

Fuel Ammonia for Decarbonization: Current Status and ASEAN Engagement

April 22, 2026

CFAA (Clean Fuel Ammonia Association)



Clean Fuel Ammonia Association

Establishment

- 2014~2018 : In pursuit of a hydrogen society, the Cross-ministerial **Strategic Innovation Promotion (SIP)** Program was implemented.
- April 1, 2019 : Green Ammonia Consortium (as an independent **General Incorporated Association**)
- January 14, 2021 : **Clean Fuel Ammonia Association (CFAA)**(name was changed)
- Members **249** Corporations, Institutions and Gov. Offices from **19** countries(1st April, 2026)

Objectives

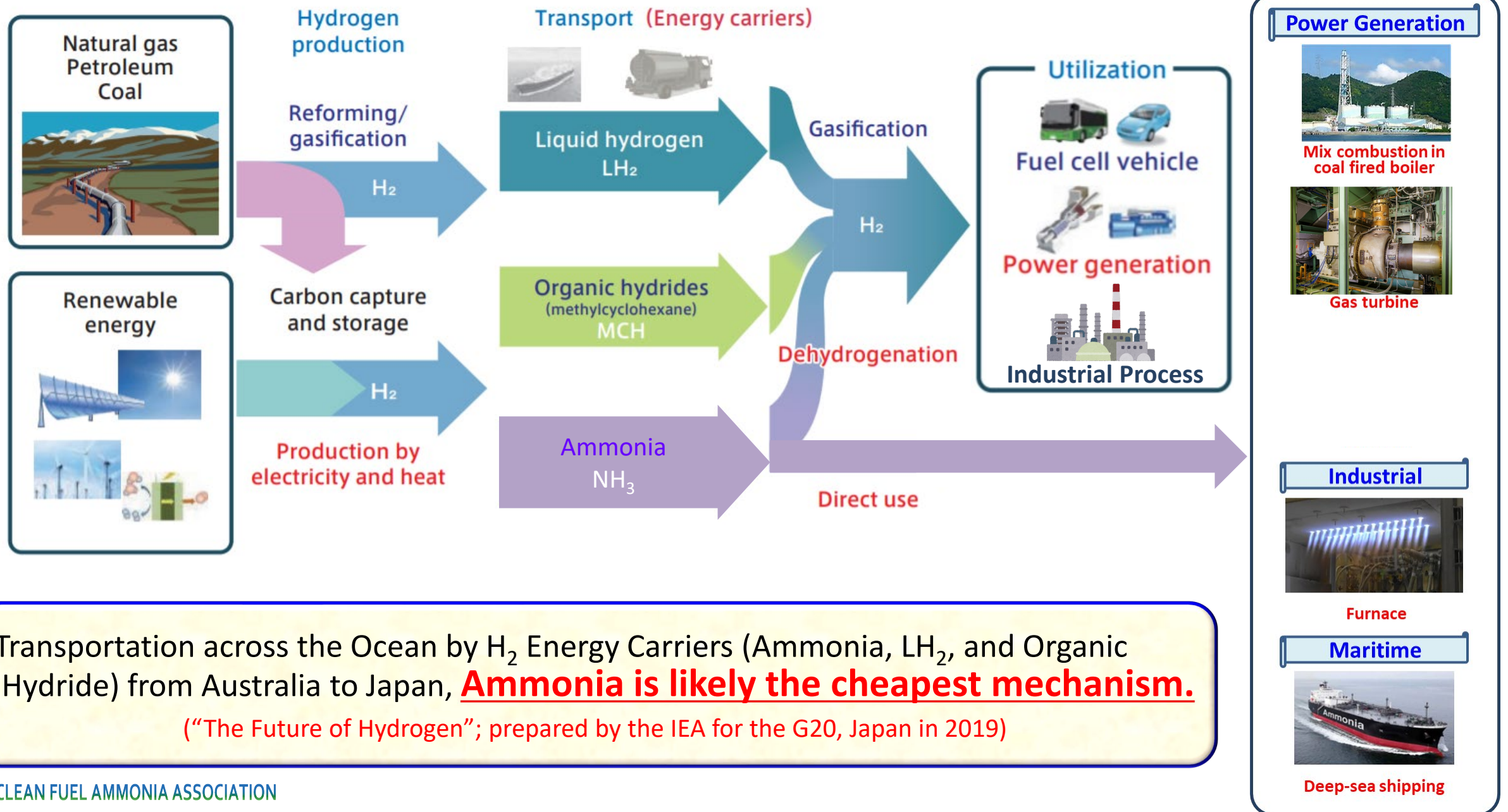
- Contribution to the realization of a **hydrogen/ammonia society** by aiming to mitigate global warming and enhance energy security, under the recognition that ammonia is a **promising hydrogen energy carrier**
- Establishment of **value chains** that focus on **using clean ammonia fuels and raw materials** to contribute to the achievement of a low-carbon society

Main activities

- Promoting collaboration by providing a **common platform** for members and stakeholders
- Promoting **information sharing and exchange** among members
- Deliberation toward the development of **technical standards and guidelines** for the ammonia supply chain
- Formulation of strategies** and **policy advocacy** for the early social implementation of clean ammonia
- International collaborations**
- Public awareness and outreach activities to promote **proper understanding and adoption** of clean fuel ammonia



Hydrogen Energy Carrier



Transportation across the Ocean by H_2 Energy Carriers (Ammonia, LH_2 , and Organic Hydride) from Australia to Japan, **Ammonia is likely the cheapest mechanism.**

(“The Future of Hydrogen”; prepared by the IEA for the G20, Japan in 2019)



Why Ammonia

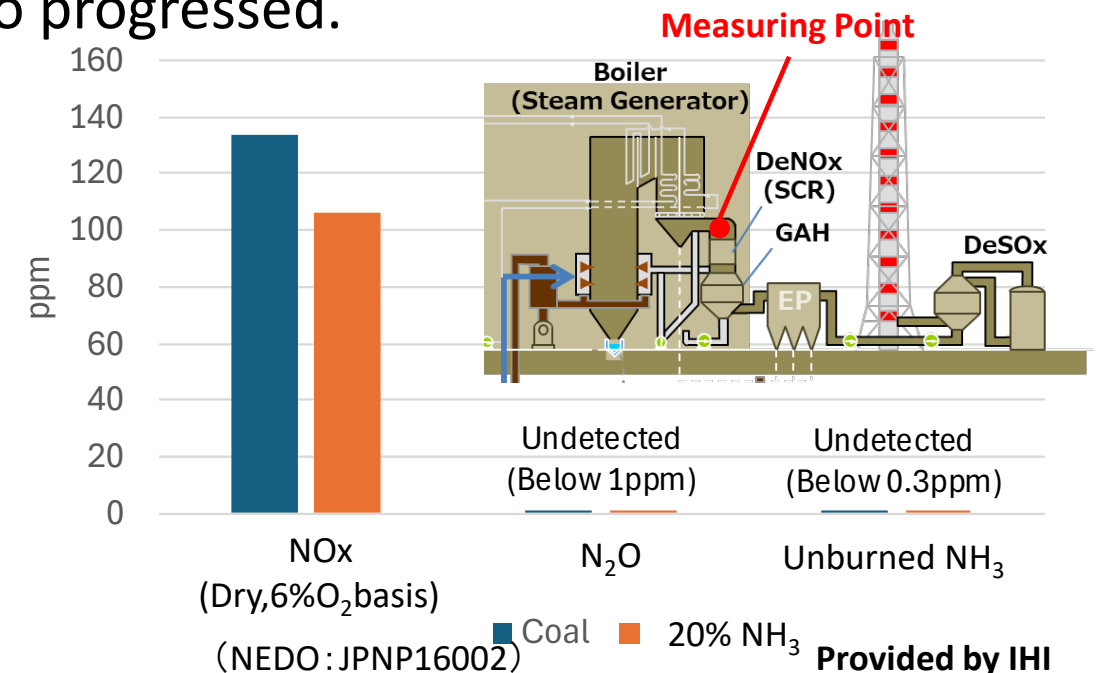
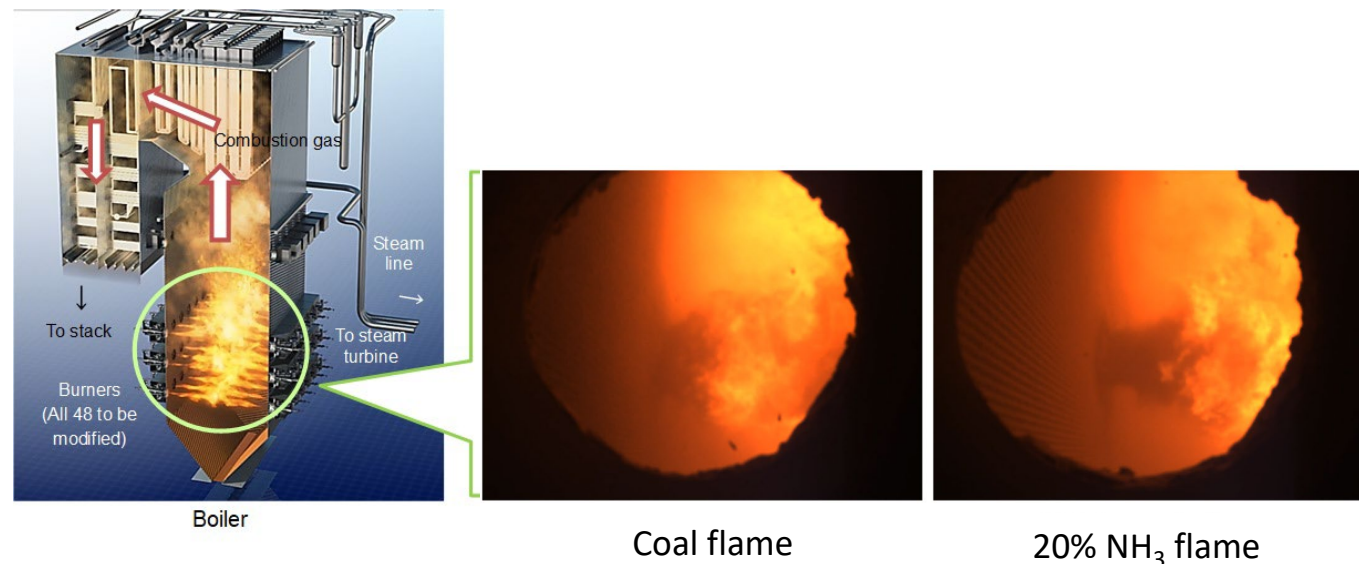
- Directly combusted without CO₂ emissions.
- Largest H₂ content among 3 carriers and most efficient in marine transportation.
(NH₃ **121** kg-H₂/m³ liquid , LH₂ 71 kg-H₂/m³ , MCH 47 kg-H₂/m³)
- Large commercial supply chain is established, and cost structure is clear.
(Global production: 200 million tons, International trade: 20 million tons)
- NOx emissions can be controlled by technologies.
(Air-fuel ratio , Two staged combustion etc.)
- Technologies are becoming ready for commercial use.
- Safety standards are practically used in chemical and power industries.
- Primary markets are controlled facilities with trained operators such as power plant, industrial factories and data centers.



Development of Fuel Ammonia Utilization Technologies Toward Social Implementation

Coal Fired Boiler

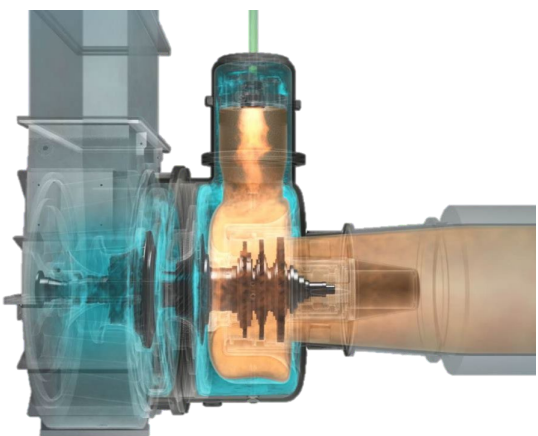
- Demonstration at 1,000MW Coal Power Plant with 20%NH₃
- This effort has yielded favorable environmental outcomes.
 - ✓ NO_x emissions are equal to or less than before ammonia substitution.
 - ✓ Emissions of powerful greenhouse gas N₂O and unburnt NH₃ have been undetectable.
 - ✓ CO₂ and SO_x emissions are reduced by 20%.
 - ✓ Flue gas properties were good condition in terms of emission.
- Preparation are ongoing for commercial operation with 20%NH₃ starting in 2028.
- Development for higher NH₃ co-firing ratio is also progressed.



Development of Fuel Ammonia Utilization Technologies Toward Social Implementation

Gas Turbine

- 2MW Power output
- ✓ Liq. NH₃ Pure Firing
- ✓ Rich and lean two stage combustion system
- ✓ NOx emissions meet Japan's urban regulations with SCR
- Under development to deploy same technologies to large-scale gas turbines up to 400MW



2MW gas turbine

Provided by IHI



2MW gas turbine system (NEDO:JPN21020)

Provided by IHI

Marine Engine

- Ammonia-fueled engine for coastal vessels (1,600kW)
- ✓ Completed max. 95% NH₃ co-firing
- ✓ Nox emissions meet Tier III regulation with SCR
- ✓ Demonstration voyage of tugboat equipped above engine successfully completed
- Ammonia fueled engines were installed on Ammonia Fueled Medium Gas Carrier last November, with delivery scheduled for November 2026 (8,000kW)



Ammonia-fueled engine
(NEDO:JPN21031)

Provided by IHI



Ammonia Fueled Tugboat
(NEDO:JPN21031)

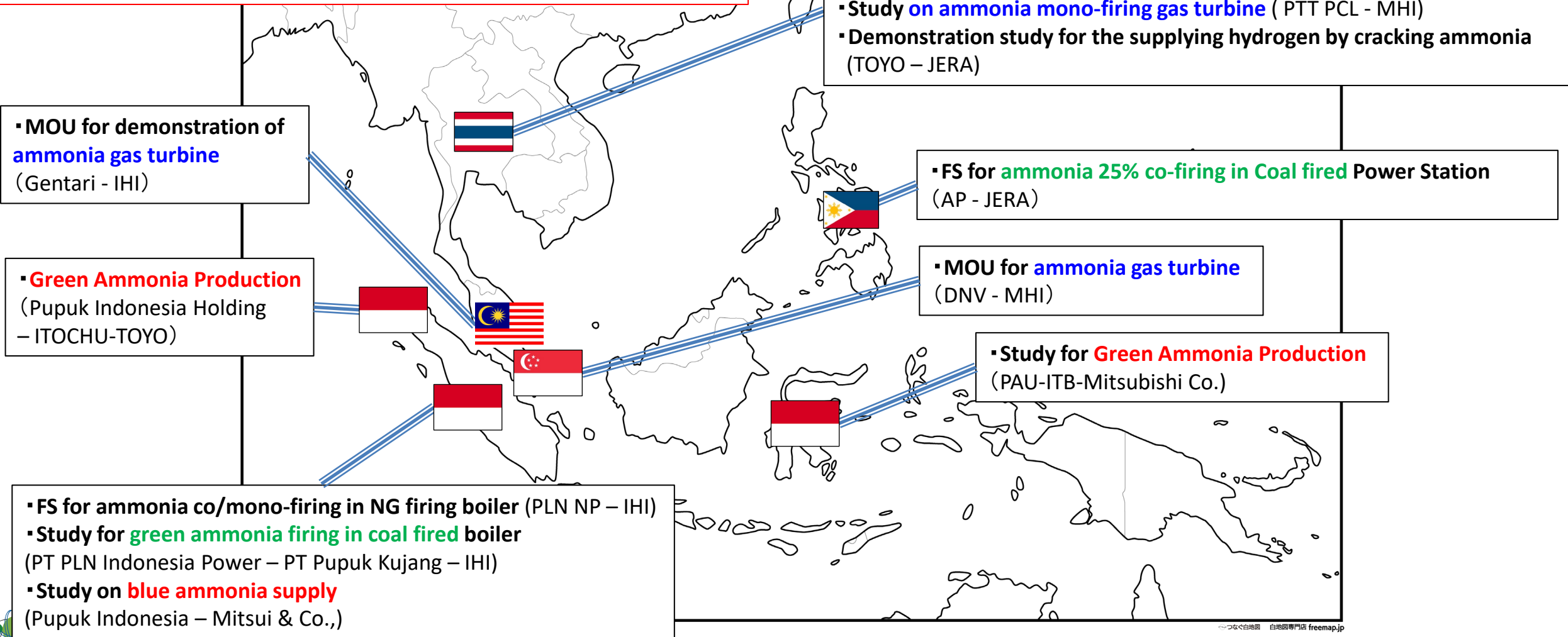
Provided by NYK Line

Our Activities in ASEAN

Green: Ammonia co-firing in coal fired boiler

Blue: Ammonia firing in gas turbine

Red: Ammonia Production/Supply



CEFIA Activity of “Hydrogen & Ammonia”

Objective:

Promote the adoption of fuel ammonia across ASEAN countries.

Key Initiatives:

- Dissemination of technical information on fuel ammonia utilization through **webinars**, **on-site technical visits**, and other outreach activities.

Outline:

▪ On-site Technical Visit:

Date : February 14, 2025 (7th CEFIA Forum in KOBE)

Focus: On-site observation of ammonia combustion burner test facility for coal-fired boilers, and a 2MW ammonia-fired gas turbine demonstration facility

▪ 1st Webinar:

Date : May 25, 2025 Theme : Utilization of Fuel Ammonia for Power Generation

▪ 2nd Webinar:

Date : February 13, 2026 Theme : Utilization of Fuel Ammonia for Industrial Furnace

Friday, 13th February 2026
15:00-18:00 Japan Time (GMT+9)

Hydrogen & Ammonia Webinar

on the Cleaner Energy Future Initiative for ASEAN (CEFIA)

» Agenda

	Time	Activity
OPENING PLENARY	15:00-15:05	Opening Remarks -Hisayuki Mitsui, Ministry of Economy, Trade and Industry (METI) of Japan
SESSION I Japanese Policies on Hydrogen & Ammonia	15:05-15:25	Overview of Japan's Hydrogen and Ammonia Policies -Mr. Yotaro Miyagawa, Ministry of Economy, Trade and Industry (METI) of Japan
	15:25-15:35	Q&A
SESSION II ASEAN's Policies on Hydrogen & Ammonia	15:35-15:50	Exploring Opportunities for Low-Carbon Hydrogen and Ammonia in ASEAN: Current and Future Policies, Markets, and Industrial Hubs -Dr. Tobagus Ariyand Gunawan, ASEAN Centre for Energy (ACE)
	15:50-16:00	Q&A
SESSION III Hydrogen	16:00-16:20	Hydrogen Business by Toyota -Mr. Ryohei Ueda, Project General Manager, Hydrogen Business Division, Hydrogen Factory, Toyota Motor Corporation
	16:20-16:40	Initiatives of Kawasaki Heavy Industries Toward Building a Large-Scale Hydrogen Supply Chain -Kensuke Koide, Chief Executive Staff Officer & Think Tank Department Senior Manager, Kawasaki Heavy Industries, Ltd.
	16:40-16:55	Q&A
	16:55-17:05	Break
SESSION IV Ammonia	17:05-17:25	Use of fuel ammonia in the glass melting furnaces -Mr. Ryoosuke Akagi, Plant Process Team Leader, Glass Process Division, Innovative Technology Laboratories, AOC, Inc.
	17:25-17:45	Ammonia Combustion in Industrial Furnaces: Challenges and Implementation -Ms. Rina Ohkura, Assistant Manager, Research & Development Div., Combustion Technology Group, GX-Product Dept, Chugai Ro Co., Ltd.
	17:45-18:00	Q&A
		Closing Remarks

» Registration for Zoom Webinar
https://bcg.zoom.us/join/wn_pk5t4kdH_TCKPu8E_dGRSBO#/registration



2MW gas turbine system (NEDO:JPN21020)

Provided by IHI



Overview of Webinars

□ Participants:

Approximately 200 attendees in Both Webinars

□ Presentations:

1st Webinar

Technologies for Power Generation Using Fuel Ammonia and Introduction of Other Carbon-Neutral Technologies

- **JERA:** JERA's Decarbonization Activities
- **IHI Corporation:** IHI Carbon Neutral Activities – Ammonia Fuel and Others
- **Mitsubishi Heavy Industries:** Development and Verification of MHI Carbon Neutral Solutions (NH₃, H₂ and CO₂)

2nd Webinar

R&D and Implementation regarding utilization of Fuel Ammonia for Industrial Furnaces

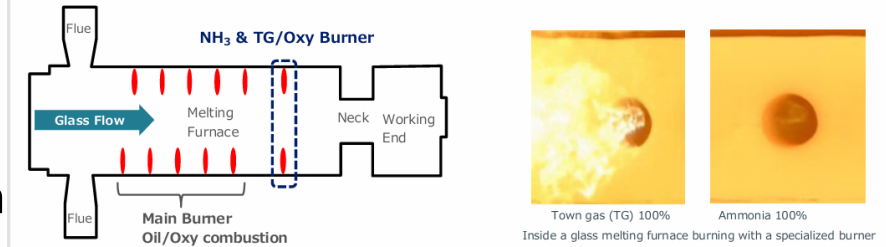
- **AGC Inc.:** Use of Fuel Ammonia in the glass melting furnaces
- **Chugai Ro Co., Ltd:** Ammonia Combustion in Industrial Furnaces: Challenges and Implementation

Webinar will continue in FY2026!

NH₃ combustion test in a glass melting furnace

AGC
Your Dream, Our Challenge

In June of 2023, AGC conducted world's first demonstration test of NH₃ combustion in a glass melting furnace that produces architectural glass.



Target

To verify whether NH₃ combustion technology can be applied to glass melting furnaces by evaluating ①NO_x emission, ②heat behavior and ③equipment stability. 6

Provided by AGC

NEDO "Energy and Environment Advanced Technology Initiative"

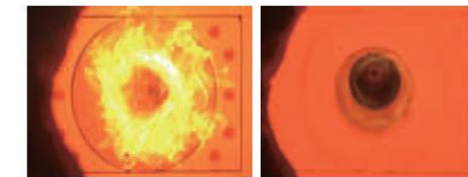
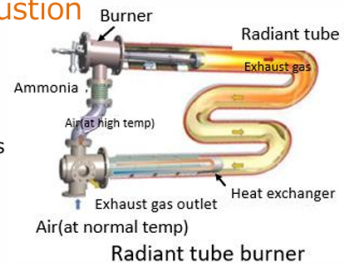
Chugai Ro

Development of Decarbonizing Industrial Furnaces through Innovative Ammonia Combustion

(Osaka university, Chugai Ro Co., Ltd, Tokyo university)

Identification and Arrangement of Issues for Social Implementation

- Various combustion simulations, numerical analyses
- Investigation of the effects on furnace structural materials and heated objects
- Performance evaluation via combustion testing using Radiant tube burner and Regenerative burner



in 100 kW-Class Combustion Test Furnace natural gas(13A) flame (left) and ammonia flame (right)

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Thank you for your kind attention

