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# IHI Group's Efforts to Build an Ammonia Value Chain and CCUS Activities

**IHI**

March 2025

**IHI Corporation**

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# Company Overview

## IHI is a global company with 30 overseas bases and presence in 22 countries



Year of establishment

# 1853

(170 year anniversary)



Revenue (Consolidated)

Approx. **10** billion USD  
(¥140)



# 28,246

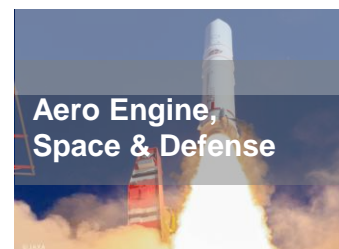
employees  
(consolidated)



Domestic base

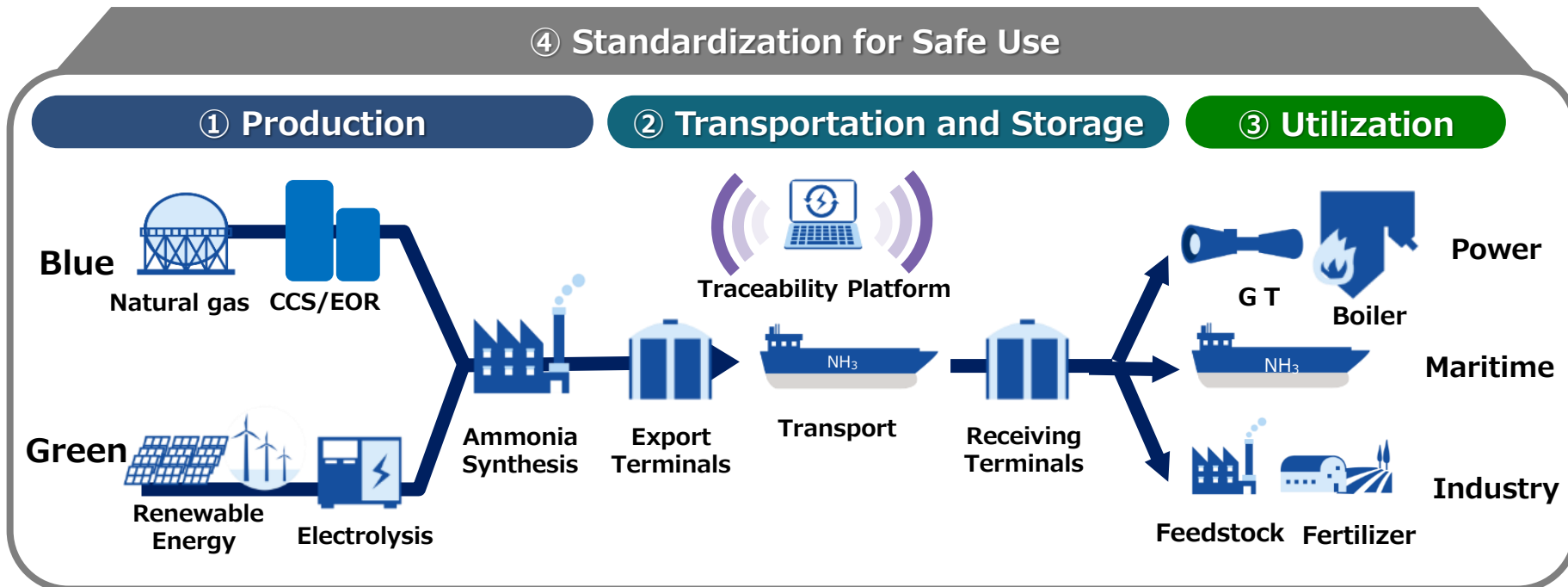
# 4

Areas of expertise



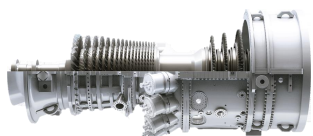
# IHI's Decarbonization Activities-Ammonia-

## ④ Standardization for Safe Use



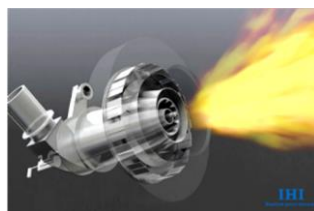
Ammonia Terminals / Large Ammonia Tank

- ✓ Development of Ammonia terminals
- ✓ Supply large ammonia tank



9F.04 : Source : GE Vernova  
Utility Scale  
Ammonia Firing Gas Turbine

- ✓ Development with GE Vernova targeting 2030



Ammonia Firing Boiler  
NEDO [JPNP16002, JPNP21020]

- ✓ 20% firing at Hekinan PS together with JERA in 2024, aiming more than 50% firing in 2028
- ✓ Mono-fires in labo level is succeeded



2MW Class  
Ammonia Firing Gas Turbine  
NEDO [JPNP21020]

- ✓ World first gas turbine using 100% liquid ammonia
- ✓ Commercialize in 2026

# Ammonia 20% Firing – Demonstration in Japan-

Plant Owner: JERA CO., Inc.

Plant: Hekinan Thermal Power Station Unit 4 (1,000MW)

Demonstration Periods: From April 1 to June 26, 2024

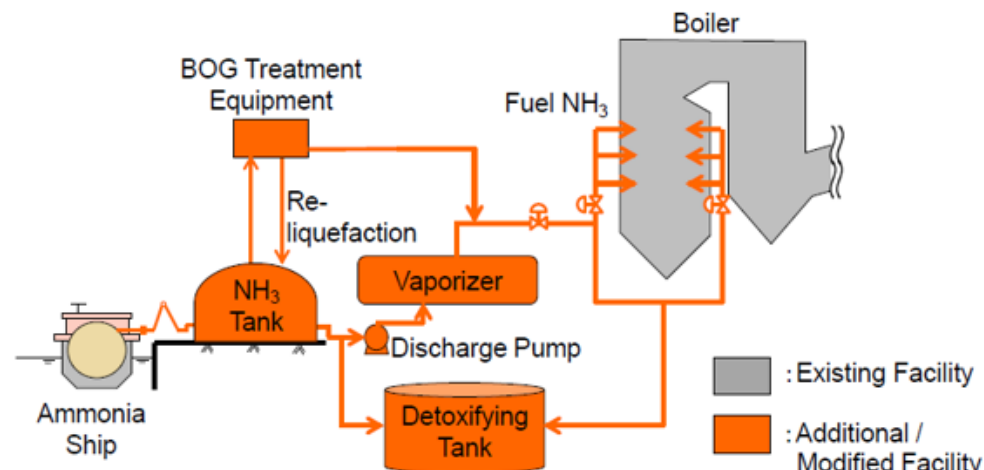
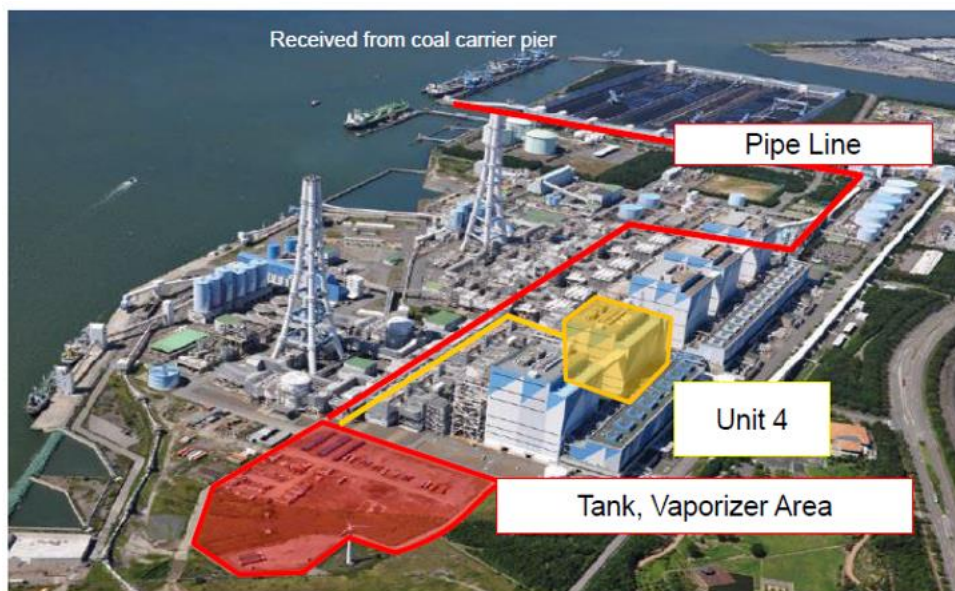
Contents: Stable operation of 20% ammonia firing(achieved on April 10, 2024)

NOx

Equal to or less than Original(Coal Firing)

SOx

Approx. 20% decreasing



Overview of Hekinan Thermal Power Station and Schematic Diagram of Ammonia Supply System (Provided by JERA Co., Inc.)

NEDO [JPNP16002]

## CO<sub>2</sub>-free power generation achieved with the world's first gas turbine using 100% liquid ammonia –Reduction of over 99% greenhouse gases during combustion–

-June 16, 2022-

Press Release

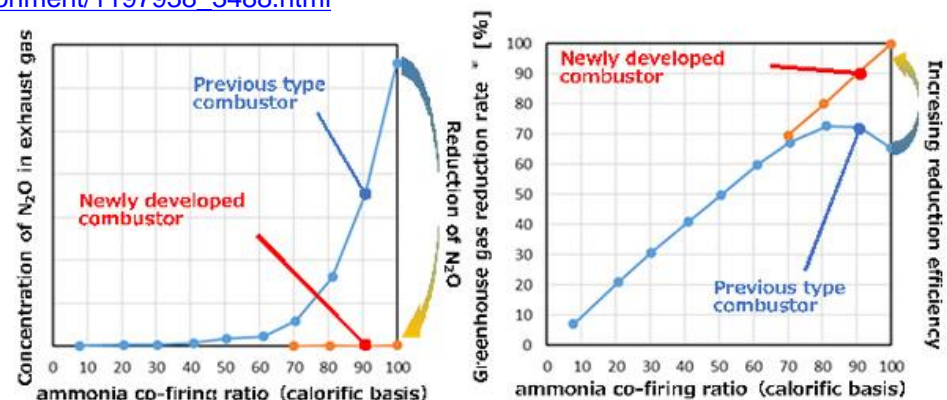
IHI has succeeded in reducing greenhouse gases by over 99% during combustion of liquid ammonia in a 2,000-kilowatt-class gas turbine achieving truly CO<sub>2</sub>-free power generation. Ammonia (NH<sub>3</sub>) can be used in existing power generation facilities as a fuel which does not emit CO<sub>2</sub> when combusted. The combustion method which IHI is pioneering involves liquid ammonia being directly sprayed into the gas turbine combustor, which presents numerous advantages for social implementation, such as the simplification of the liquid ammonia fuel supply system from the storage tank to turbine, as well as improved controllability.

Until now, when operating gas turbines at ammonia co-firing rate of over 70%, nitrous oxide (N<sub>2</sub>O) which has a greenhouse warming effect around 300 times that of CO<sub>2</sub>, was susceptible to formation, nullifying the effect of reducing CO<sub>2</sub> emissions. As a result of mounting and testing a newly developed combustor on the 2,000-kilowatt-class gas turbine at IHI Yokohama Works, we were able to achieve a greenhouse gas reduction rate exceeding 99%, even when the ammonia fuel ratio is at 70~100%, and we verified the output of 2,000kW when mono-firing liquid ammonia. Looking forward, we will further reduce NO<sub>x</sub> levels, improve operability, evaluate long-term durability, and proceed with efforts toward the practical application of a 100% liquid ammonia combustion gas turbine in 2025.

[https://www.ihico.jp/en/all\\_news/2022/resources\\_energy\\_environment/1197938\\_3488.html](https://www.ihico.jp/en/all_news/2022/resources_energy_environment/1197938_3488.html)



NEDO [JPNP21020]





# Utility Scale Gas Turbine using 100% Ammonia

## GE Vernova and IHI move to the next phase of the technology roadmap aiming to develop a 100% ammonia capable gas turbine combustion system by 2030

-January 24, 2024-

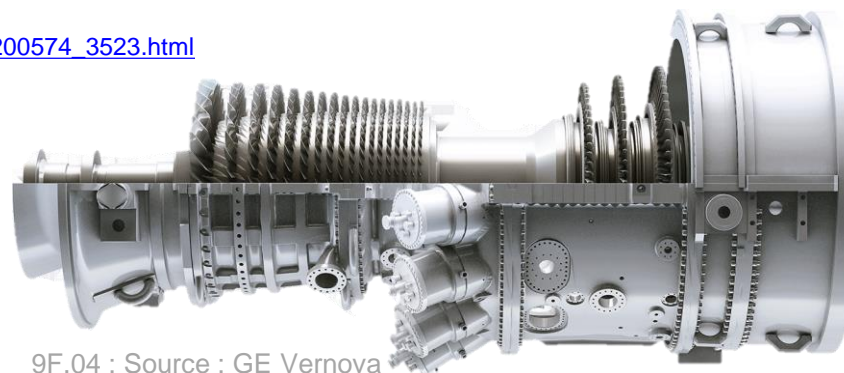
Press Release

GE Vernova and IHI announced the recent signing of a Joint Development Agreement (JDA) to progress to the next phase of technology and engineering for the development of a new gas turbine combustor capable of using ammonia as a viable fuel option for power generation compatible with GE Vernova's 6F.03, 7F and 9F gas turbines. This collaboration is a follow-up to earlier MOUs between the companies.

In this engineering phase, combustion technology concepts will be evaluated for their ability to meet key operational requirements and the impact on the entire power plant. GE Vernova and IHI plan to develop a two-stage combustor configured to burn up to 100% ammonia to comply with emission requirements. Combustion testing for the maturation of the new combustor design will take place in IHI's facilities in Japan.

In addition to installation for new builds, the new combustor is expected to offer an alternative path to decarbonize existing gas turbine power plants. Without replacing the existing gas turbine, power plants operating on conventional fuels can be upgraded to operate on fuel that does not produce carbon emissions when combusted by simply changing the natural gas combustor to a new ammonia combustor with minimum upgrades to the fuel system and associated balance of plant systems.

[https://www.ihi.co.jp/en/all\\_news/2023/resources\\_energy\\_environment/1200574\\_3523.html](https://www.ihi.co.jp/en/all_news/2023/resources_energy_environment/1200574_3523.html)

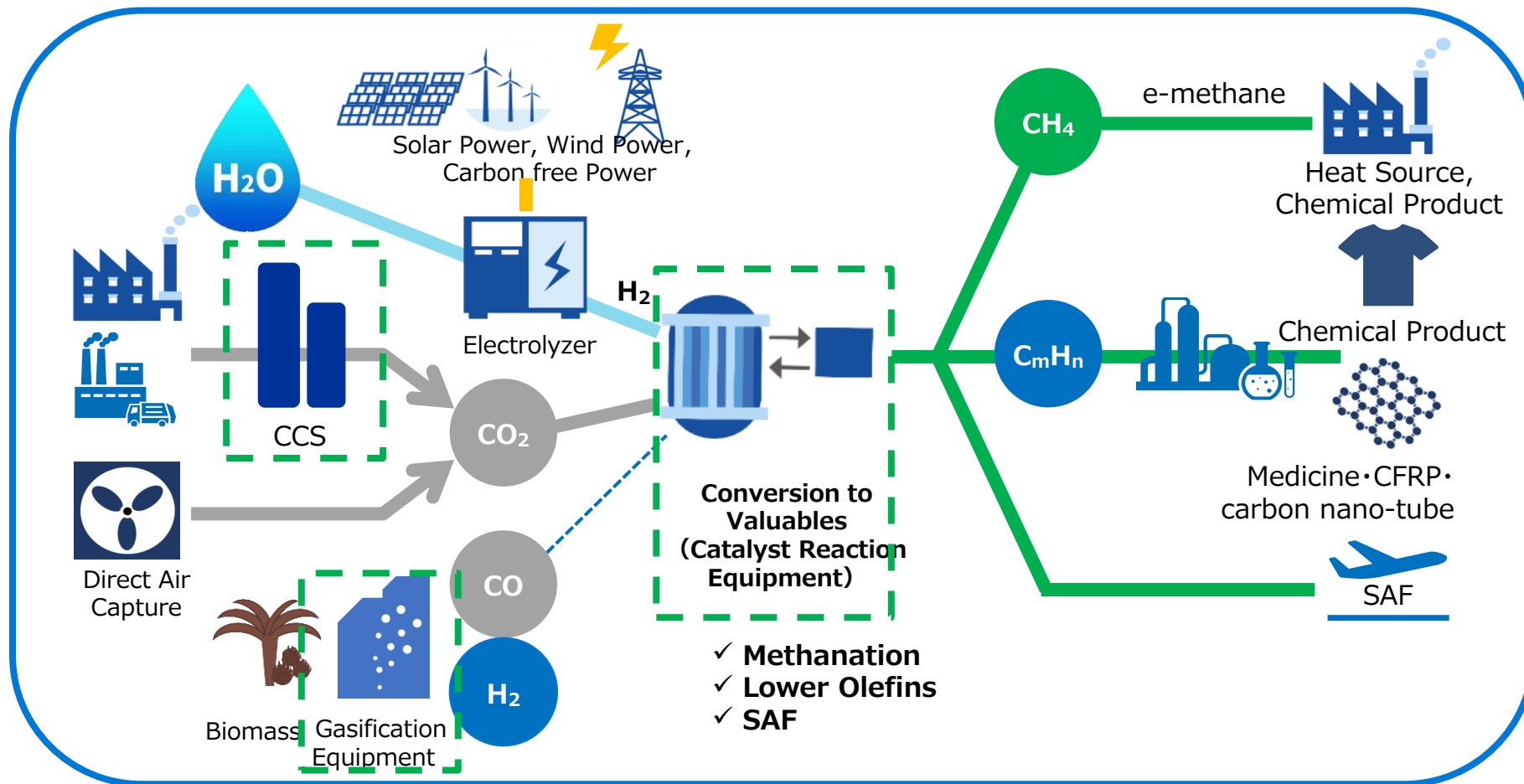


9F.04 : Source : GE Vernova

# IHI's Ammonia Utilization Technologies & Storage Technologies

Sector	Equipment	Note
Power	Boiler	<ul style="list-style-type: none"> <li>JERA/ IHI started demonstration of 20% ammonia fuel-conversion at a 1,000MW coal-fired power plant (Hekinan#4) from April 2024.</li> <li>Development of 100% Ammonia mono-firing burner will be completed in 2025.</li> </ul>
	Heavy Duty GT	<ul style="list-style-type: none"> <li>IHI and GE is collaborating to develop ammonia combustion technologies for GE's 6F.03, 7F and 9F systems to fire up to 100% ammonia by 2030.</li> </ul>
Industry	Small GT	<ul style="list-style-type: none"> <li>The CO<sub>2</sub>-free power generation achieved with the world's first gas turbine using 100% liquid ammonia.</li> <li>Long term durability test started from July 2024 at IHI Aioi Works.</li> </ul>
	Furnace	<ul style="list-style-type: none"> <li>The ammonia mono-firing burner technology for naphtha cracking furnace was demonstrated at Idemitsu Shunan Chemical Complex.</li> </ul>
	Engine	<ul style="list-style-type: none"> <li>The demonstration program for ammonia fueled tag boat started from 2024. 90% of diesel oil is converted to ammonia.</li> </ul>
Maritime		
Storage	Tank	<ul style="list-style-type: none"> <li>Large-scale ammonia receiving terminal including storage tank</li> </ul>

# IHI's Decarbonization Activities -CCUS-



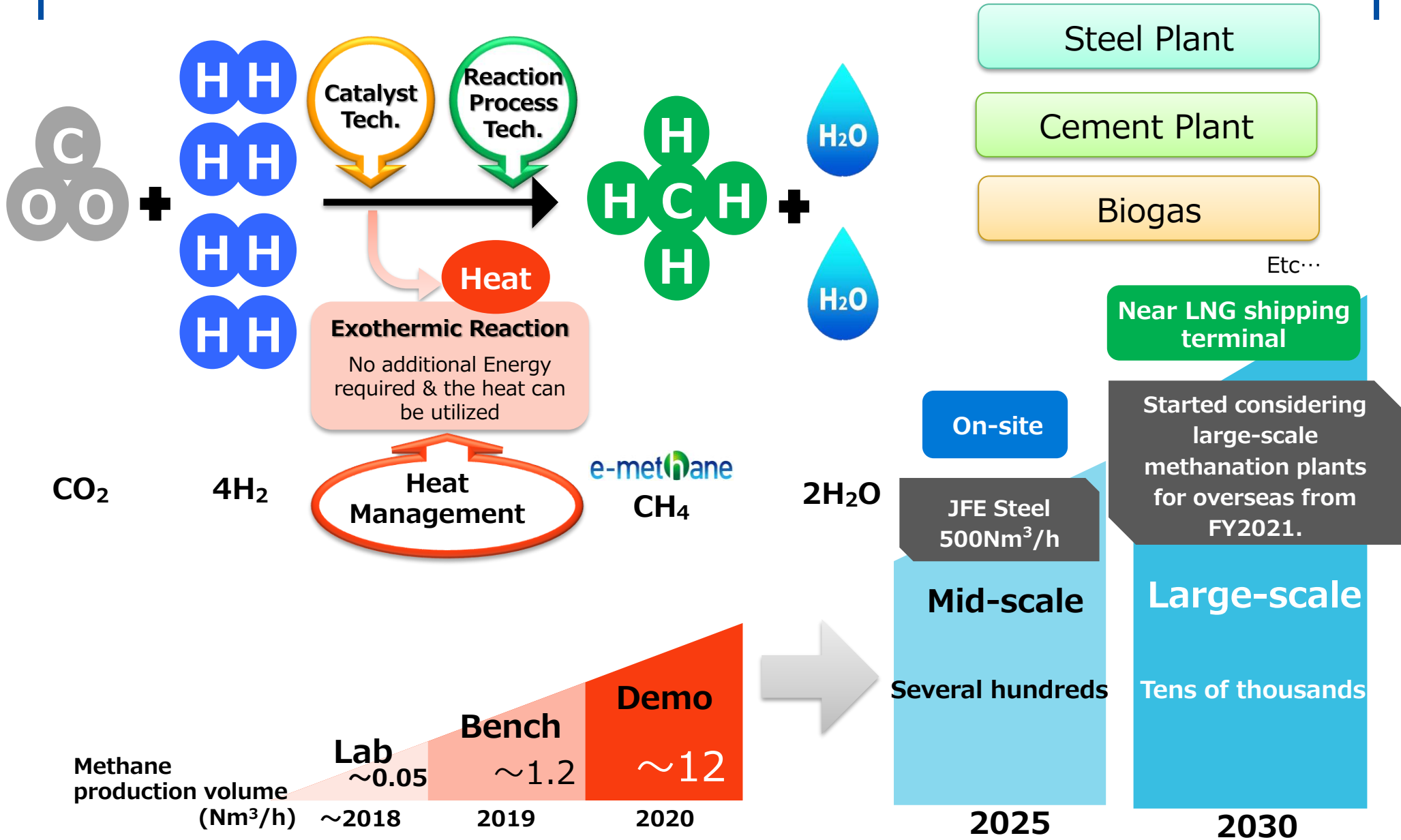
**Methanation**

- ✓ Sabatier type
- ✓ Catalyst developed by IHI with partner
- ✓ Standard type (12.5Nm<sup>3</sup>/h) available
- ✓ 500Nm<sup>3</sup>/h project will be completed in 2025
- ✓ CCS technology also can be supplied by IHI
- ✓ Developing Innovative Methanation Technology





# Scale up of Methanation Process



**Thank you for your kind attention.**

