



IHI's Technologies for Creating a Green Ammonia Society

IHI

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IHI Power System Malaysia SDN BHD / IHI Corporation

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Company Overview (As of March 31, 2025)



Year of establishment

1853



Revenue (Consolidated)

Approx. **11** billion USD
(@¥150)



employees (Consolidated)

27,990



IHI Global Network

20 Overseas bases and

131 Overseas Group Companies

4
Areas of
expertise



**Resources, Energy
& Environment**



**Aero Engine, Space
& Defense**

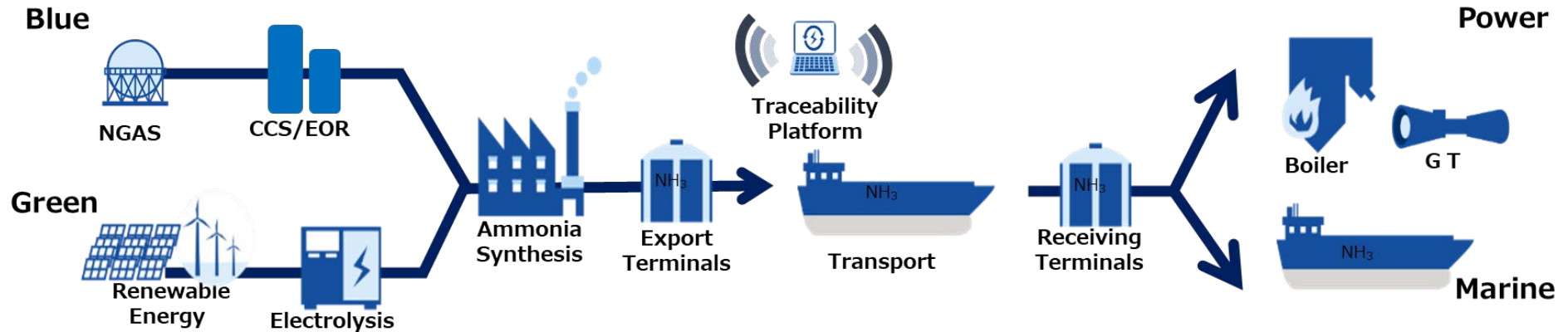


Social Infrastructure



**Industrial Systems &
General-Purpose Machinery**

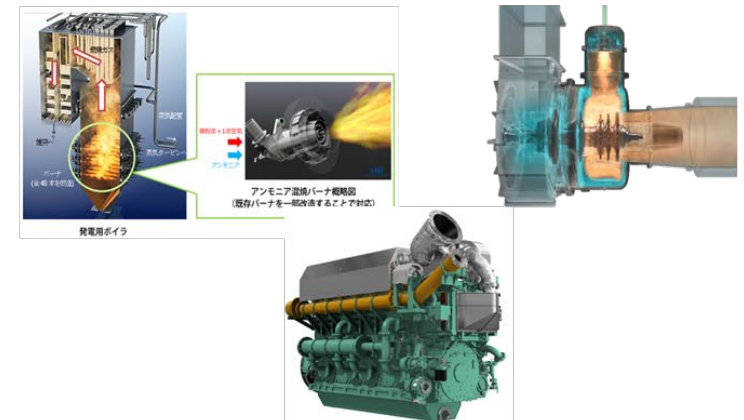
Ammonia Value Chain and IHI key products



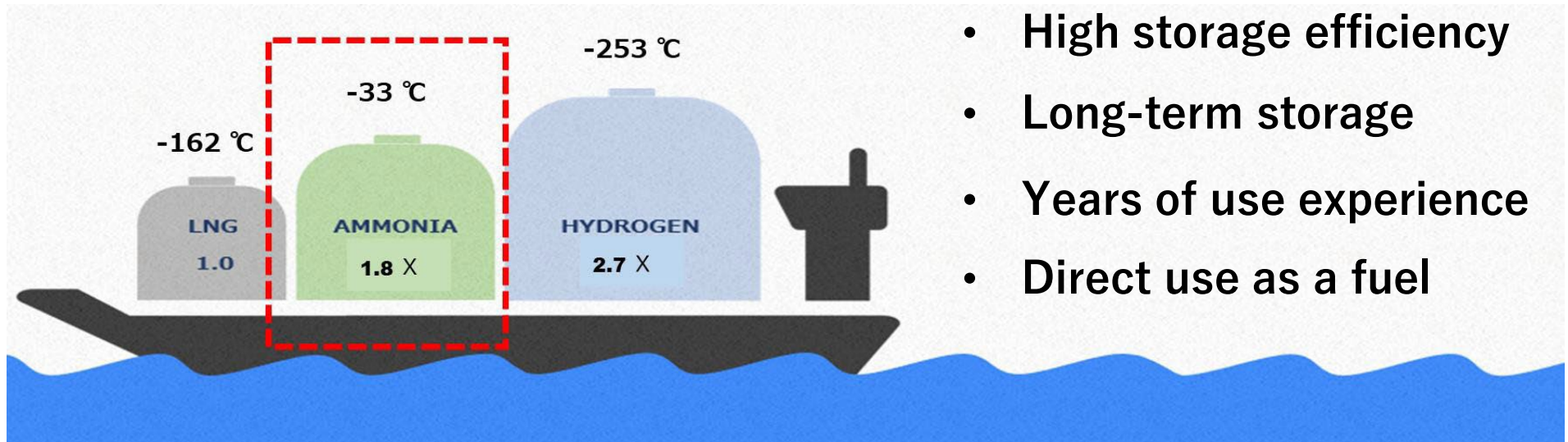
Production:
Water Electrolyzer



Storage & Transportation:
Tank and Burge



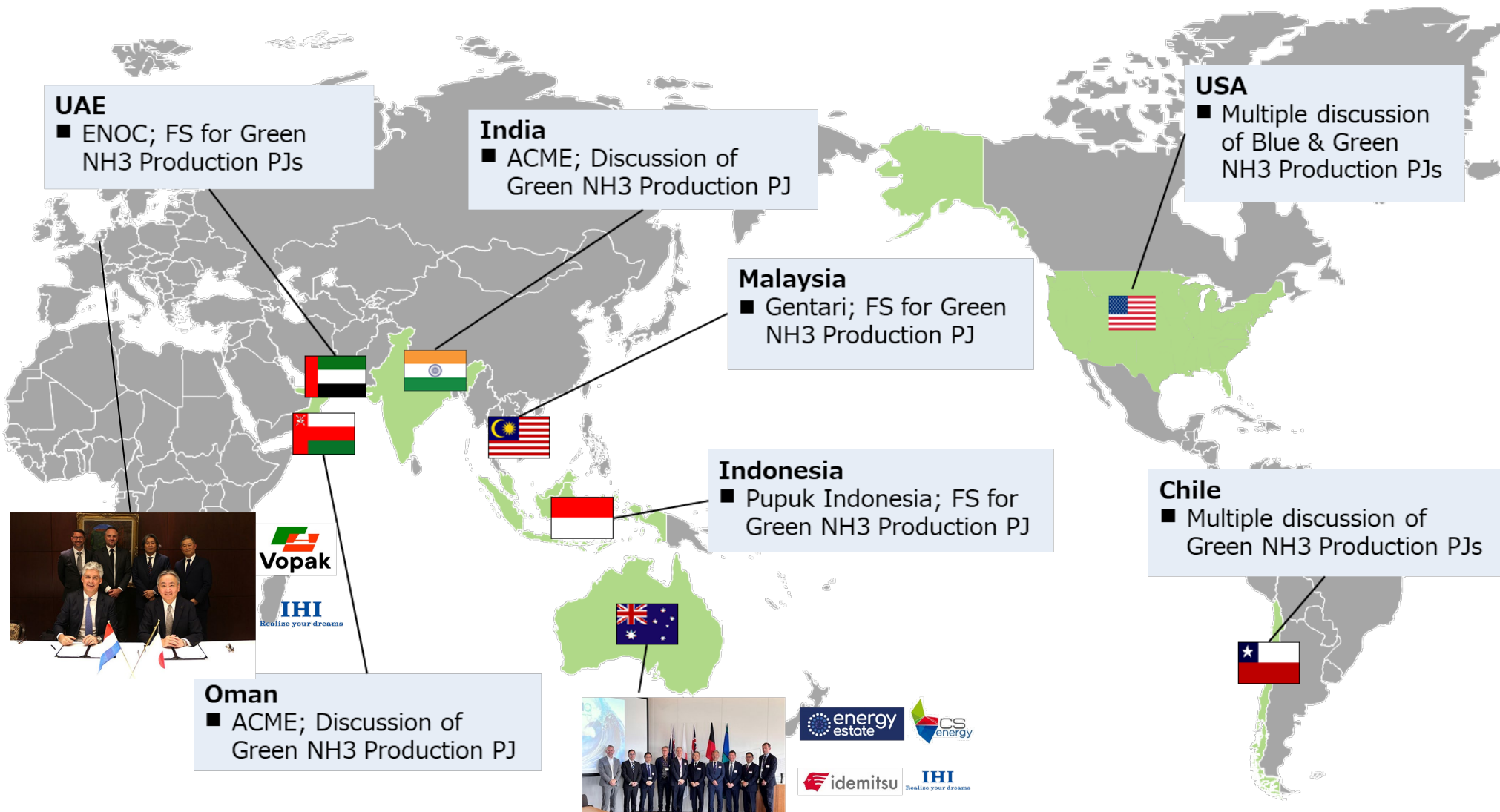
Utilization:
Power Generation systems (BGT, GT, ICE)

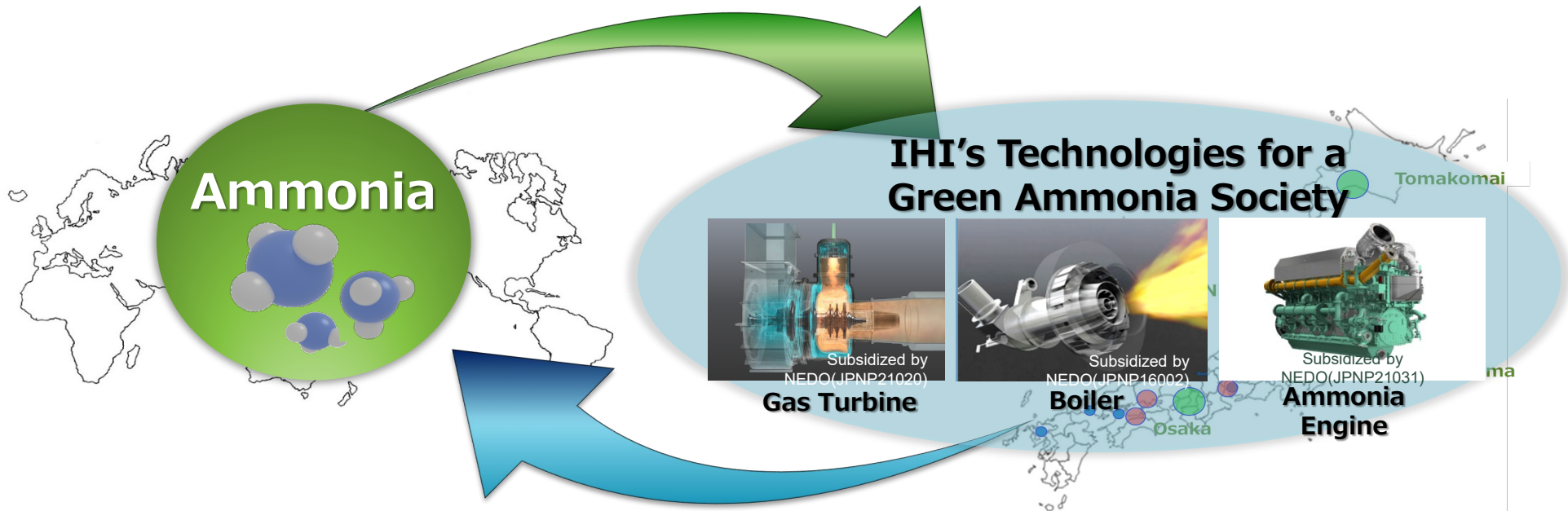


Characteristics of Liquefied Gas Fuels

	LNG	LNH ₃	LH ₂
Energy Density (MJ-LHV/l)	22.6	12.7	8.5
Tank Material	SUS (9%Ni)	C/S (SLA325A)	SUS
Boiling Point (°C)	-162	-33	-253
Storage Period	14 Days	Long Term	7 Days

Green Ammonia Production Projects



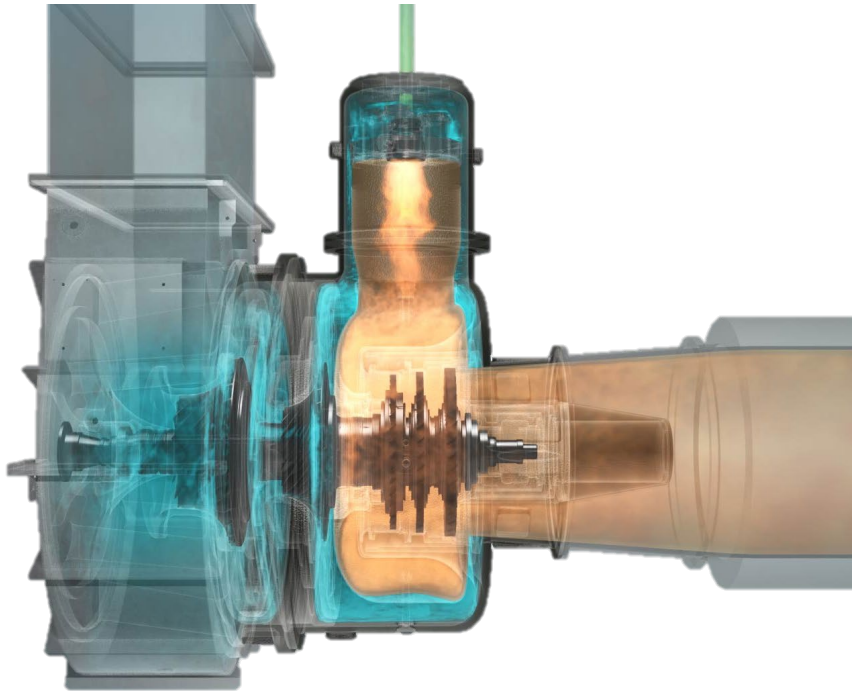


IHI has developed utilization technologies **since early 2010s** and **achieved excellent results** whilst conducting multiple **breakthrough demonstrations**

Key year 2024 – series of world's first implementation demos under three important initiatives were conducted in Japan to verify the **reduced environmental impact, safety** and **operational reliability** of **fuel ammonia**

Current Achievements

- Ammonia fueled single can combustor 2MW gas turbine
- Gas turbine test facility in IHI Yokohama Works
- Achieved full load operation with 100% liquid ammonia combustion in 2022.



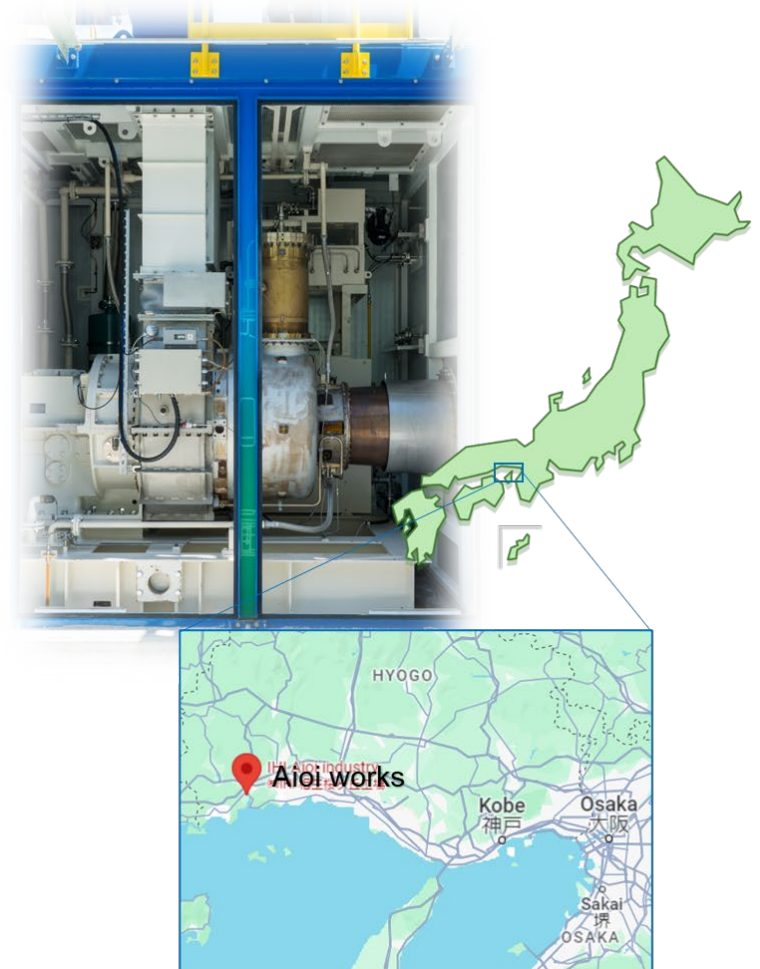
IHI IM270 gas turbine



Ammonia GT test facility & Fuel Supply System
at IHI Yokohama

Current Achievements

- Achieved 2,500 hours of operation
- Operated using 2,250 tons of blue ammonia



Technology deployment to large gas turbine

Joint Development Agreement with GE Vernova for Ammonia-Fired F-Class Gas Turbine

Up to 100%

Two-stage combustion system

- ✓ Configured to burn up to 100% of ammonia @ normal operation with 99+% GHG reduction
- ✓ Start-up with Natural Gas or carbon neutral fuel

Retrofittable

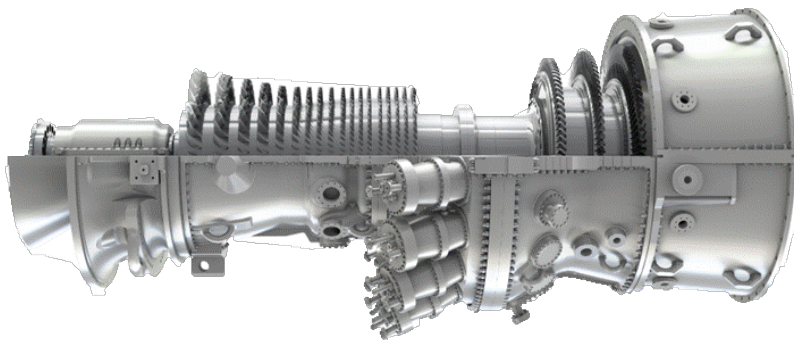
Reduced investment & same life as existing

- ✓ Utilize existing power plant assets with smaller modification for fuel conversion from natural gas to ammonia
- ✓ Target to maintain component durability and existing F-class life

NOx emission

Comply with stringent emission requirement

- ✓ New combustion technology with conventional NOx after treatment systems
- ✓ Target to meet Japan's regulation for NOx



9F.04 : Source : GE Vernova



IHI's Large-scale Combustion Test facility (LCT)

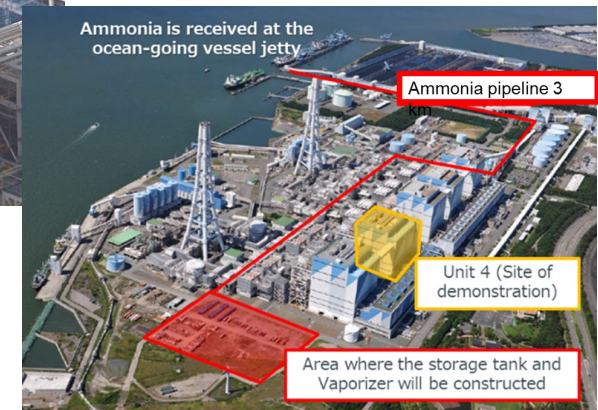
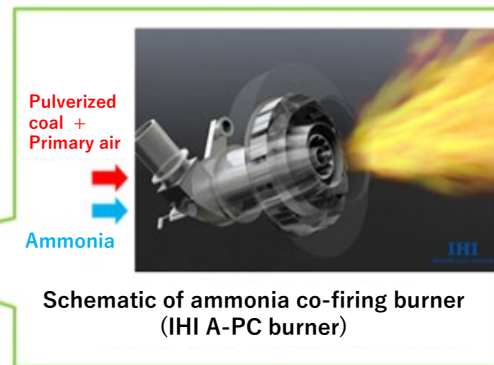
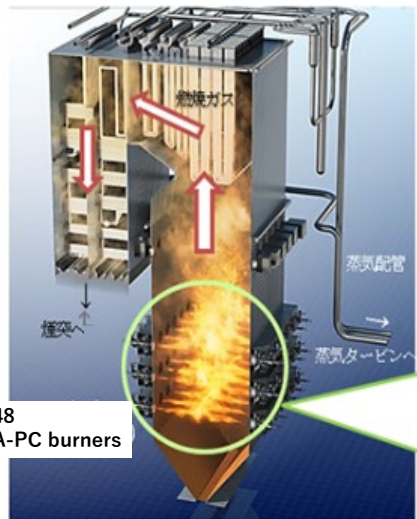
Ammonia Firing Thermal Power Generation

IHI and JERA Joint Demonstration Project in 2024

- 1GW Coal-Fired Power Plant with 20% Ammonia firing
- Annual Ammonia Consumption: 0.5 million tons
- Annual CO2 Reduction: 1 million tons

Key Contributions

- Accelerating a Speedy and Smooth Energy Transition
- Maximizing Utilization of Existing Infrastructure
- Achieving Significant CO2 Reduction
- Establishing a Large-Scale Ammonia Hub

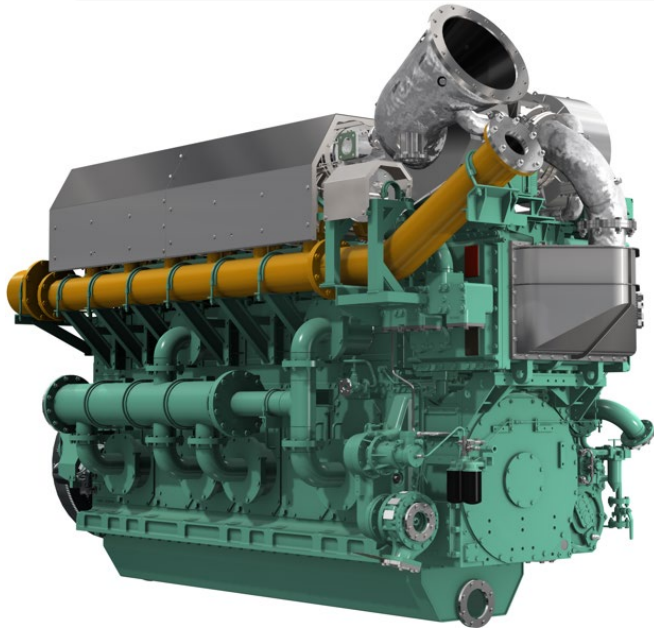


Source: JERA HP

JERA Hekinan Power Station

Current Achievements

- Three-Month Operation with 90%+ Ammonia Firing in Tokyo Bay, Starting August 2024
- Verification of Comprehensive Engine Performance
Output, Efficiency, Emissions, etc.
- Verification of Onboard Operations
Fuel Handling and Safety Management Systems



**Ammonia-fueled Engine
(28ADF,2200PS)**

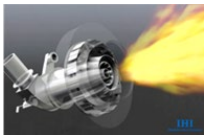


NEDO : JPNP21031

**Ammonia-Fueled Tugboat
(Sakigake, NYK Line)**

Updates in Technologies for Ammonia Utilization IHI

Wide range of ammonia utilization technologies currently in development

Field	Items		Description	Status
Power	Boiler		Developing ammonia combustion technologies for thermal power plants	Demonstration of 20% ammonia combustion at JERA's Hekinan Thermal Power Station #4 from Apr 2024 - successfully completed Jun 2024
	Large Gas Turbines	 9F.04 : Source : GE Vernova	IHI and GE Vernova (GEV) entered into joint development agreement to apply IHI's 100% ammonia combustion technology to GEV's gas turbines (6F.03, 7F and 9F)	Aiming to develop a commercially viable gas turbine by 2030
Maritime	Recip. Engine	 Source: NYK Line	Developing reciprocating engines for vessels with ammonia-fueled engine	Ammonia-Fueled Tugboat completed demonstration voyage Nov 2024 , Ammonia-Fueled Ammonia Gas Carrier will be delivered by Nov 2026 .
			To be used as a means for both maritime and onshore applications	Dual fuel engine to be commercialized in 2027 and single fueled ammonia engine in the near future for onshore application.
Industry	Small Gas Turbine		World's first 100% ammonia combusted gas turbines to achieve CO ₂ free power generation	Durability test from July 2024 to 2025 , to be commercialized in 2026
	Furnace		IHI to convert existing fuel for various industrial furnaces (naphtha cracking furnace etc.) to ammonia fuel	Ammonia single-fuel burners demonstrated at naphtha cracking furnace, Idemitsu Kosan Co., Ltd in Feb 2024

IHI has **achieved key technology** milestones across a range of ammonia utilization technologies including:

- **20% Ammonia firing on a 1000MW boiler (2024)**
- **100% Ammonia mono-firing on the 2MW gas turbine** demonstrator and subsequent Joint Development Agreement with GE Vernova. **New Test Facility completed June 2025** to accelerate full scale technology validation and commercialization
- **90+% Ammonia firing on 4 stroke Maritime Engines (2024)**

These technologies will play a key role in the energy transition from traditional fossil fuel to renewables, hydrogen and ammonia. **IHI is now actively pursuing upstream, midstream and downstream opportunities** globally for creating the green ammonia society.



Acknowledgment:

The results on gas turbine, boiler and engine were obtained from projects, JPNP21020(Green Innovation Fund Project), JPNP16002 and JPNP21031(Green Innovation Fund Project) led by the New Energy and Industrial Technology Development Organization (NEDO).