

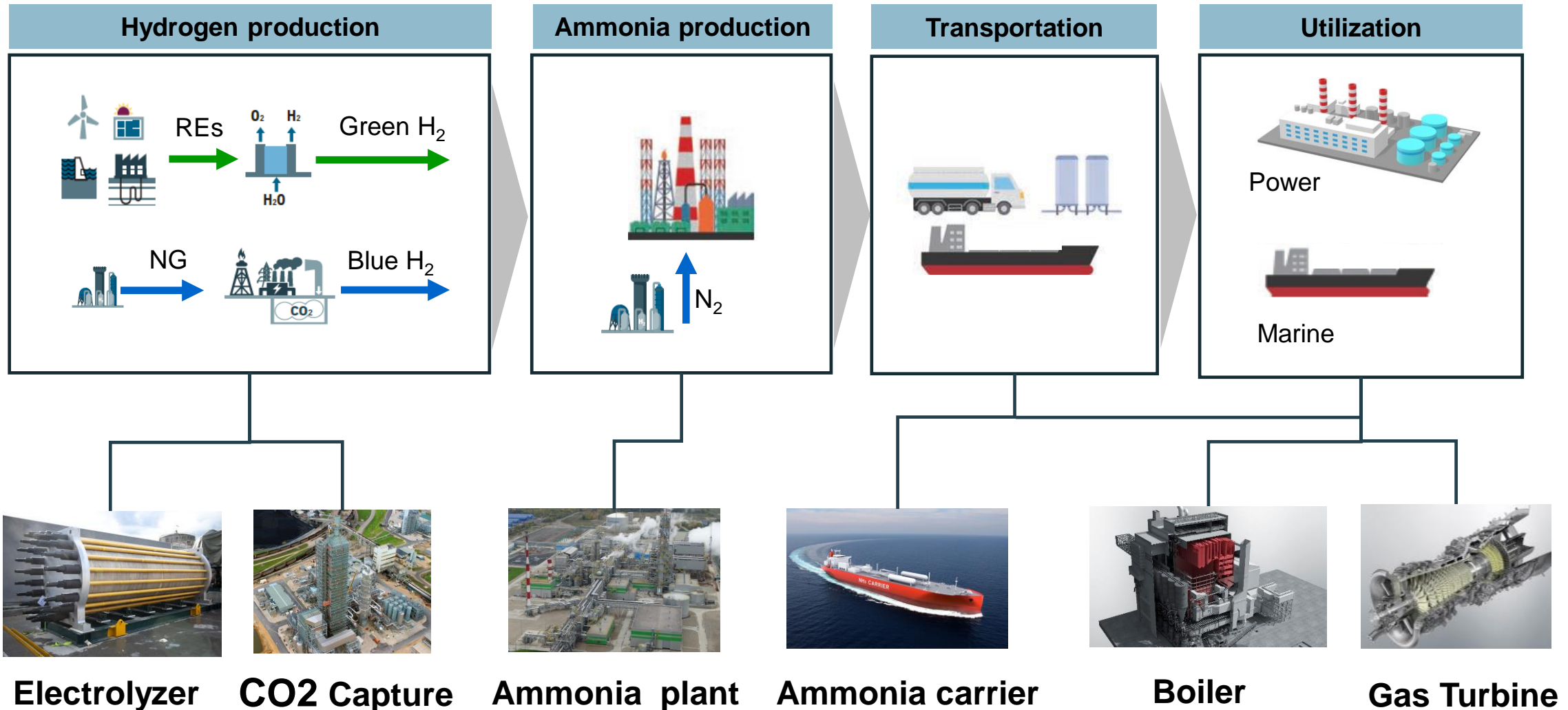
MHI Group Activities to Establish Ammonia Value Chain for Fuel Use

Second International Conference on Fuel Ammonia

September 28, 2022

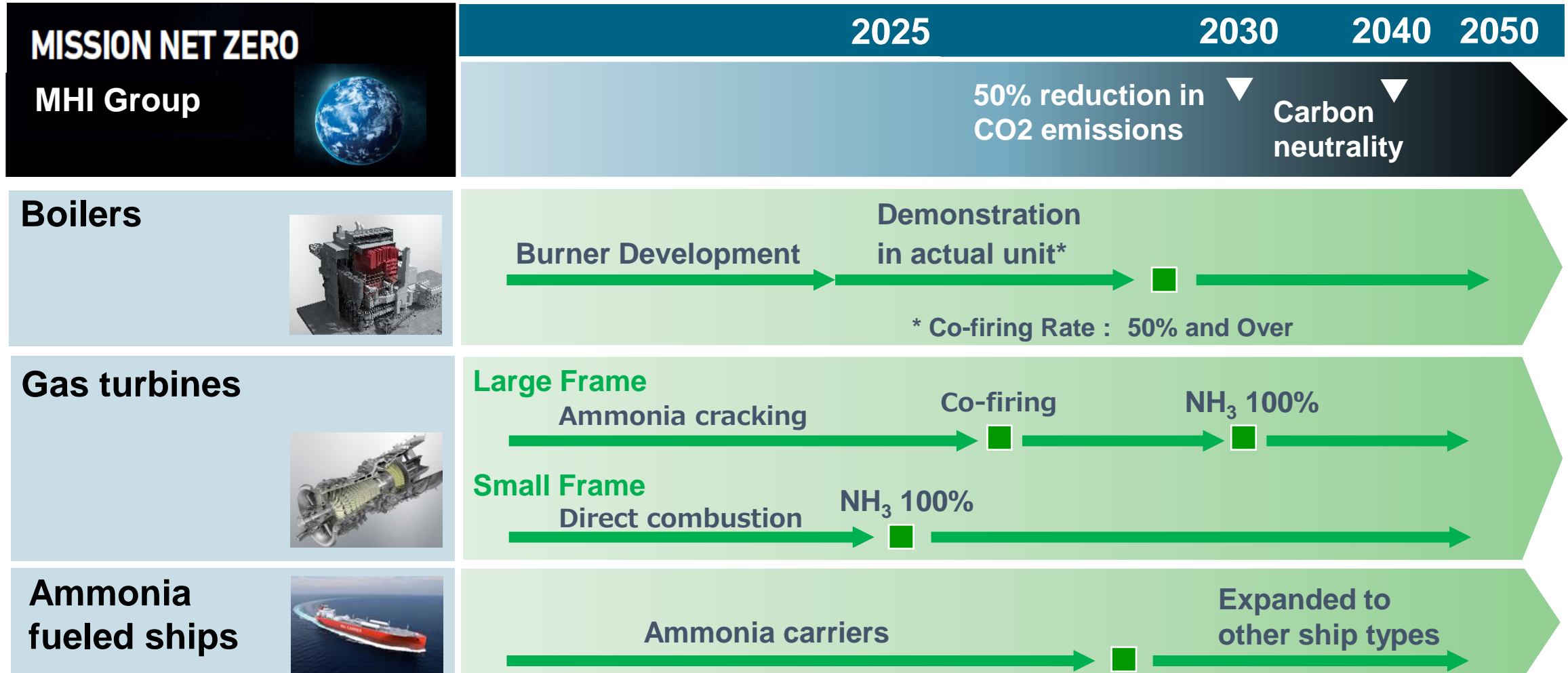
Mitsubishi Heavy Industries, Ltd.

- MHI Group has many products that contribute to the establishment of the ammonia value chain



- MHI group promotes the development of products using ammonia, a decarbonized fuel, with targets of a 50% reduction in CO2 emissions by 2030 and carbon neutrality by 2040.

Commercialization



Ammonia Combustion Technology Development

- Under the developing the ammonia co-firing technologies, and to be planned demonstration of ammonia co-firing in actual coal-fired boilers, with 50% over co-firing rate, supported by GI Fund*¹ program of NEDO*².

*1: **G**reen **I**nnovation Fund (National project in Japan)

*2: **N**ew **E**nergy and Industrial Technology **D**evelopment **O**rganization

- The R&D and co-firing demonstration will be completed by end of 2028. They are now on schedule.



Ammonia Burner (Image only)

Ammonia Co-firing Feasibility Study in Coal-fired Plant

- MHI has started feasibility study to be conducted for the Suralaya Power Station in Indonesia using fuel ammonia, supported by Japan's METI*³.

*3: **M**inistry of **E**conomy, **T**rade and **I**ndustry

- Under the discussion with overseas customers in Taiwan, Thailand, India and so on as well as domestic customers, for the future fuel ammonia utilization.



★: FS in progress

★: Under discussion of FS

Potential customer for fuel ammonia co-firing boiler

100% Ammonia Direct Combustion Power Plant on Jurong Island, Singapore

- Singapore, August 19, 2022 - Jurong Port, JERA Asia, MHI-AP concluded MOU
- Joint study for 60 MW class gas turbine combined cycle plant fueled by 100 % ammonia
- Produce carbon-neutral electricity, as well as stimulate ammonia demand to be ready for ammonia bunkering in future



Ammonia Carrier



Ammonia tank terminal



100% Ammonia direct combustion power generation



Ammonia fueled ship

The other potential projects



TNB

Expansion of Kapar plant with H2-ready & low-carbon gas turbine technology



Malakoff

De-carbonization of existing Tanjung Bin coal fired power plant



Keppel New Energy

100% ammonia fueled power plant in Singapore



PLN

Modification of existing H-25 GTCC power plant in Indonesia



Institut Teknologi Bandung (ITB)

Joint research and development for ammonia technology

PRESS INFORMATION

Mitsubishi Shipbuilding to Commence Development of Large-size Ammonia Carrier Fueled by Ammonia -- Collaboration with Mitsui O.S.K. Lines and Namura Shipbuilding Targets Decarbonization of Maritime Industry --

2021-11-04



- Aims set on achieving operation of vessels fueled by ammonia – a clean energy – and increasing volume of marine transportation of ammonia
- Basic design concept to be developed among those three partners.



PRESS INFORMATION

Mitsubishi Shipbuilding Completes Conceptual Study on Floating Storage and Regasification Unit (FSRU) for Ammonia Together with Mitsui O.S.K. Lines -- FSRU Will Promote Use of Ammonia as Energy Contributing to Decarbonization --

2022-02-03



- Mitsubishi Shipbuilding studied various specifications and conditions, and developed conceptual designs of more environmentally friendly Ammonia FSRU
- An MOU has been concluded with Mitsui O.S.K. Lines and Kansai Electric Power toward realizing the world's first Ammonia FSRU



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