MOVE THE WORLD FORWARD MITSUBISHI HEAVY INDUSTRIES GROUP

Global market overview
Gas turbine sector needs

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Mitsubishi Power, Ltd.

MITSUBISHI HEAVY INDUSTRIES

Agenda

1. Introduction of Mitsubishi Heavy Industries
2. Market Overview
3. Technologies for Carbon Neutral

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Mitsubishi Heavy Industries Group at a Glance

1884 Foundation
over 130 years history

78,486 Employees
(Consolidated)

256 Group Companies
(Consolidated)

¥4.2TN ($31.1BN*) Revenue
(FY2022, consolidated)

Diverse **products**
On land, at sea, in the sky, in space

Note: The U.S. dollar revenue figure was converted from Japanese yen using the FY2022 average exchange rate, JPY 134.9/USD.


Gas turbines


Compressors


Aero engines

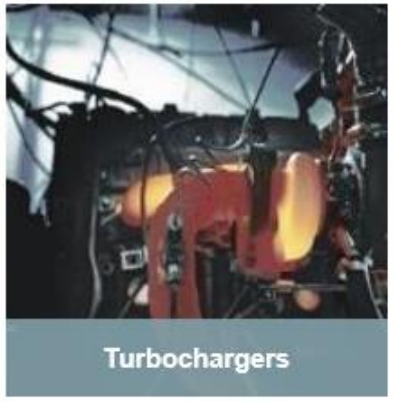

CO_2 capture plants


Metals machinery


Chemical plants


Transportation


Waste-to-energy


Turbochargers


Aerospace


Rocket engines


Defense

2040 Carbon Neutrality Declaration

Target Year	Reduce CO_2 emissions across MHI Group Scope 1&2	Reduce CO_2 emissions across MHI's value chain Scope 3 + reductions from CCUS
2030	-50% (compared to 2014)	-50% (compared to 2019)
2040	Net Zero	Net Zero

Path to achieving Carbon Neutrality

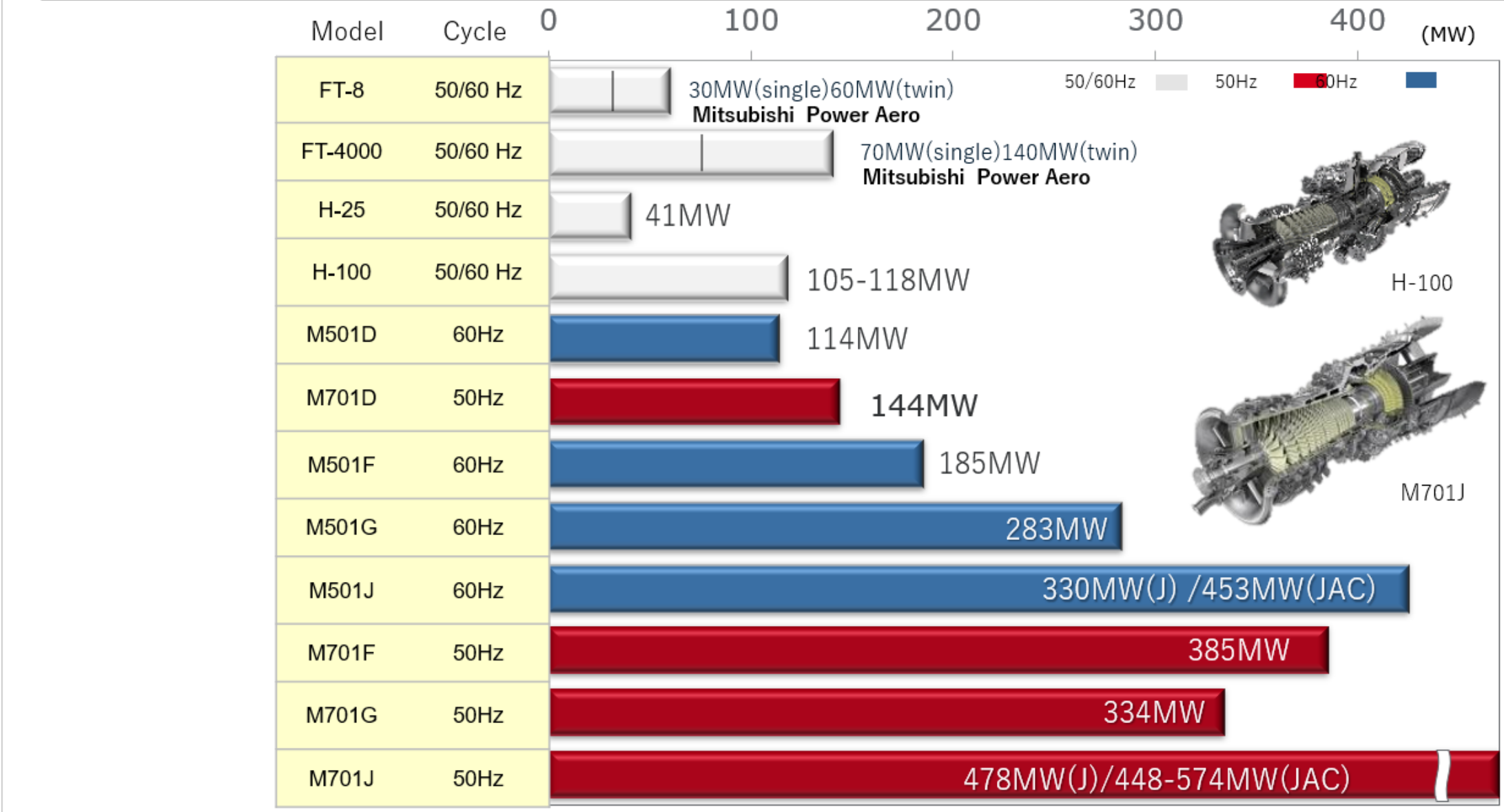
Build an innovative solutions ecosystem to realize a carbon neutral future

Scope 1&2: The calculation standard is based on the GHG Protocol.
Scope 3: The calculation standard is based on the GHG Protocol. However, we also account for reductions achieved by CCUS as an MHI original index.

GHG: Greenhouse Gas CCUS: Carbon dioxide Capture, Utilization and Storage

Gas Turbine Line Up

Model	Cycle	
FT-8	50/60 Hz	30MW(single)60MW(twin) Mitsubishi Power Aero
FT-4000	50/60 Hz	70MW(single)140MW(twin) Mitsubishi Power Aero
H-25	50/60 Hz	41MW
H-100	50/60 Hz	105-118MW
M501D	60Hz	114MW
M701D	50Hz	144MW
M501F	60Hz	185MW
M501G	60Hz	283MW
M501J	60Hz	330MW(J) /453MW(JAC)
M701F	50Hz	385MW
M701G	50Hz	334MW
M701J	50Hz	478MW(J)/448-574MW(JAC)



H-100

M701J

*All ratings are at the generator terminals.

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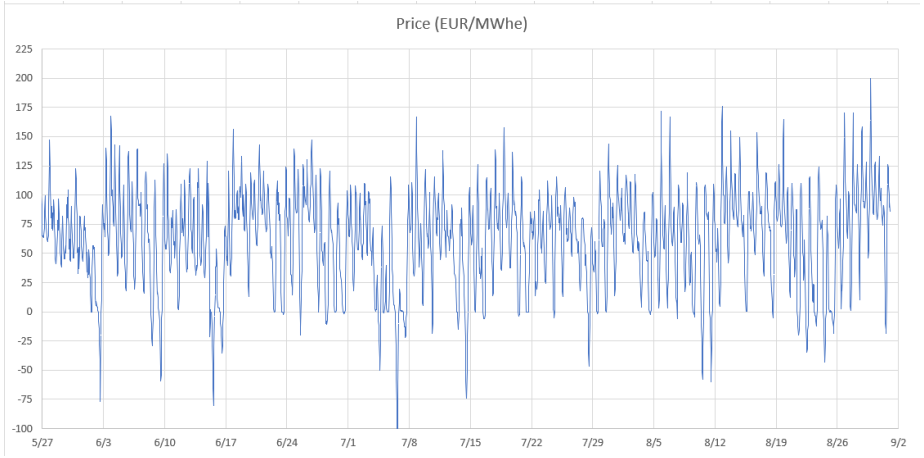
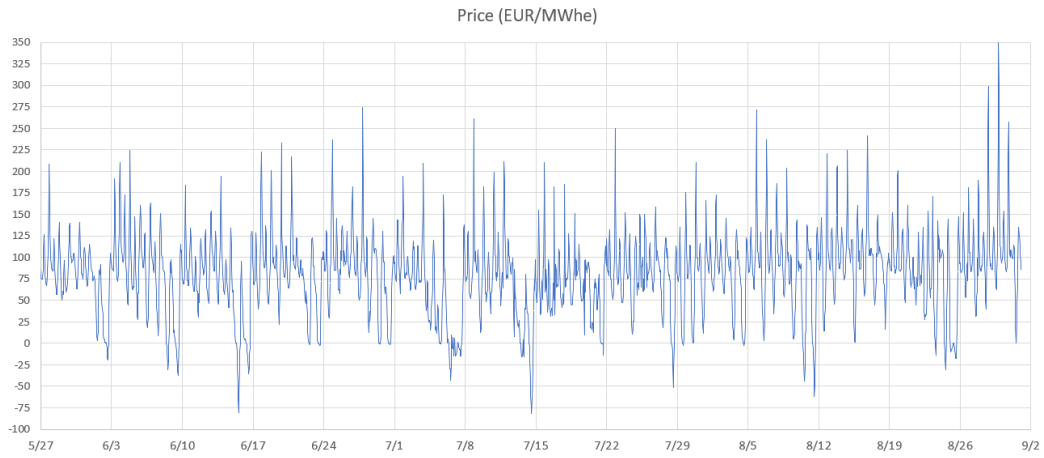
2. **Market Overview**
3. Technologies for Carbon Neutral

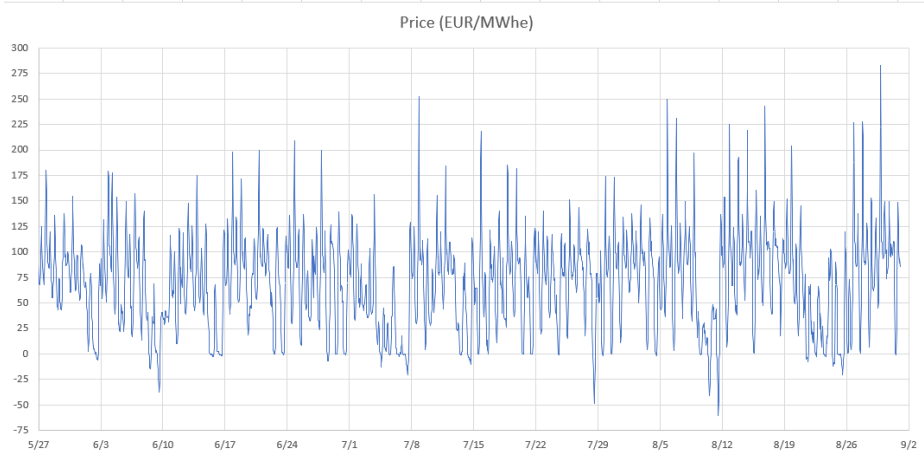
Europe day ahead power prices



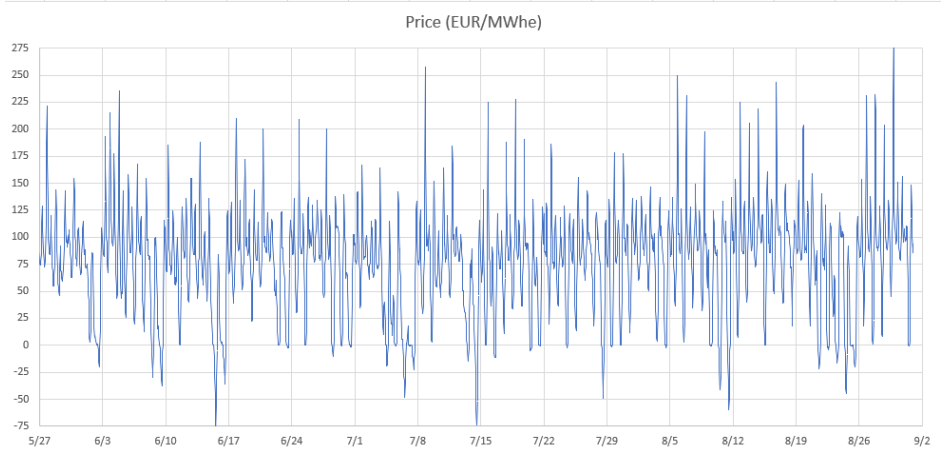
Belgium



Czech Republic



Denmark



Germany

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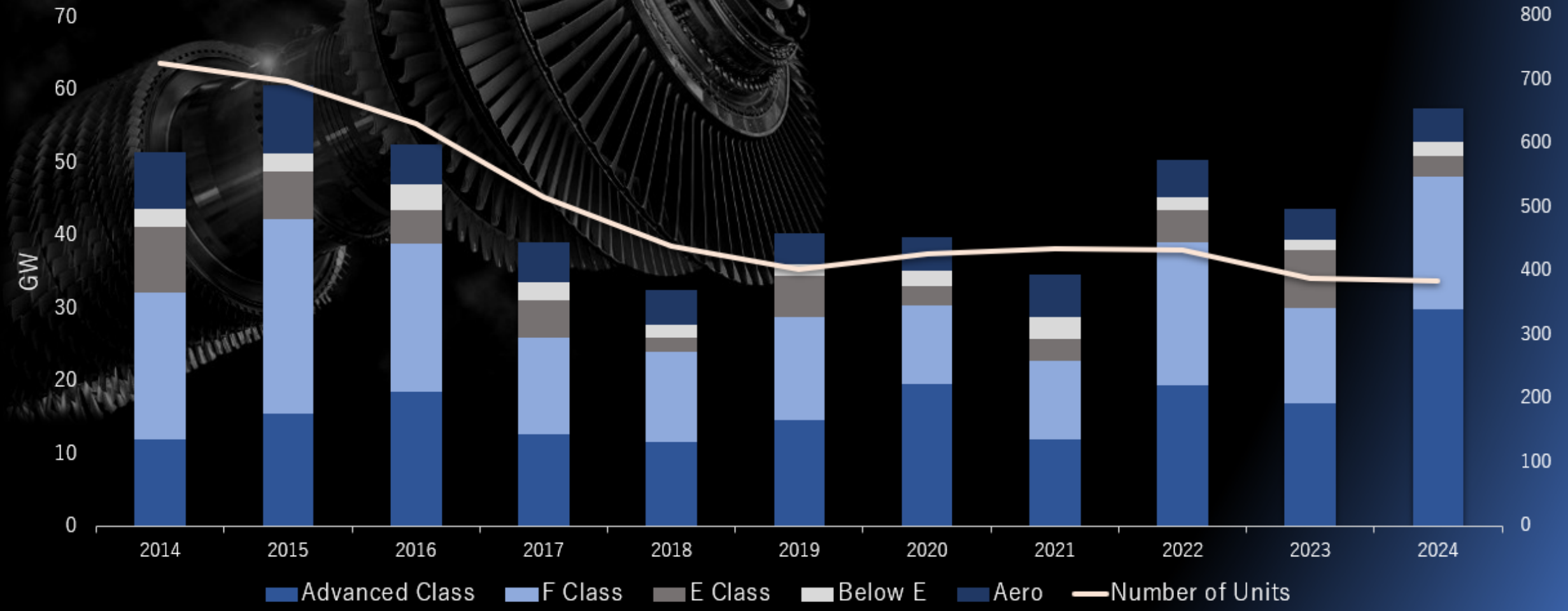
2024

McCOY POWER REPORTS

The GT Market reached **57.4 GW** (+38%) and 378 units in 2024

Strong GW trend and decreased number of units due to the rise of Advanced Class GTs



Source: McCoy Power Report 2024

Agenda

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3. **Technologies for Carbon Neutral**

Delivering on the Energy Transition

Decarbonizing existing infrastructure

Build a hydrogen solutions ecosystem

Build a CO2 solutions ecosystem

- Carbon-free power generation using hydrogen and ammonia
- Optimizing assets through energy savings
- Centralized and distributed power & heat solutions

Available in the US.

CO_2 Zero power generation technology Roadmap

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Reduce CO_2 by High Efficiency Gas Turbine ➡ ZERO CO_2 by Hydrogen Gas Turbine

CO_2 Reduction -65%

1 High Efficiency Natural Gas-fired Gas Turbine

JAC series

Co-firing

2-1 Ammonia Biomass Co-firing Boiler

Ammonia co-firing

CO_2 Capture

2-2 Gas Turbine Combined Cycle plant +CCUS

CO_2 Zero

3 Hydrogen Gas turbine Development

Hydrogen Gas turbine

Ammonia Gas Turbine Development

*1 :Based on Sub-C CO_2 Emission, *2:67% High efficient Gas Turbine

Takasago Hydrogen Park

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Utilize Power generation

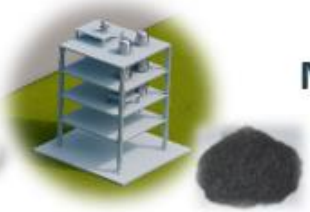
Small & Middle-size Gas Turbine(40MW)

Large-size Gas Turbine(566MW)

Production

solid oxide electrolysis cells (SOEC)

alkaline electrolyzer (in operation)



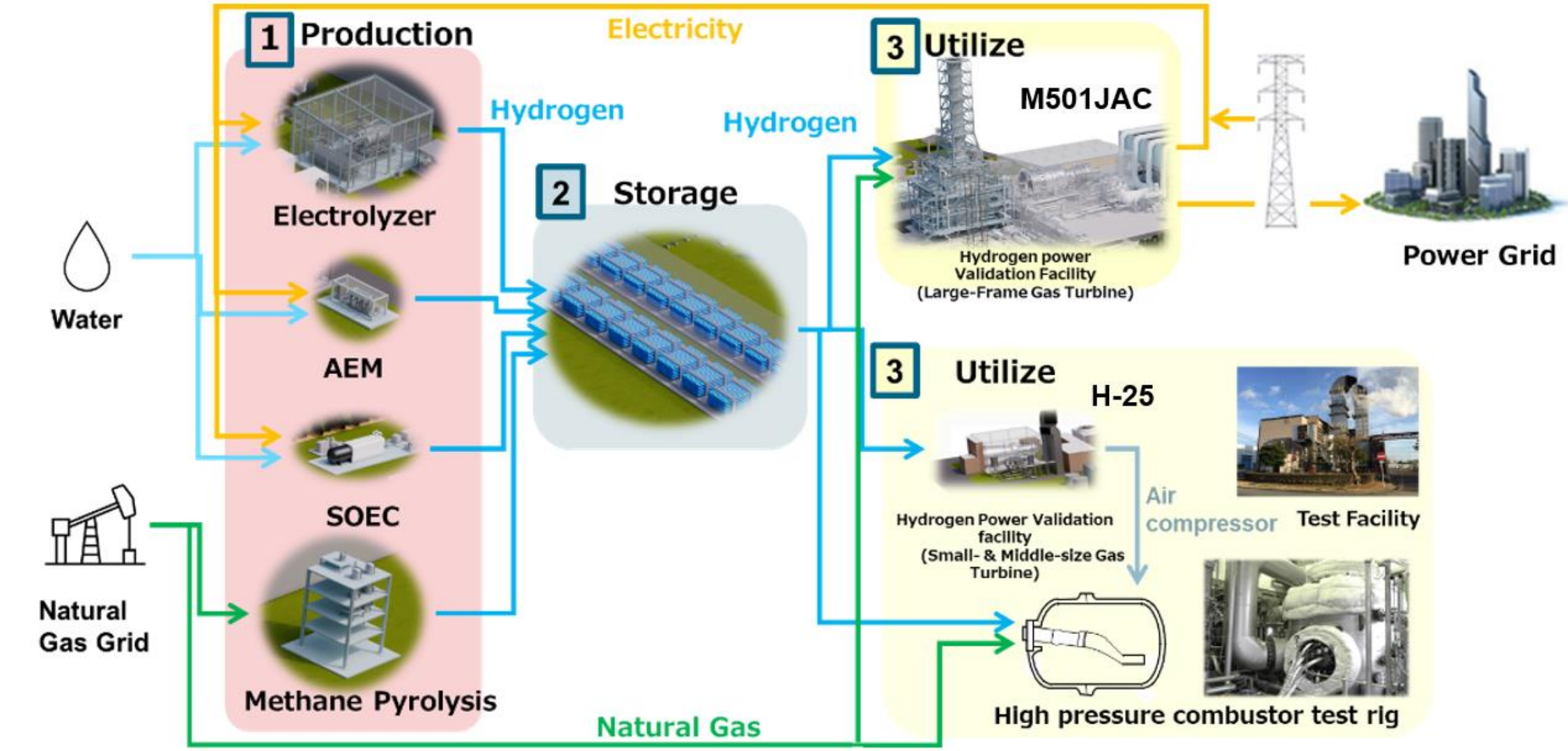
Methane Pyrolysis

anion exchange membrane (AEM) water electrolyzers

Storage

Hydrogen Storage

Takasago Hydrogen Park　Flow diagram



AEM ：Anion Exchange Membrane
SOEC: Solid Oxide Electrolysis Cell

Hydrogen usage※

Large-Frame GTCC(M501JAC)	GT453MW、CC664MW	31ton/h
Small-& Middle-size GTCC(H-25)	GT41MW、CC60MW	4ton/h

Ammonia Fuel Applications for Gas Turbines

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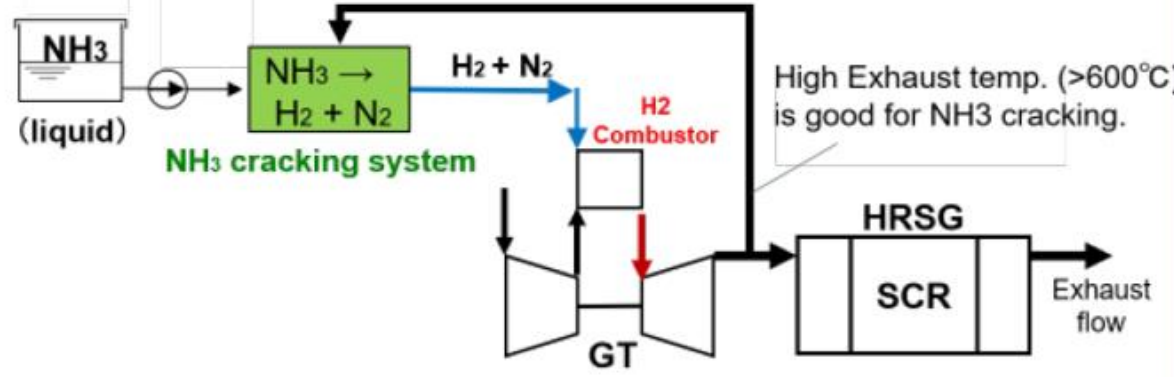
Ammonia(NH3)

- Hydrogen can be efficiently transported long distances and be stored as ammonia
- Ammonia can be used as a carbon free source of energy
- Direct firing of Ammonia results in high NOx generation (Fuel NOx)

High efficiency large frame GT

Ammonia cracking cycle gas turbine system

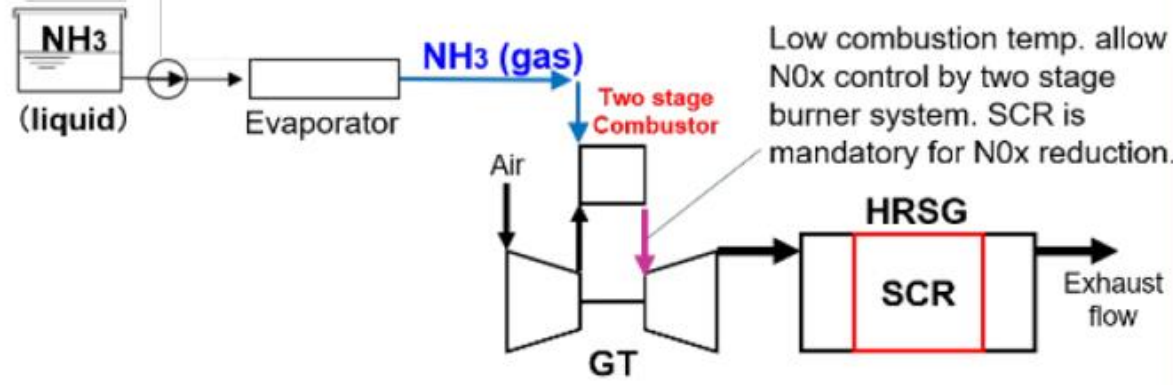


Cracking System
Standalone
Verification Test : 2025～

GTCC Combination

Middle & Small Frame GT

Ammonia direct combustion gas turbine system



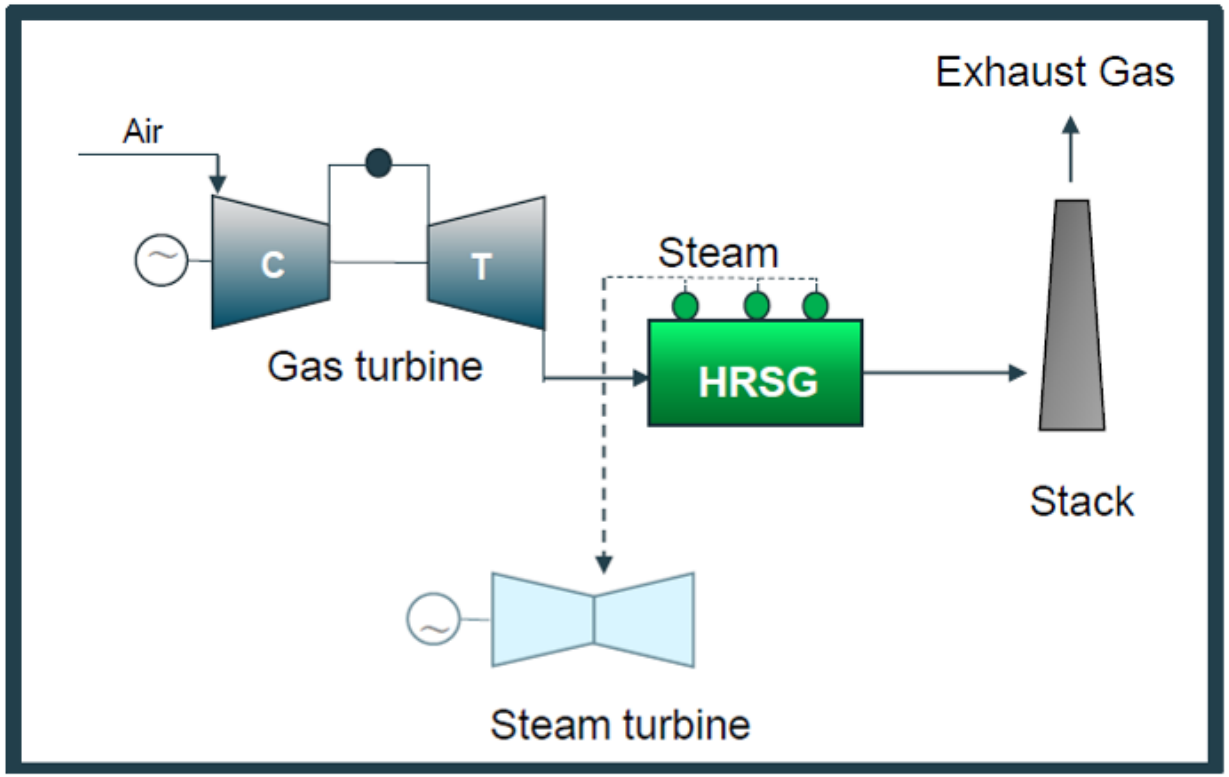
Small Frame
Combustor Test : 2023～
Engine Verification: 2025～

Large Frame GT combustor development

Integrated CCGT with CO2 capture plant

Best integration and total optimization under advanced OEM technology

- Complete System Integration with GT, ST, HRSG, CO2Absorber, Flue Gas Quencher, Regenerator design and performance, Steam/Water heat utilization, Flue Gas Draft design, Operation flexibility & Optimization, Environment Control, etc.
- Three (3) primary technology: Proprietary solvents, Amine washing system and Heat integration system



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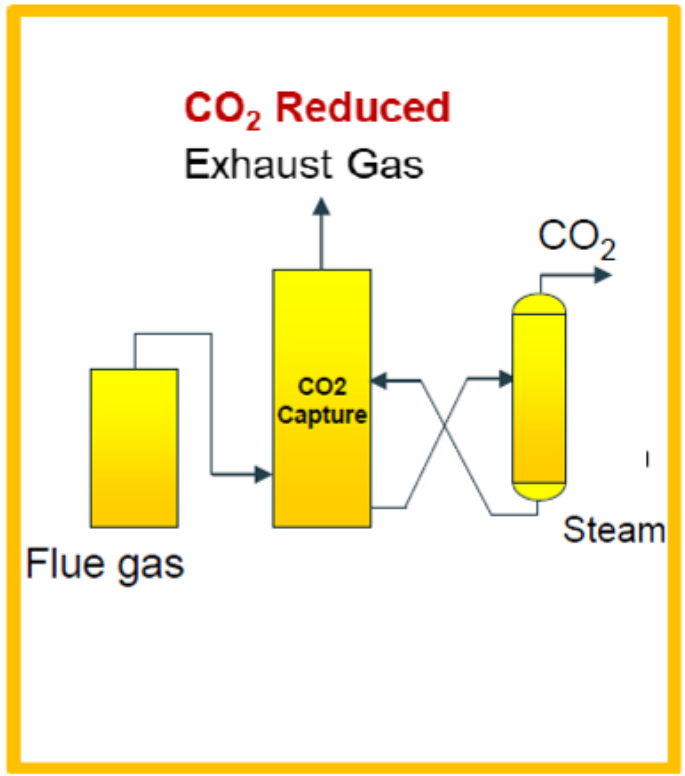
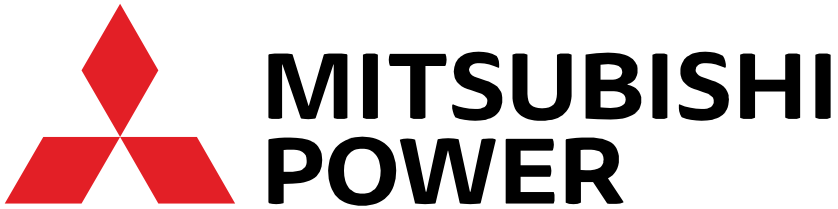


Mitsubishi Heavy Industry



Mitsubishi Power is a power solutions brand of Mitsubishi Heavy Industries.