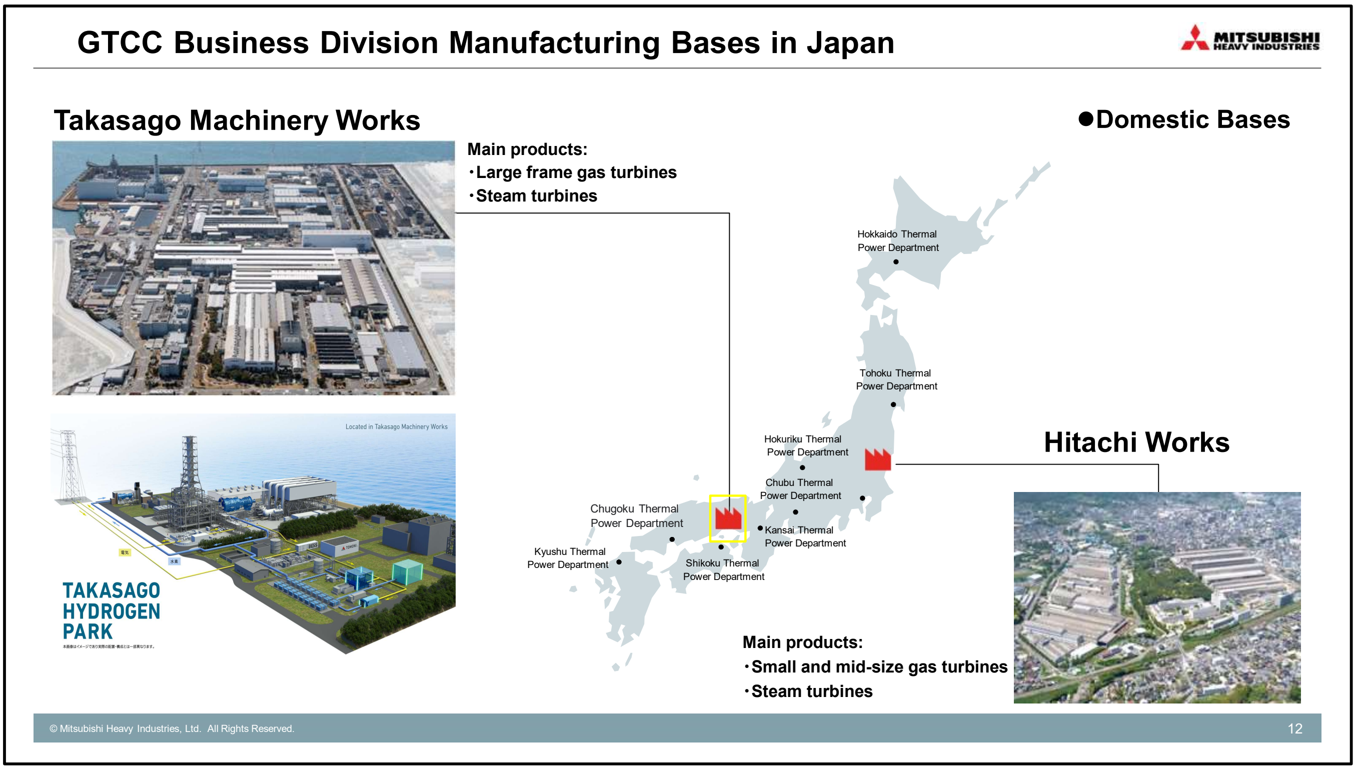
In Asia, there is strong demand for gas turbines in South Korea, Taiwan, as well as Southeast Asia, where various contract negotiations are currently underway.



Our manufacturing facilities are primarily based in Japan, with plants located in Takasago (Hyogo Prefecture) and Hitachi (Ibaraki Prefecture).

In addition to our plant in Savannah, Georgia in the United States, we are planning to hold an opening ceremony this week for our final assembly plant in Dammam, Saudi Arabia.

The green circles on the map indicate our service bases. Since gas turbine maintenance is critically important, we have established service bases across Asia, Europe, the Middle East, and North America.



In Japan, Takasago Machinery Works serves as our main plant, while the Hitachi Works primarily handles the manufacturing and servicing of mid- and small-size turbines.

This concludes my part of the presentation.

2. MHI Gas Turbine Technology

My name is Masanori Yuri, and I serve as Senior General Manager of the GTCC Business Division, as well as Head of Takasago Machinery Works.

Continuing the briefing, I will speak about our GTCC technology.

How Gas Turbines and GTCC Power Plants Work

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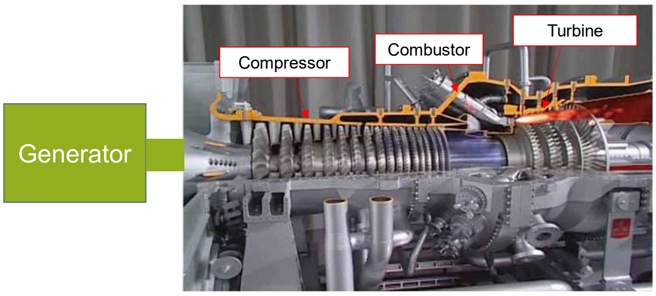
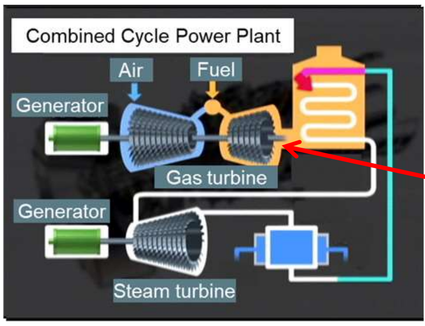
■ Combined cycle efficiency can be improved by increasing gas turbine inlet temperature

Gas Turbine Layout



- Main components are compressor, combustor, and turbine.
- High pressure, high temperature gas from combustion of fuel gas expands and produces power by rotating the turbine

Combined Cycle Power Plant Layout



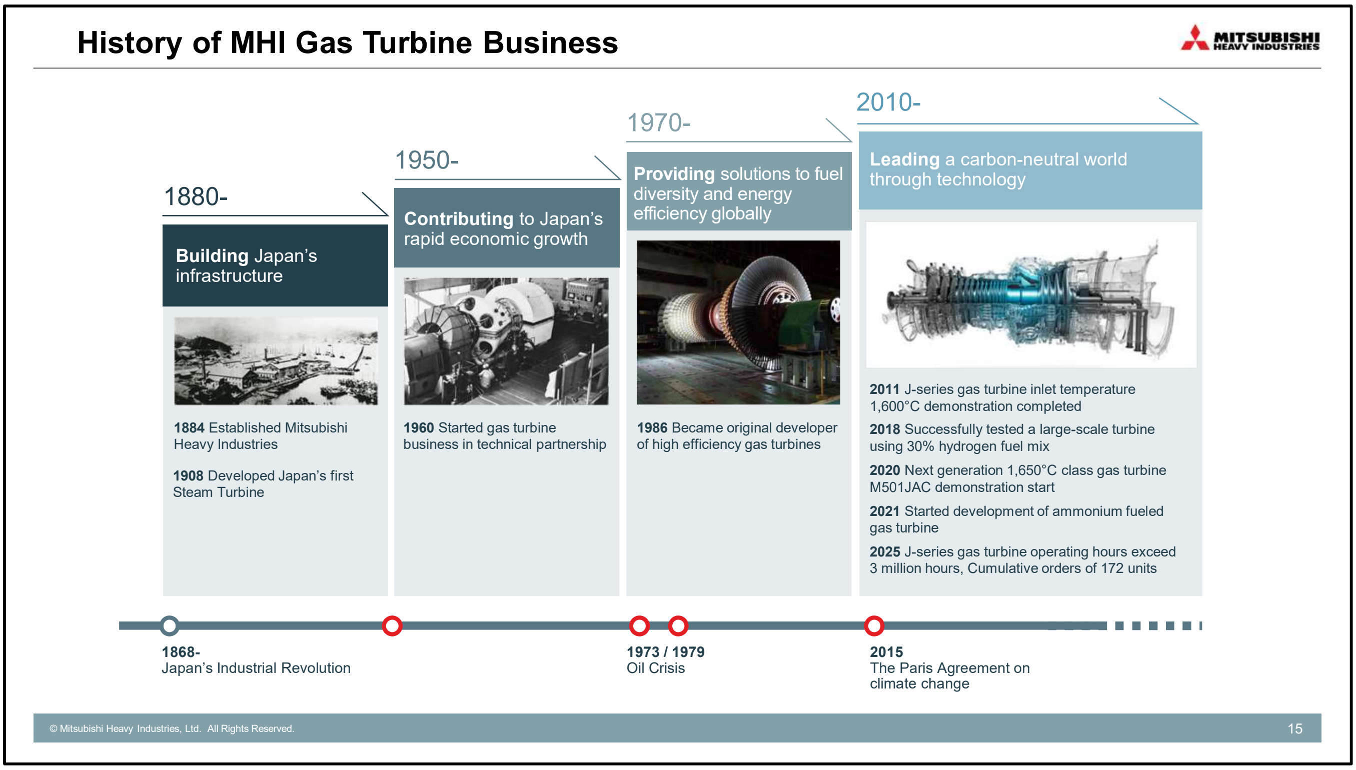
GT exhaust approx. 600°C

- After generating electricity with the gas turbine, gas turbine exhaust heat is utilized to generate additional electricity with a steam turbine
- Combined cycle (gas turbine + steam turbine) achieves the highest thermal efficiency

First, I will explain how gas turbines and GTCCs operate.
The principle of a gas turbine is similar to that of a jet engine used in aircraft, although it is larger in scale. As illustrated on the left, a gas turbine consists of three main components: a compressor, a combustor, and a turbine. It generates electricity by combusting intake air and fuel within the combustor, then expanding the resulting high-temperature, high-pressure gas to turn a rotor, which in turn drives a generator.

In a combined cycle system, as shown on the right, exhaust gas from the gas turbine is directed into a boiler to produce steam, which then drives a steam turbine to generate additional electricity.

A combined cycle system integrates these two processes. By feeding fuel into the gas turbine, power is generated from both the gas turbine and the steam turbine, making GTCC power generation highly efficient.



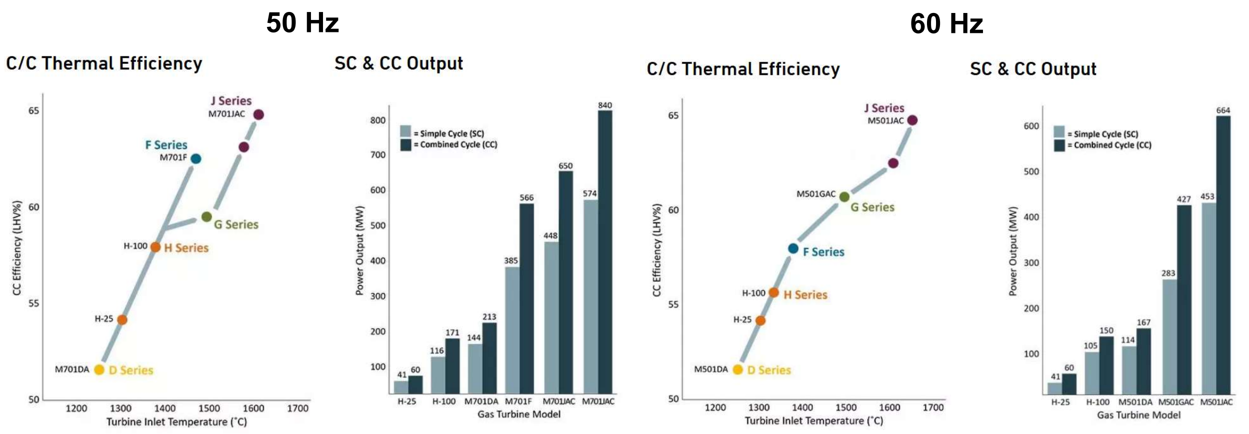
Next, I will explain the history of MHI's gas turbine business.

MHI began our gas turbine business in 1960 through a technical partnership. Subsequently, the two oil shocks in the 1970s accelerated our efforts to develop high-efficiency gas turbines in-house.

The efficiency of a gas turbine increases with higher turbine inlet temperatures. As such, we have been working for over 60 years to raise turbine inlet temperatures to improve gas turbine efficiency.
In 2011, we developed the J-Series gas turbine with a turbine inlet temperature of 1600ºC. In 2020, we launched the latest model, the JAC-Series. Recently, the market has been very active, and the large frame JAC-Series gas turbine has become our best-selling product.

MHI Gas Turbine Technology

■ MHI offers a wide range of Gas Turbines – from small frame to large frame.



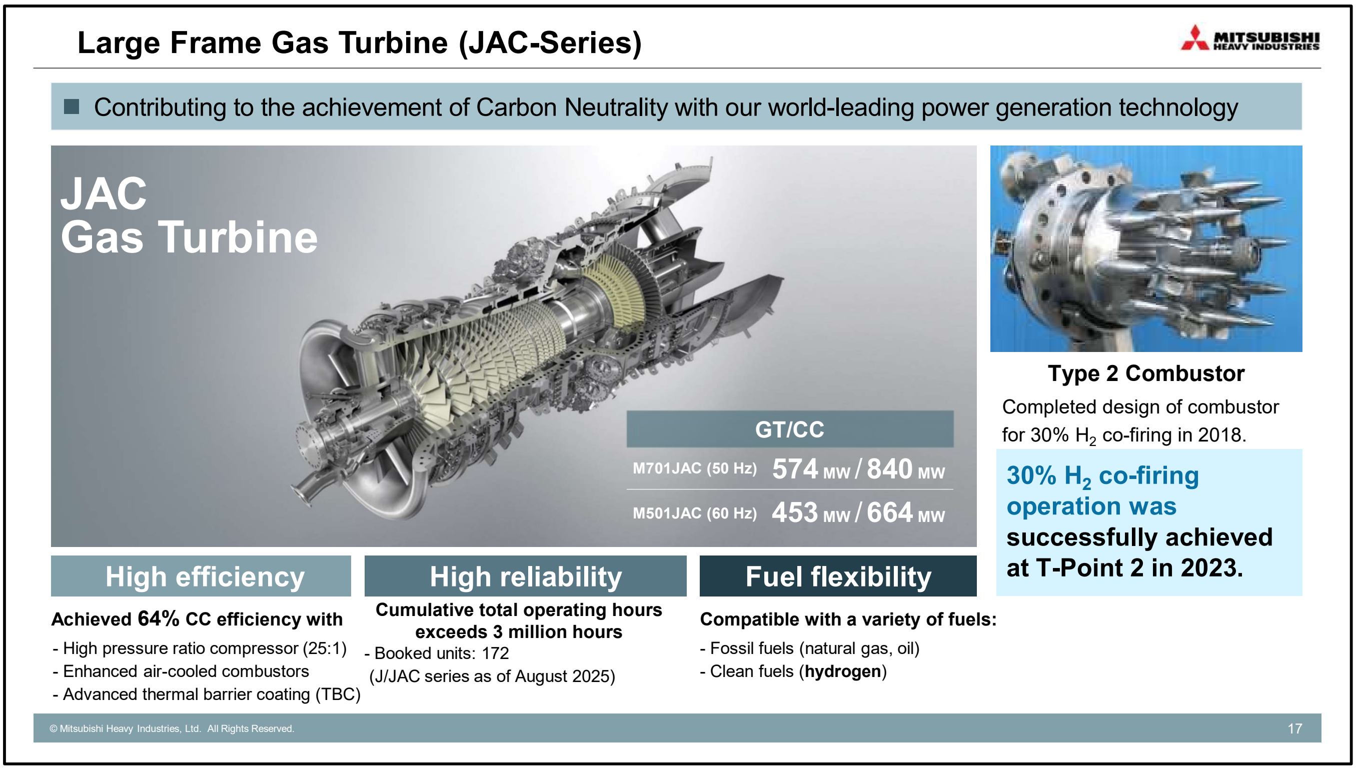
M701JAC GTCC Output: 840MW (50 Hz), equivalent to 2 million households' worth of electricity, which covers Yokohama City (1.8 million households).

Some regions use 50 Hz electricity while others use 60 Hz, and our company offers a product lineup tailored to each region.

For example, even within the 50 Hz region, there are diverse customers and applications, so we provide a wide range of gas turbine outputs, from 40 MW up to 570 MW at the largest scale.

The 701JAC, our largest 50 Hz gas turbine, achieves a combined cycle output of 840 MW from one gas turbine and one steam turbine. A single combined cycle unit of this size can supply electricity to approximately 2 million households, roughly equivalent to the number of households in Yokohama, Japan.

In terms of efficiency, the latest JAC-Series has achieved a thermal efficiency of 64%.



The photo shows a top-down view of our state-of-the-art JAC-Series gas turbine. We have achieved an output of 840 MW in 50 Hz and 664 MW in 60 Hz.

The first key feature of our gas turbines is their high efficiency. As I mentioned earlier, in combined cycle operation, we have attained an efficiency of 64% with a turbine inlet temperature in the 1650ºC range.
The second feature is high reliability. One of our major strengths, which I will explain more later, is that we ensure high reliability by delivering gas turbines to customers only after thorough verification at our demonstration power plan within Takasago Machinery Works. Including the J-Series and the JAC-Series, we have booked orders for 172 units and operated them for over 3 million hours, demonstrating a solid track record.

Additionally, our gas turbines are fuel-flexible. Other than gas and oil, our gas turbines can also combust a mixture of hydrogen and natural gas. In fact, 30% hydrogen co-firing was successfully verified at our demonstration facility at Takasago Machinery Works two years ago. Our gas turbines are fully hydrogen-ready.

Small Frame Gas Turbine (H-25-Series)

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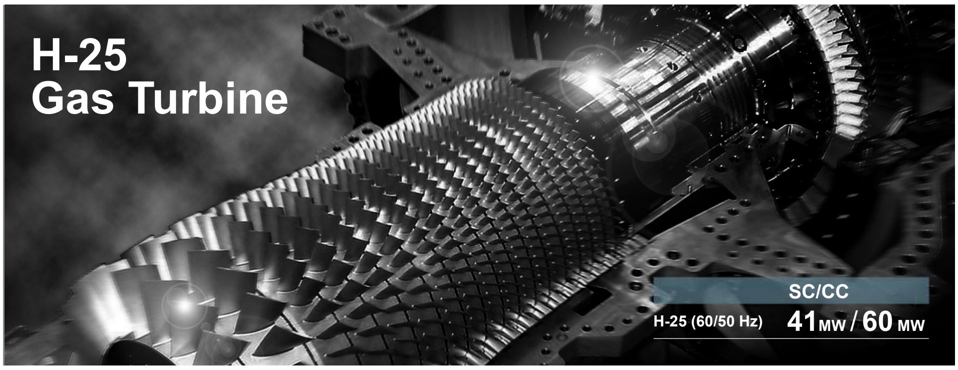
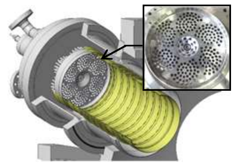
- 30-40 MW gas turbine optimized for cogeneration* systems. Extensive track record of over 30 years.
- Developing combustors for use with hydrogen and ammonia





Type 3 Combustor

Demonstration of 100% H_2 firing began at Takasago Machinery Works in 2024

High Efficiency

More than 80% Total Cogeneration Efficiency

- Simple cycle 36.2%
- Combined cycle 54.0%
- Cogeneration Over 80.0%
  79 ton/h (heat output)

High Reliability

Cumulative total operating hours exceeds 12.5 million hours

- Booked units: 206
  (H-25 as of August 2025)

Fuel Flexibility

Compatible with a variety of fuels:

- Fossil fuels (natural gas, oil)
- Clean fuels (**hydrogen**)

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*Cogeneration: Concurrent production of electricity or mechanical power and useful thermal energy

This photo shows the H-25, a slightly smaller, 40-MW-class gas turbine.

Primarily manufactured at Hitachi Works, we have booked orders for a total of 206 units, and the H-25 has operated for over 12.5 million hours.

The H-25 is often used for co-generation at manufacturing facilities, which involves the simultaneous production of electricity and steam.

For this type of turbine as well, we are currently developing and testing a combustor for the combustion of 100% hydrogen at Takasago Hydrogen Park.

Commercial-Scale Power Plant for Long Term Validation: T-Point 2

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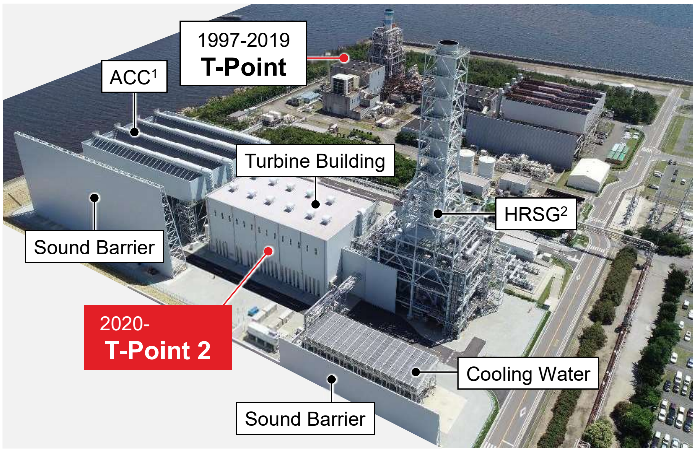

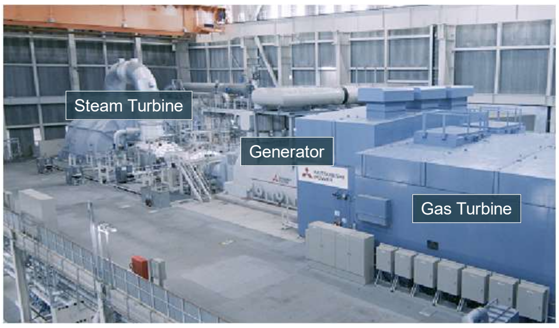

- Since 1997, all new gas turbine models have been validated in our on-site, commercial-scale power plant
- In 2020, renovations were completed, allowing for the validation of more advanced gas turbine technologies with larger capacities

	T-Point	T-Point 2
Output (@5°C)	389MW	566MW
GT Type	M501J	M501JAC
Began Operation	June 1997	July 2020
Turbine Inlet Temp.	1,600°C	1,650°C
Combustor Cooling Method	Steam Cooled	Air Cooled
CC Efficiency[3]	62% LHV[4]	>64% LHV

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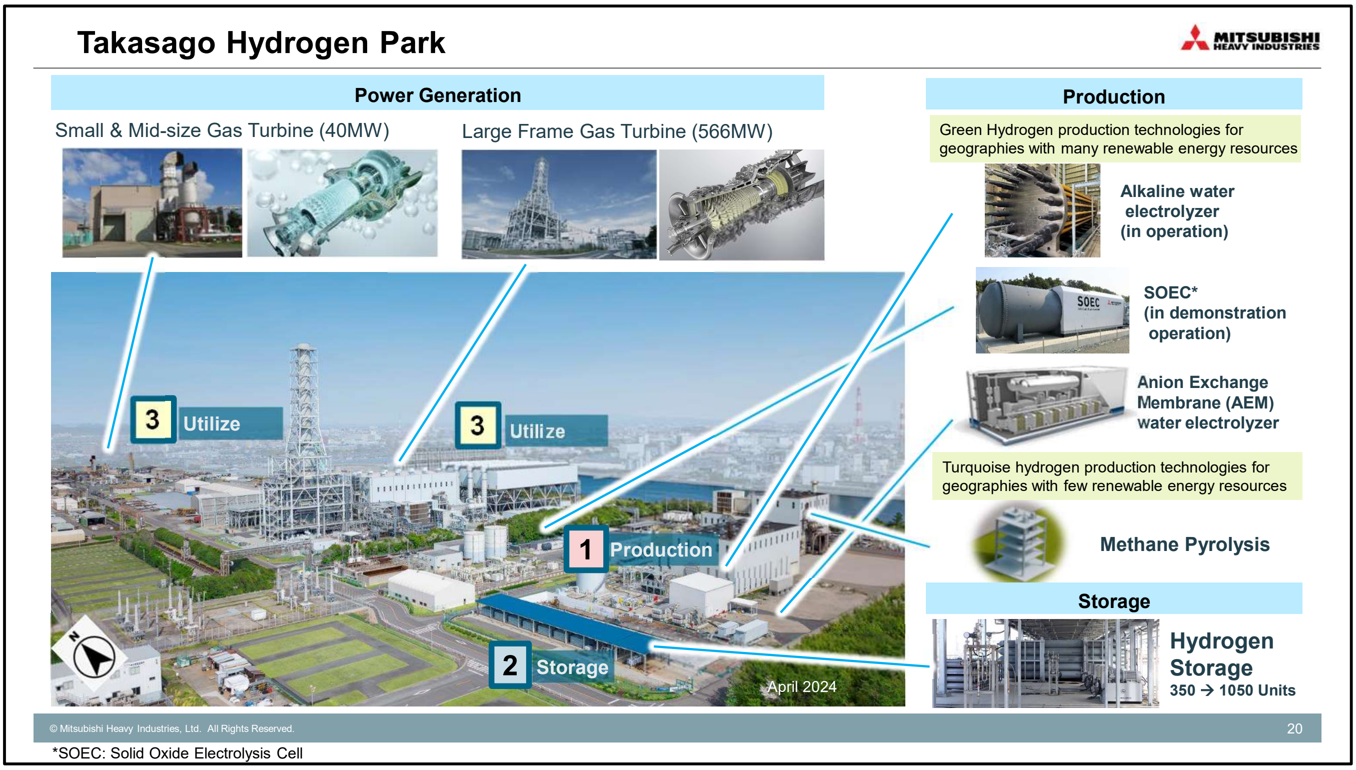
1 ACC: Air-Cooled Condenser 2 HRSG: Heat Recovery Steam Generator

3 CC efficiency: M501J/JAC ISO, 1 GT + 1 ST, gas fuel 4 LHV: Low Heating Value

This photo shows the demonstration power plant at Takasago Machinery Works.

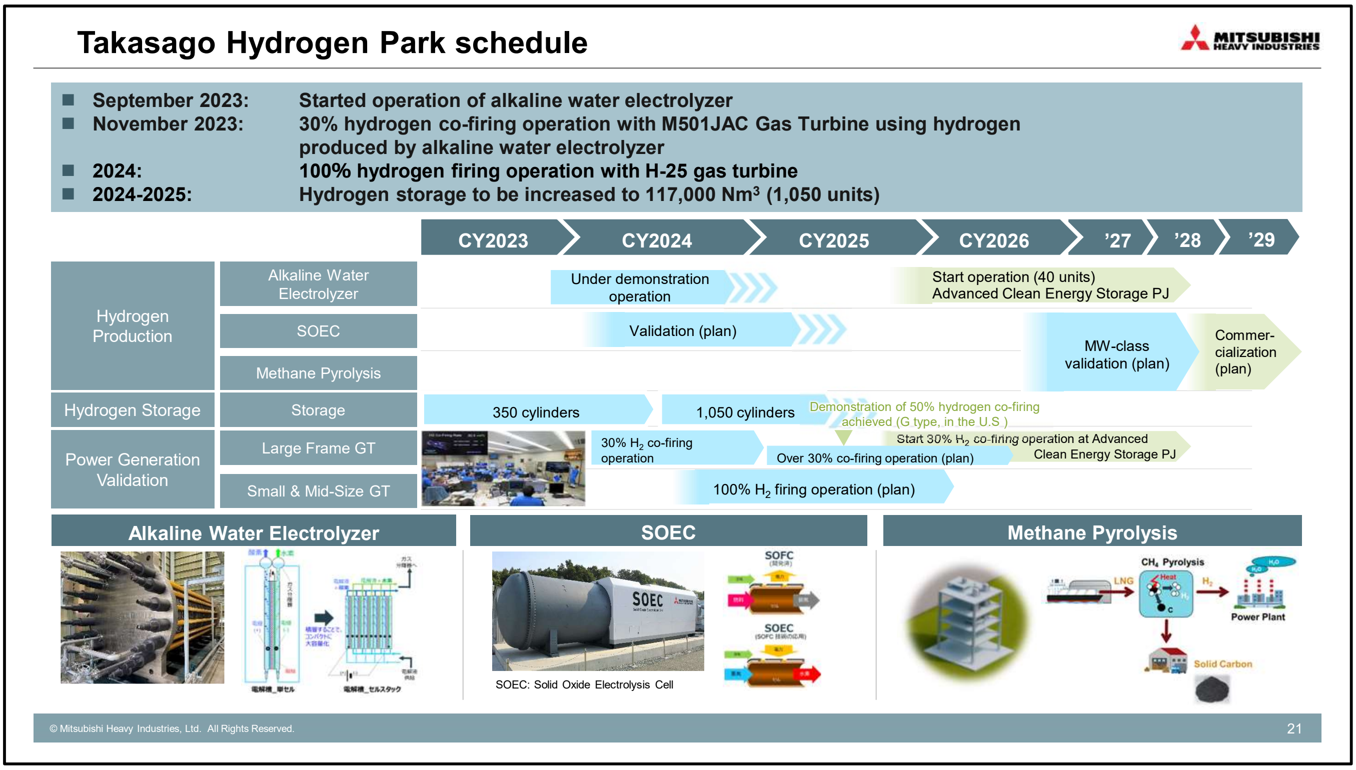
The facility in the foreground is T-Point 2, which has been in operation. The facility in the background is the original T-Point, which was built in 1997 when we developed the G-Series gas turbine.
When we developed the state-of-the-art JAC-Series gas turbine in 2020, we built T-Point 2.
As you can see in the table on the right side of the page, T-Point 2 is a single-shaft combined cycle plant featuring an advanced JAC-Series gas turbine, with an output of 566 MW and an efficiency exceeding 64%.

Our gas turbine development policy is to deliver new technologies to customers only after they have been reliably validated, and we have adhered to this approach since 1997. The ability to conduct long-term validation in a commercial-scale power plant is a significant advantage, and high reliability remains one of our core strengths.



Around two years ago, we established Takasago Hydrogen Park adjacent to our demonstration power plant, commencing validation operation of a hydrogen-fired gas turbine as part of our decarbonization initiatives.

Takasago Hydrogen Park is not only used to validate hydrogen-fired gas turbines but also serves as a comprehensive testing ground for validation of the entire hydrogen supply chain – including hydrogen production, storage, and power generation using hydrogen.



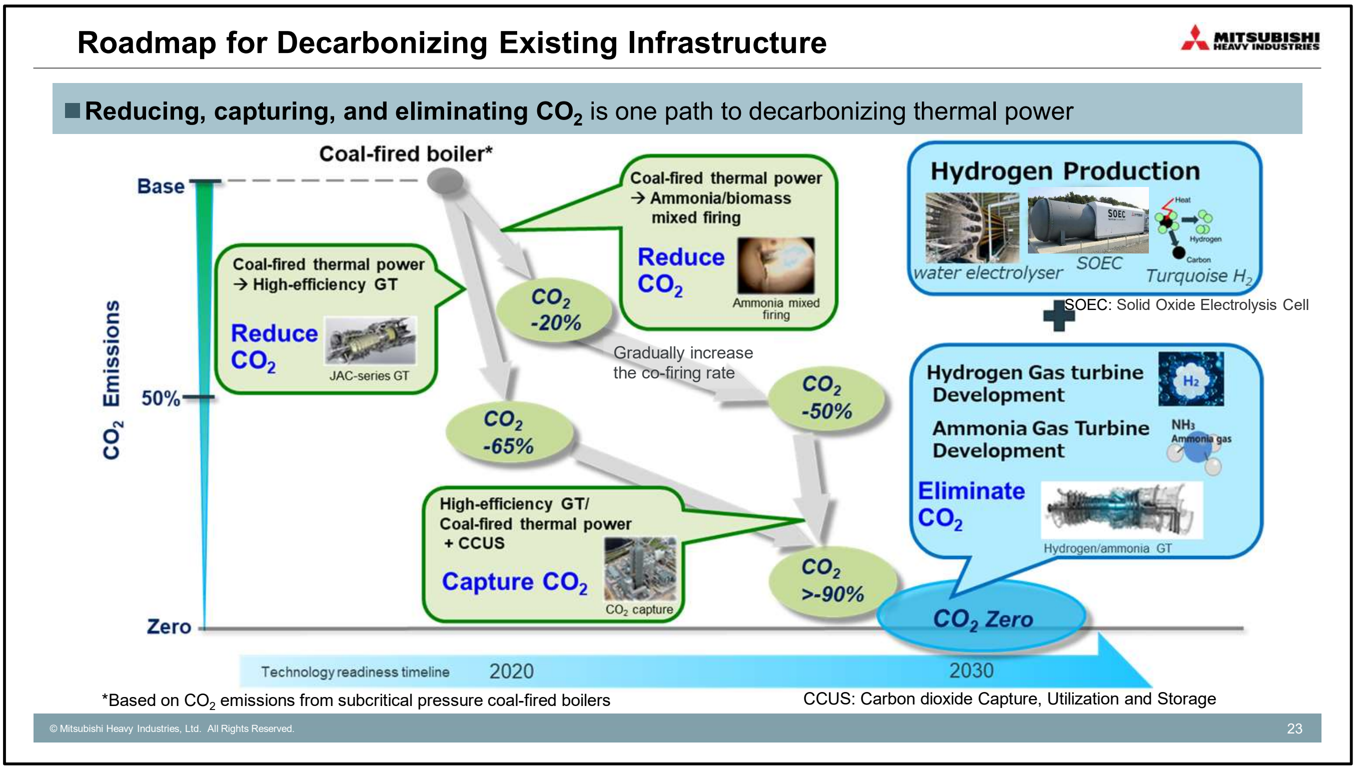
This chart shows our validation schedule at Takasago Hydrogen Park.

Hydrogen co-firing tests using large frame gas turbines have already been conducted up to 30%, and we are currently working to increase this range from 30% to 50%. For mid- and small-size turbines, we have been validating 100% hydrogen firing.

Additionally, we are developing and validating hydrogen production technologies, including alkaline water electrolysis, solid oxide electrolysis cells (SOEC) – which produce hydrogen from steam – and methane pyrolysis.

3. MHI Energy Transition Initiatives

I will now introduce our Energy Transition-related initiatives.



This page outlines the roadmap for the decarbonization of thermal power. The vertical axis represents CO2 emissions, starting from a subcritical coal-fired boiler with about 40% efficiency.

There are three main ways to cut CO2: reducing emissions, capturing emissions, and eliminating emissions altogether. One approach, shown on the lower side of the graph, is replacing coal-fired boilers with high-efficiency GTCC systems, which can cut CO2 emissions by 65%. By adding carbon capture and storage technologies, we can reduce emissions by over 90%.

We are also developing low-carbon technology that involves co-firing ammonia with coal in boilers, and work is currently underway in Nagasaki.

Finally, in order to completely eliminate CO2 emissions, we are developing technologies to convert from natural gas combustion to the combustion of carbon-free fuels like ammonia and hydrogen.

Conversion to Hydrogen/Ammonia Gas Turbine

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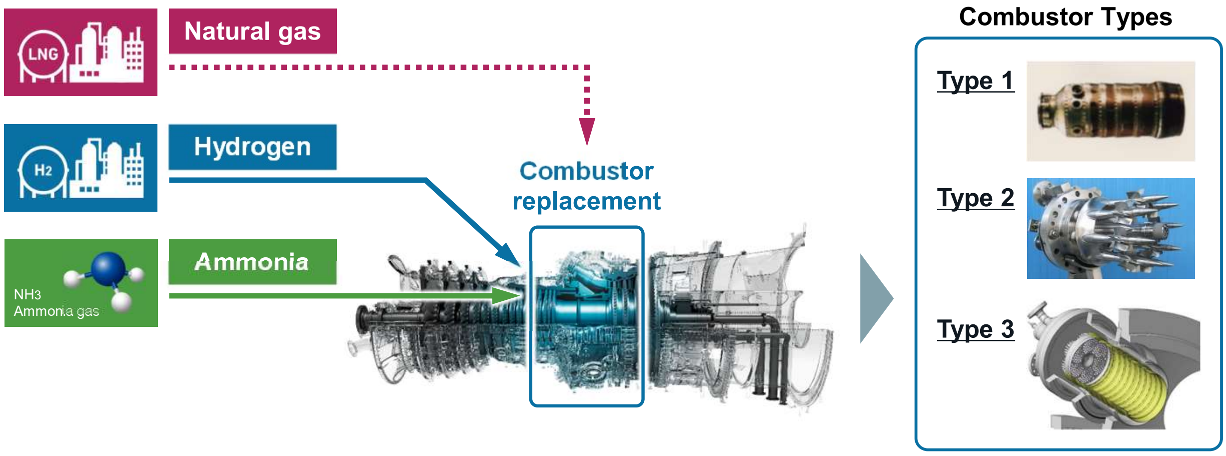
- Fuel conversion from natural gas to hydrogen/ammonia is easily achieved by replacing combustors and adding fuel systems



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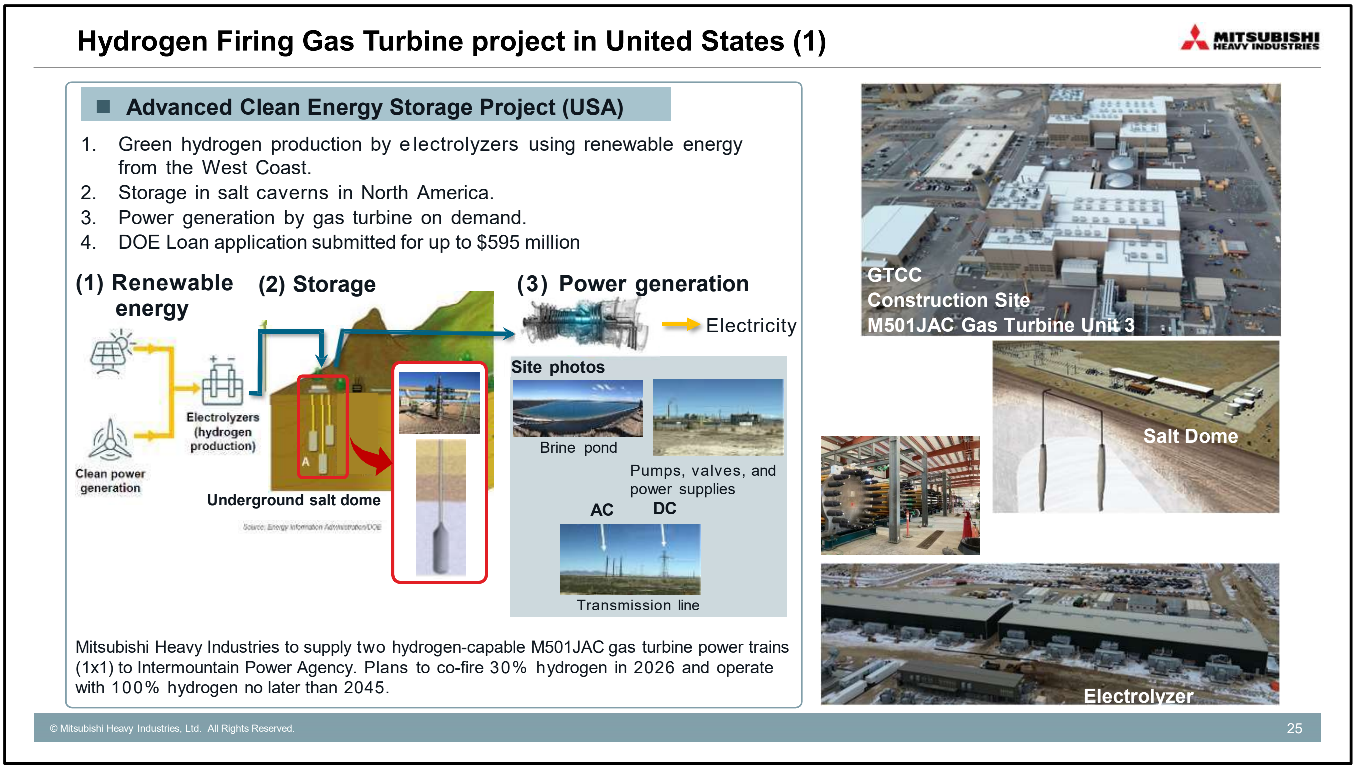
*This presentation is based on results obtained from a project commissioned by the Japan New Energy and Industrial Technology Development Organization (NEDO)

This page explains the process of converting a gas turbine to fire hydrogen or ammonia.

For example, when converting a gas turbine from natural gas firing to hydrogen firing, it is not necessary to replace the entire gas turbine. A key feature of hydrogen-fired gas turbines is that conversion can be achieved by replacing only the combustor components responsible for fuel mixing and the fuel supply system, thereby limiting the extent of modifications and reducing investment costs.

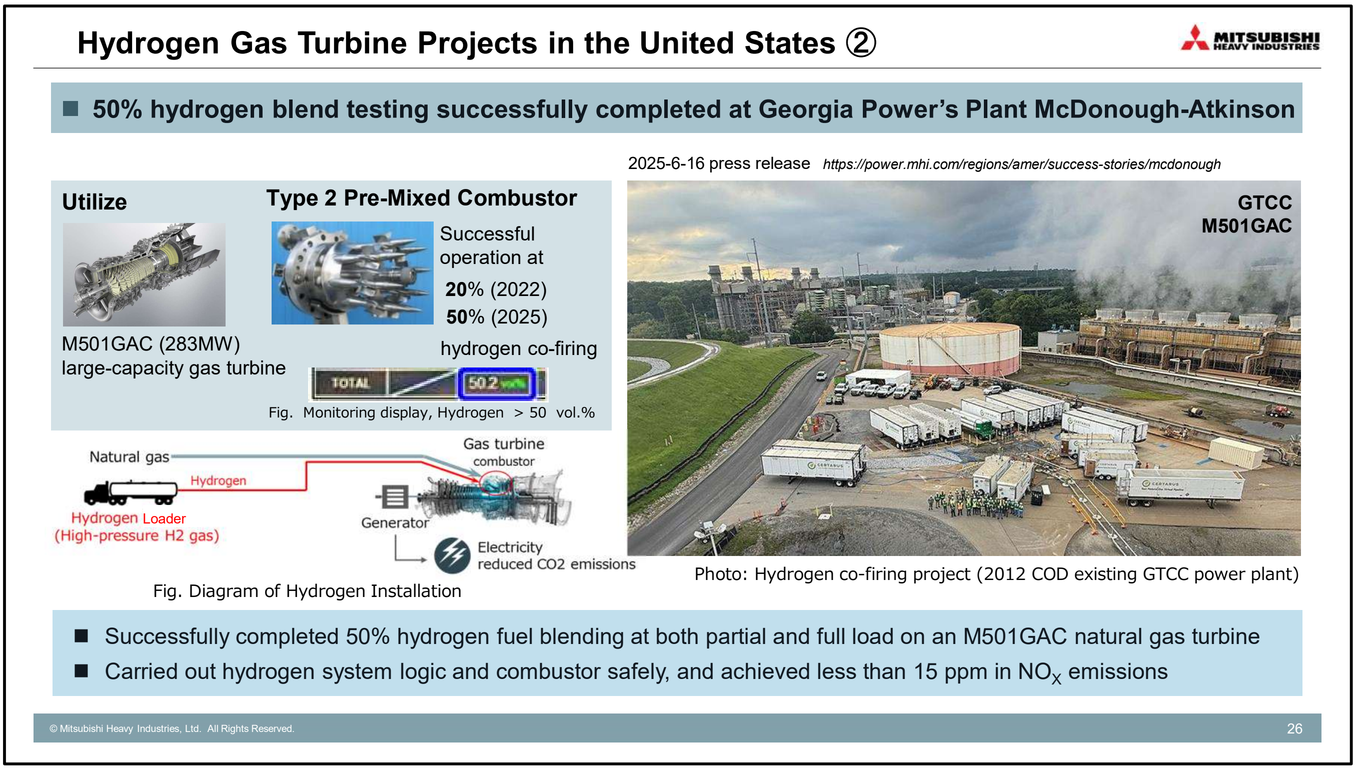
Our company has three types of hydrogen-fired combustors, some of which are currently under development.



Now, I would like to introduce two actual projects related to hydrogen-fired gas turbines.

The first project is the Advanced Clean Energy Storage Project located in Utah in the U.S. This is a GTCC plant utilizing two gas turbines, which is currently under construction and trial operation. The plant has a capacity of 840 MW and uses surplus renewable energy from the West Coast of the United States. Hydrogen produced by water electrolysis is stored in an underground salt dome and supplied to the gas turbines as needed for power generation.

The plan is to begin with 30% hydrogen co-firing and gradually increase the ratio of hydrogen, with the final goal of achieving 100% hydrogen firing by 2045. MHI has already delivered the two gas turbines, and a hydrogen production system comprising 40 alkaline water electrolyzers, each rated at 5 MW, is also undergoing trial operation. This project represents a real-world example of a hydrogen-fired gas turbine power plant using GTCC technology.



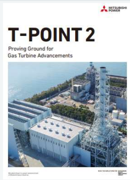
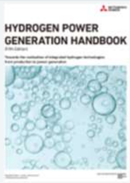
The second project involves validation of hydrogen co-firing in the gas turbine at an existing power plant.

We conducted co-firing tests on a GAC-Series gas turbine that has been in operation since 2012 at Plant McDonough-Atkinson, owned by Georgia Power, a U.S. electric utility. In 2022, we validated 20% hydrogen co-firing, and in June of this year, we successfully generated electricity at 50% co-firing.

During the validation, hydrogen was transported by tanker truck and mixed into the natural gas supply line to achieve 50% hydrogen co-firing. During this test, we confirmed that extremely stable co-firing is achievable.

Both of these projects exemplify our ongoing technological advancements to ensure that our gas turbines can be effectively utilized in a future, hydrogen-powered world.

Reference Materials

Materials		URL (QR code)	URL	Materials		URL (QR code)	URL
TAKASAGO MACHINERY WORKS			https://www.mhi.com/company/location/takasagow/catalogue.pdf	Carbon Neutrality Handbook			https://www.mhi.com/company/overview/carbon-neutral/pdf/cn_handbook_2022.pdf
T-POINT 2 (Proving Ground for Gas Turbine Advancements)			https://power.mhi.com/catalogue/pdf/t-point2.pdf	HYDROGEN POWER GENERATION HANDBOOK			https://power.mhi.com/catalogue/pdf/hydrogen_en.pdf
GTCC (Gas Turbine Combined Cycle Power Plants)			https://power.mhi.com/catalogue/pdf/gtcc.pdf				

Finally, I would like to share the URLs for related, publicly-available materials.
This concludes my presentation. Thank you for your attention.

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