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)

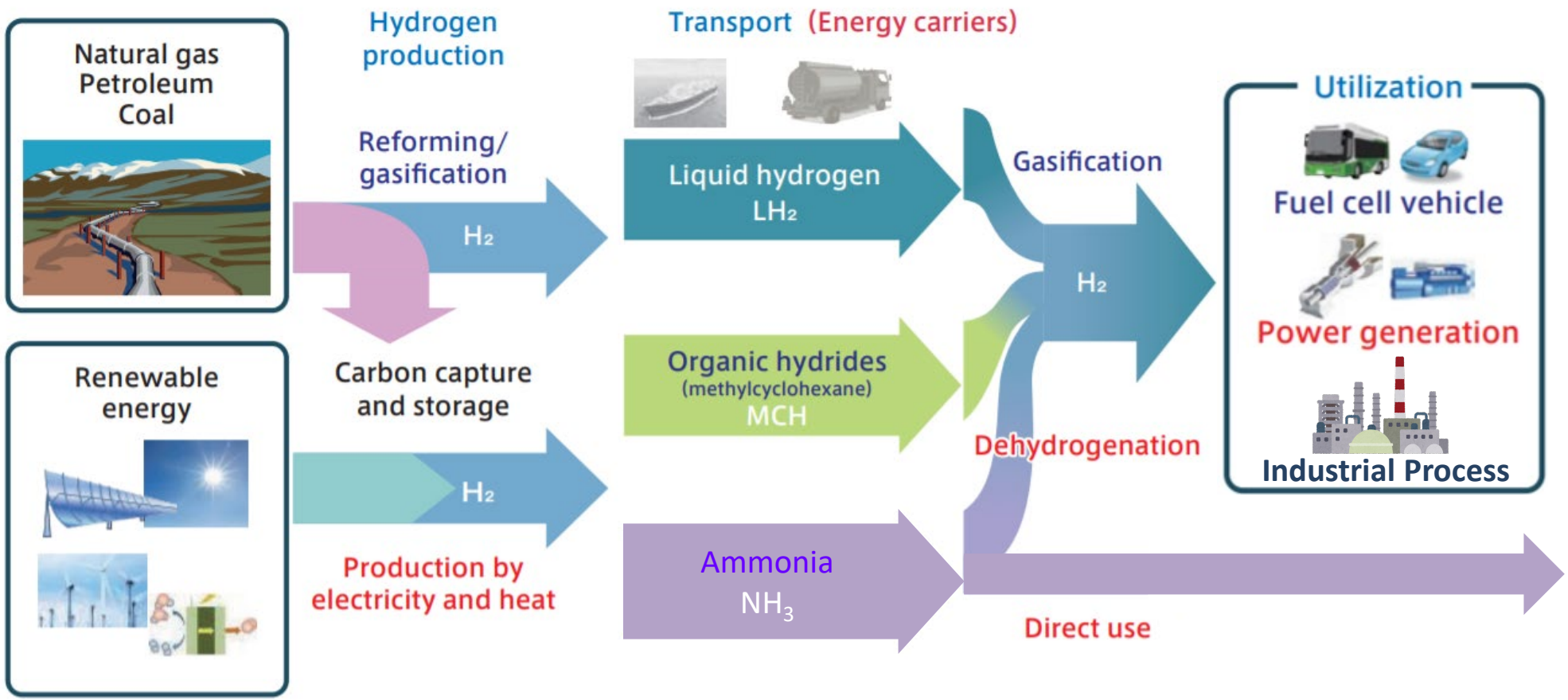
Objectives

- 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

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

Hydrogen Energy Carrier



Power Generation

Mix combustion in coal fired boiler

Gas turbine

Industrial

Furnace

Maritime

Deep-sea shipping

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)

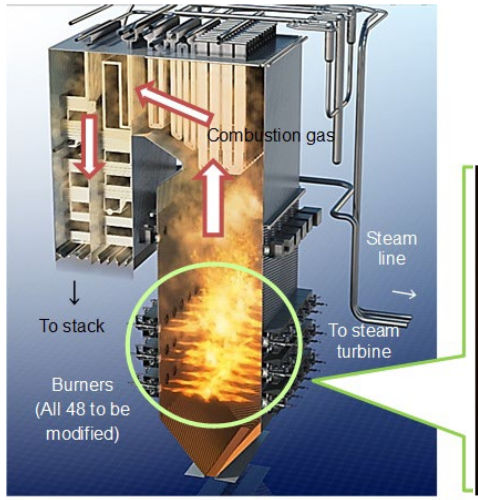
Why Ammonia

- Directly combusted without CO_2 emissions.
- Largest H_2 content among 3 carriers and most efficient in marine transportation.
  (NH_3 **121** kg-H_2/m^3 liquid , LH_2 71 kg-H_2/m^3 , MCH 47 kg-H_2/m^3)
- 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.

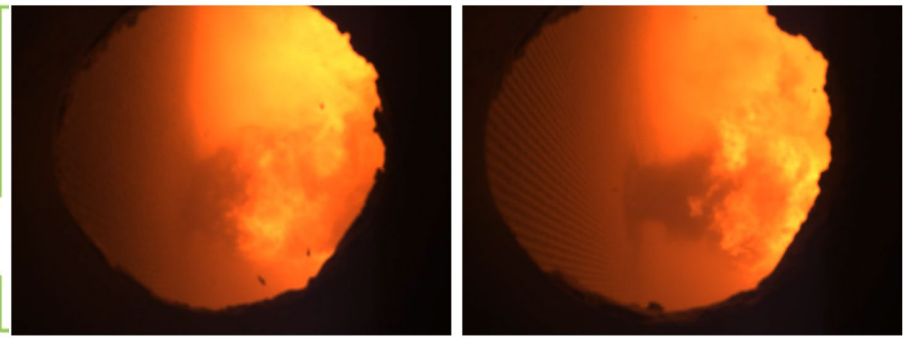
Development of Fuel Ammonia Utilization Technologies Toward Social Implementation

Coal Fired Boiler

- Demonstration at 1,000MW Coal Power Plant with 20%NH_3
- This effort has yielded favorable environmental outcomes.
  - ✓ NOx emissions are equal to or less than before ammonia substitution.
  - ✓ Emissions of powerful greenhouse gas N_2O and unburnt NH_3 have been undetectable.
  - ✓ CO_2 and SOx emissions are reduced by 20%.
  - ✓ Flue gas properties were good condition in terms of emission.
- Preparation are ongoing for commercial operation with 20%NH_3 starting in 2028.
- Development for higher NH_3 co-firing ratio is also progressed.



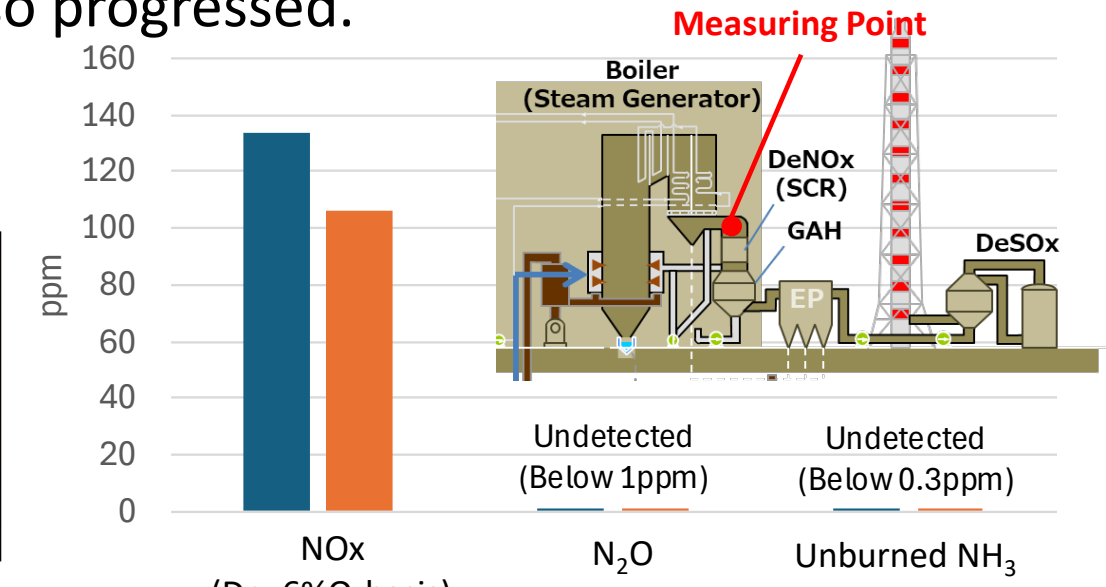
Boiler


Coal flame

20% NH_3 flame

(NEDO：JPNP16002)

Provided by IHI



(NEDO：JPNP16002)

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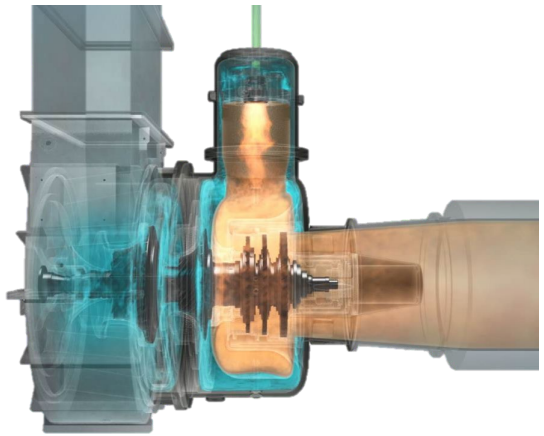
Development of Fuel Ammonia Utilization Technologies Toward Social Implementation

Gas Turbine

- 2MW Power output
- ✓ Liq. NH_3 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% NH_3 co-firing
- ✓ Nox emissions meet TierⅢ 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)

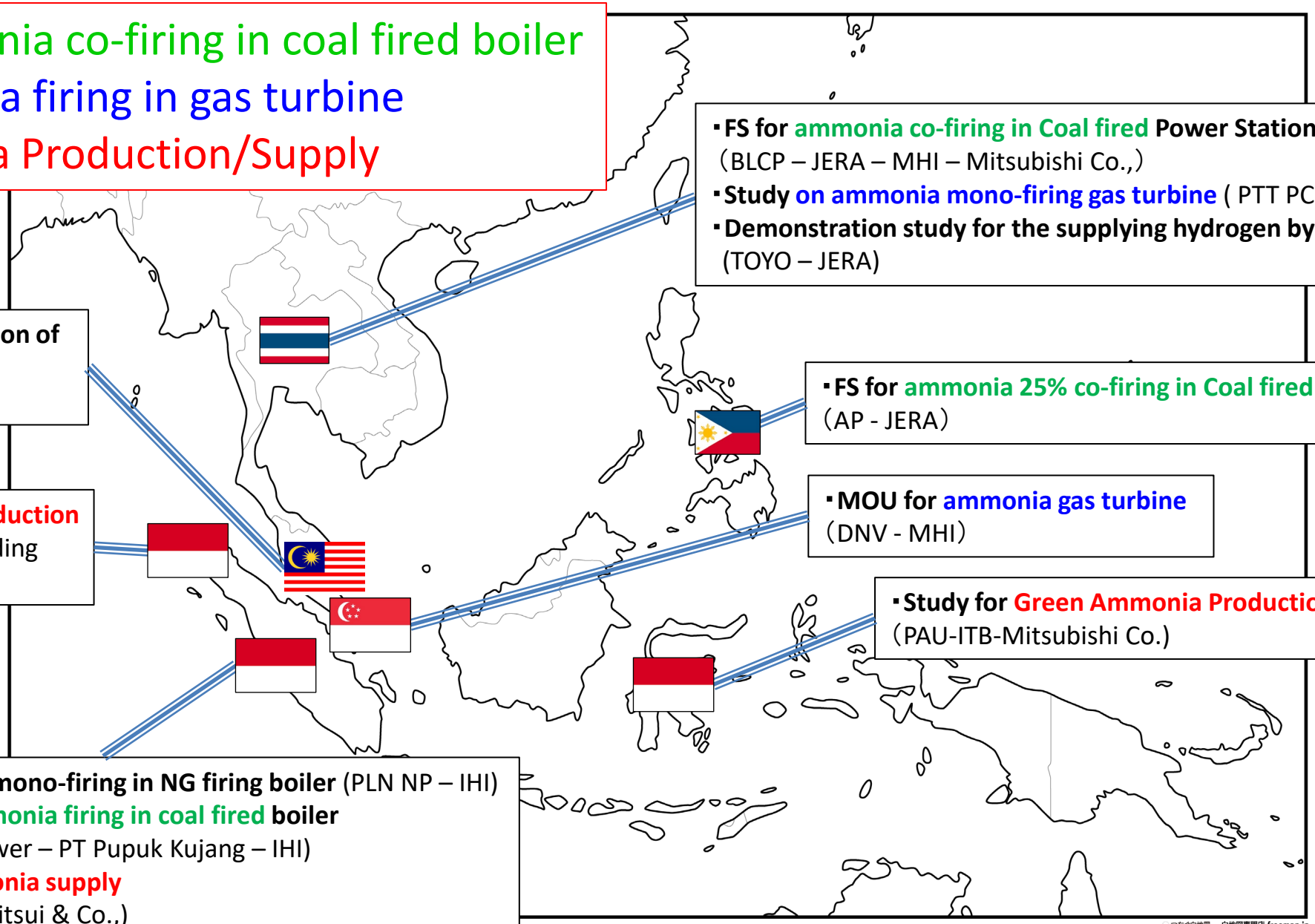
Provided by IHI

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



- **FS for ammonia co-firing in Coal fired Power Station**
（BLCP – JERA – MHI – Mitsubishi Co.,）
- **Study on ammonia mono-firing gas turbine** (PTT PCL - MHI)
- **Demonstration study for the supplying hydrogen by cracking ammonia**
(TOYO – JERA)

- **MOU for demonstration of ammonia gas turbine**
（Gentari - IHI）

- **FS for ammonia 25% co-firing in Coal fired Power Station**
（AP - JERA）

- **MOU for ammonia gas turbine**
（DNV - MHI）

- **Green Ammonia Production**
（Pupuk Indonesia Holding – ITOCHU-TOYO）

- **Study for Green Ammonia Production**
（PAU-ITB-Mitsubishi Co.）

- **FS for ammonia co/mono-firing in NG firing boiler** (PLN NP – IHI)
- **Study for green ammonia firing in coal fired boiler**
(PT PLN Indonesia Power – PT Pupuk Kujang – IHI)
- **Study on blue ammonia supply**
(Pupuk Indonesia – Mitsui & Co.,)

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

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

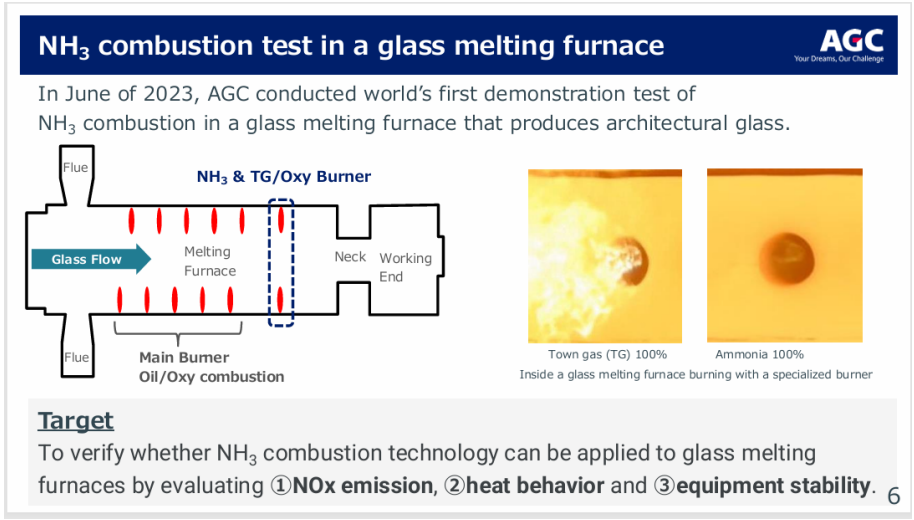
- **JERA:** JERA's Decarbonization Activities
- **IHI Corporation:** IHI Carbon Neutral Activities – Ammonia Fuel and Others
- **Mitsubishi Heay Industries:** Development and Verification of MHI Carbon Neutral Solutions（NH3, H2 and CO2）

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!



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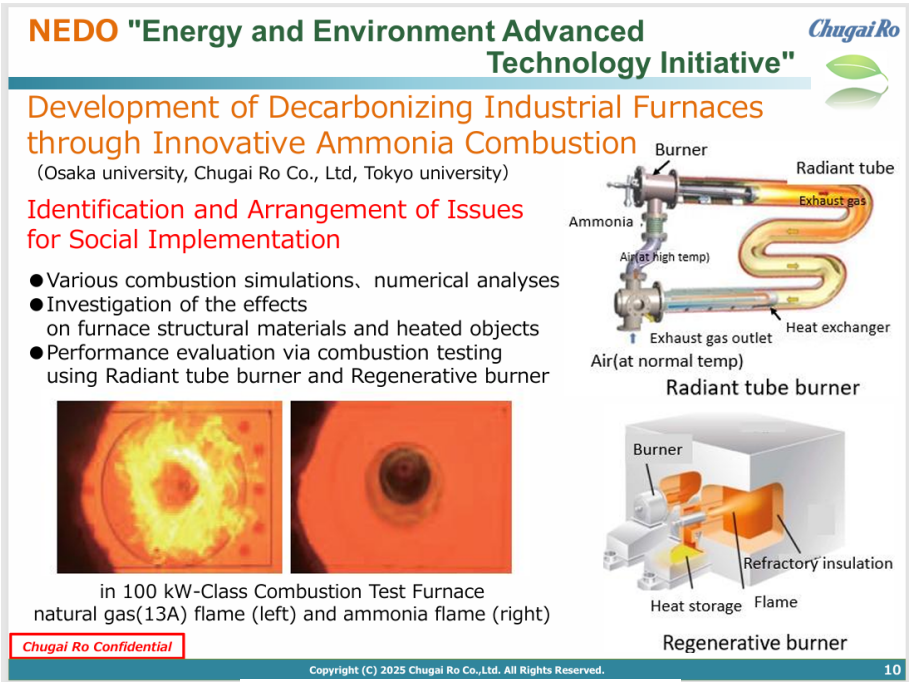

Provided by Chugai Ro

Thank you for your kind attention