August 30, 2024

Mitsubishi Heavy Industries, Ltd. 40th Series Unsecured Bond (1st Mitsubishi Heavy Industries Transition Bond) Reporting (FY2023)

Introduction

Mitsubishi Heavy Industries (MHI) Group has developed “Mitsubishi Heavy Industries, Ltd. Green/Transition Finance Framework”*1 with the aim of further promoting the initiatives*2 set forth in its 2040 Carbon Neutrality Declaration and Roadmap to Achieve Carbon Neutrality. We are working on "Decarbonize existing infrastructure," "Build a hydrogen solutions ecosystem," and "Build a CO_2 solutions ecosystem," which are Eligible businesses and/or projects of Transition Projects defined in the framework.

*1：https://www.mhi.com/finance/stock/esg/transitionbond/pdf/fw.pdf

*2：https://www.mhi.com/company/aboutmhi/carbon-neutral

The proceeds from Mitsubishi Heavy Industries, Ltd. 40th Series Unsecured Bond (1st Mitsubishi Heavy Industries Transition Bond) issued on September 8, 2022 have been allocated to new investments and refinancing of existing investments in Hydrogen gas turbine (co-firing) classified as “Decarbonize existing infrastructure” and Hydrogen production (blue or turquoise, etc.) classified as “Build a hydrogen solutions ecosystem,” which are Eligible businesses and/or projects of Transition Projects. Both projects are proceeding in terms of the allocation and the development and demonstration of technologies.

MHI group's energy transition initiatives to achieve a Carbon Neutral society are progressing as planned. We will continue our efforts to achieve Net Zero by 2040 and realize a Carbon Neutral society.

1. Allocation Reporting (As of March 31, 2024)

The net proceeds from the ¥10 billion raised by 1st Mitsubishi Heavy Industries Transition Bond, excluding issuance costs, have been fully allocated as shown in the table below, and there is no unallocated balance.

(Unit: million Yen)

Section			Amount
Proceeds raised (Amount Excluding Issuance Costs from the Issue Amount of the Bonds)			9,952
Proceeds used			9,952
	Hydrogen gas turbine (co-firing) – (1)	New investment	4,585
		Refinancing	1,697
	Hydrogen production (blue or turquoise, etc.) – (2)	New investment	2,780
		Refinancing	890
Proceeds to be used			0

2. Impact Reporting

(1) Hydrogen gas turbine (co-firing)

① Development of Hydrogen GTCC

・Project overview

Development of hydrogen co-firing, single-fuel hydrogen firing gas turbines, consideration of operation in actual pressure combustion test facility and power generation demonstration facility

・Period

- FY2030 (planned)

・Progress

In FY2022, the project has completed the development of a gas turbine combustor capable of mixing natural gas with hydrogen at a ratio of 30% by volume (hereinafter, "30% co-firing") in large gas turbines. In addition, we have successfully completed combustion tests and are developing a combustor that is capable of mixing 50% by volume (hereinafter, "50% co-firing") in large gas turbines. Furthermore, MHI has conducted combustion testing of 100% hydrogen dry firing in a combustor for small- and medium-sized gas turbines, and is developing a combustor for large gas turbines based on the knowledge obtained.

[Relevant information]

Mitsubishi Heavy Industries, Ltd. technical Review Vol. 59 No. 4 (2022) Carbon Neutral Development of Hydrogen/Ammonia-firing Gas Turbine for Carbon Neutrality
https://www.mhi.co.jp/technology/review/pdf/e594/e594040.pdf

In FY2023, we successfully executed a fuel blend of 30% hydrogen and natural gas demonstration at partial load and full load using a grid-connected state-of-the-art 1,650℃ class J-series Air-Cooled (JAC) gas turbine. Using hydrogen produced at Takasago Hydrogen Park, this demonstration was the world's first power generation test on a large frame gas turbine using a fuel mixture of 30% hydrogen while connected to the local power grid and using hydrogen produced and stored on the same site.
The project is progressed as planned.

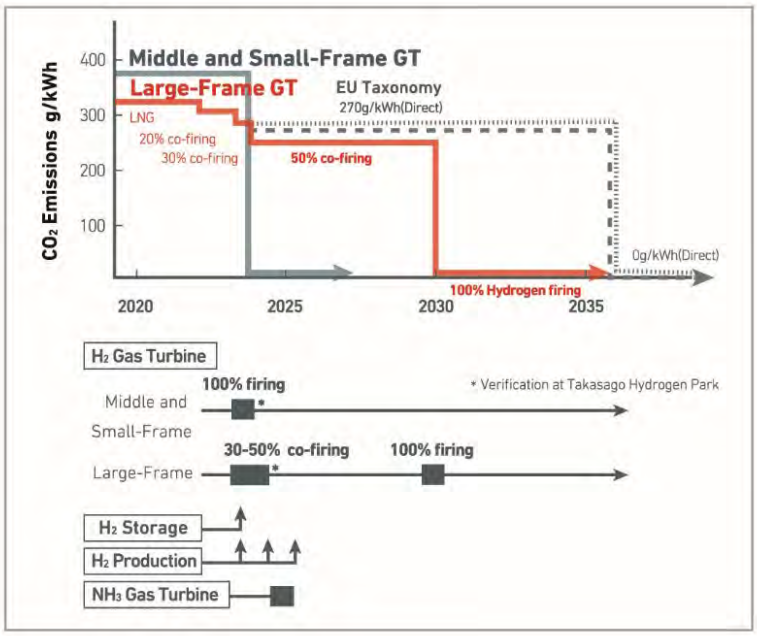
[Relevant information]

Mitsubishi Heavy Industries Technical Review Vol. 60 No. 3 (September 2023) Hydrogen/Ammonia-fired Gas Turbine Initiatives for Carbon Neutrality
https://www.mhi.com/technology/review/sites/g/files/jwhtju2326/files/tr/pdf/e603/e603030.pdf

[Relevant news]

November 30, 2023, News release
Mitsubishi Power Successfully Operates an Advanced Class Gas Turbine with 30% Hydrogen Fuel Co-Firing at Grid-Connected T-Point 2
https://www.mhi.com/news/23113001.html

[EU CO_2 Emissions Regulations and Gas Turbines Development Schedule]



[Central Control Room during Hydrogen Fuel 30vol% Co-firing Operation]

(2) Hydrogen production (blue or turquoise, etc.)

① Hydrogen Power Generation Demonstration Facility "Takasago Hydrogen Park"

・Project overview

Development, verification, and manufacturing of 100% hydrogen firing hydrogen gas turbine for early commercialization

(Takasago City, Hyogo Prefecture "Takasago Hydrogen Park")

・Period

FY2021 - FY2026(planned)

・Progress

The Takasago Hydrogen Park, which is the world's first integrated verification facility for technologies ranging from hydrogen production to power generation, has been established at the Takasago Machinery Works, where hydrogen gas turbines are developed and manufactured.

In FY2022, we constructed hydrogen production and storage facilities. Takasago Hydrogen Park plans to expand its related facilities in order to commercialize 30% co-firing large gas turbines in 2025 and 100% hydrogen firing small- and medium-sized gas turbines from 2025 onwards.

[Relevant information]

Mitsubishi Heavy Industries, Ltd. technical Review Vol. 59 No. 4 (2022) Carbon Neutral Initiatives
"Takasago Hydrogen Park" to Create a Hydrogen Society
https://www.mhi.co.jp/technology/review/pdf/e594/e594030.pdf

[Relevant news]

February 22, 2022, News release
Mitsubishi Power to Establish Hydrogen Power Demonstration Facility "Takasago Hydrogen Park" at Takasago Machinery Works
- In-house Structure for Systematic Validation of Hydrogen Value Chain from Production to Power Generation -
https://www.mhi.com/news/22022202.html

In FY2023, electrolysis hydrogen production beginning in September 2023, hydrogen production, storage, and utilization facilities were able to be operated in cooperation, and Takasago Hydrogen Park entered full-scale operation. The project is progressed as planned.
Takasago Hydrogen Park is divided into sections according to three hydrogen-related functions: hydrogen production, storage, and utilization. In the production area, an alkaline electrolyzer manufactured by HydrogenPro AS of Norway with a hydrogen production capacity of 1,100Nm^3/h, the highest in the world, has entered operation. The hydrogen produced will be stored in storage equipment with a total capacity of 39,000 Nm^3.
The validation of hydrogen firing equipment will be done at the T-Point 2 combined cycle power plant validation facility located in the utilization area, using a Mitsubishi Power JAC (J-series Air-Cooled) large frame gas turbine (450 MW class), as well as small- and medium-sized H-25 gas turbine (40 MW class) that had been previously installed for compressor driving at combustion test facility.
We are currently developing hydrogen production technologies, including solid oxide electrolysis cells (SOEC), anion exchange membrane (AEM) water electrolyzers, and next-generation turquoise-hydrogen production technology that produces hydrogen without emitting CO_2 through the pyrolysis of methane into hydrogen and solid carbon. We plan to conduct verification and validation in these areas sequentially and improve product reliability through the validation of hydrogen co-firing and 100% hydrogen firing of gas turbines.

[Relevant information]

Mitsubishi Heavy Industries Technical Review Vol. 60 No. 3 (September 2023)
"Hydrogen Park Takasago" and "Carbon Neutral Park Nagasaki" Initiative to Create Decarbonized World
https://www.mhi.com/technology/review/sites/g/files/jwhtju2326/files/tr/pdf/e603/e603020.pdf

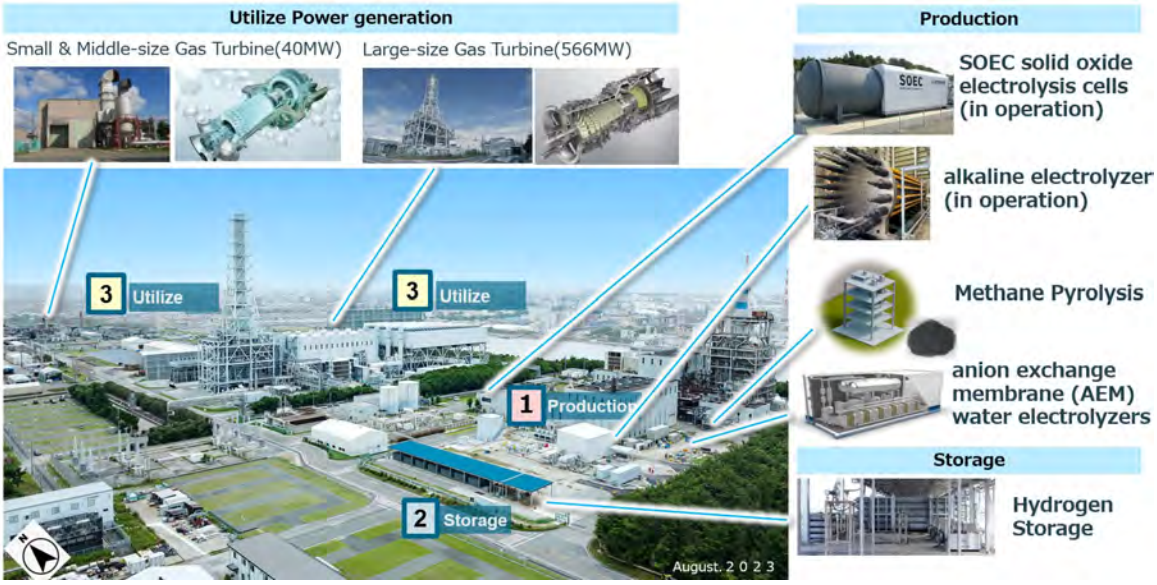
[Relevant news]

September 20, 2023, News release

Takasago Hydrogen Park, the World's First Integrated Validation Facility for Technologies from Hydrogen Production to Power Generation, Enters Full-Scale Operation -- Electrolysis Hydrogen Production Begins –

https://www.mhi.com/news/23092003.html

[Takasago Hydrogen Park]



② Investment in Monolith Materials, Inc.

・Project overview

MHI invests in Monolith Materials, Inc. (Monolith), a U.S. company with innovative technology enabling the production of hydrogen and carbon black from methane, which is abundant in natural gas, by the process of methane pyrolysis. The investment has been executed through Mitsubishi Heavy Industries America, Inc.

By investing in Monolith, MHI Group looks to strengthen and diversify its hydrogen value chain - one of the key factors needed to reduce environmental impact and ensure the energy transition's success - through technologies that can produce turquoise hydrogen, which does not emit CO_2 in its production process, as well as high-purity carbon black.

・Progress

Through its capital investment in Monolith, MHI Group will enter the field of hydrogen production and supply supporting that company's pyrolysis technology which enables use of renewable energy as the heat source. MHI will explore technological innovations to promote decarbonization throughout the industrial sector, using the produced hydrogen not only in power generation systems, but also in fertilizer production facilities, steelworks, etc.

[Relevant news]

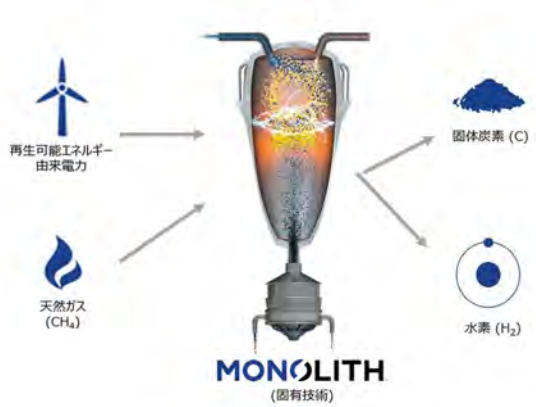
November 30, 2020, News release

Mitsubishi Heavy Industries Invests in Monolith Materials

- Leader in Innovative Technology for Reducing Environmental Impact -

https://www.mhi.com/news/201130.html

[Monolith Process]



[Commercial-scale facility in Nebraska, US]

③ Investment in C-Zero Inc.

・Project overview

MHI has invested in C-Zero, a hard tech startup located in Santa Barbara, Calif., to accelerate the first commercial-scale deployment of C-Zero's decarbonization technology, The investment has been executed through Mitsubishi Heavy Industries America, Inc.

C-Zero's technology uses innovative thermocatalysis to split methane – the primary molecule in natural gas – into hydrogen and solid carbon in a process known as methane pyrolysis.

With the investment, MHI continues to strengthen and diversify the hydrogen value chain, advancing both strategic initiatives for its energy transition business and its commitment to making continued progress toward global carbon neutrality goals.

・Progress

MHI will examine the potential of using the company's technology for the production and supply of hydrogen that could then be utilized for power generation systems and the decarbonization of industry.

[Relevant news]

February 10, 2021, News release

MHI Invests in C-Zero, a U.S. Hard Tech Startup, to Accelerate Efforts to Produce Clean Hydrogen from Natural Gas

https://www.mhi.com/news/21021001.html

3. MHI Group's Transition Initiatives

Realizing a Carbon Neutral Society is a global issue, and we believe that as a technology leader, with a proven track record in the field of decarbonization, it is MHI's responsibility to help lead the fight against climate change.

The steady execution of its Energy Transition Strategy will contribute to the realization of the Government of Japan's goal of carbon neutrality by 2050.

MHI considers the execution of Green/ Transition Finance as the funding for our initiatives toward achieving MHI group's Net Zero in 2040, and believe that dialogue with stakeholders through the framework of green and transition finance, annual reports, integrated reports, etc. will serve as an opportunity to disseminate our company's Initiatives. MHI's long-term strategy will be reviewed when government policies or other assumptions change.

4. External Review

MHI has received an annual review of the performance up to March 2024 from DNV Business Assurance Japan K.K. and has posted the review results on our website.