

July 2022

Capital Link Decarbonization Forum

DESIGNING SHIPS OF THE FUTURE -TECHNOLOGY TO
ENSURE DECARBONIZATION SHIP AND SOCIETY

= Integrated Project for NH3 Fuel Ship =

ITOCHU Corporation
Green Innovation Business Unit



I am One with Infinite Missions

1. Introduction

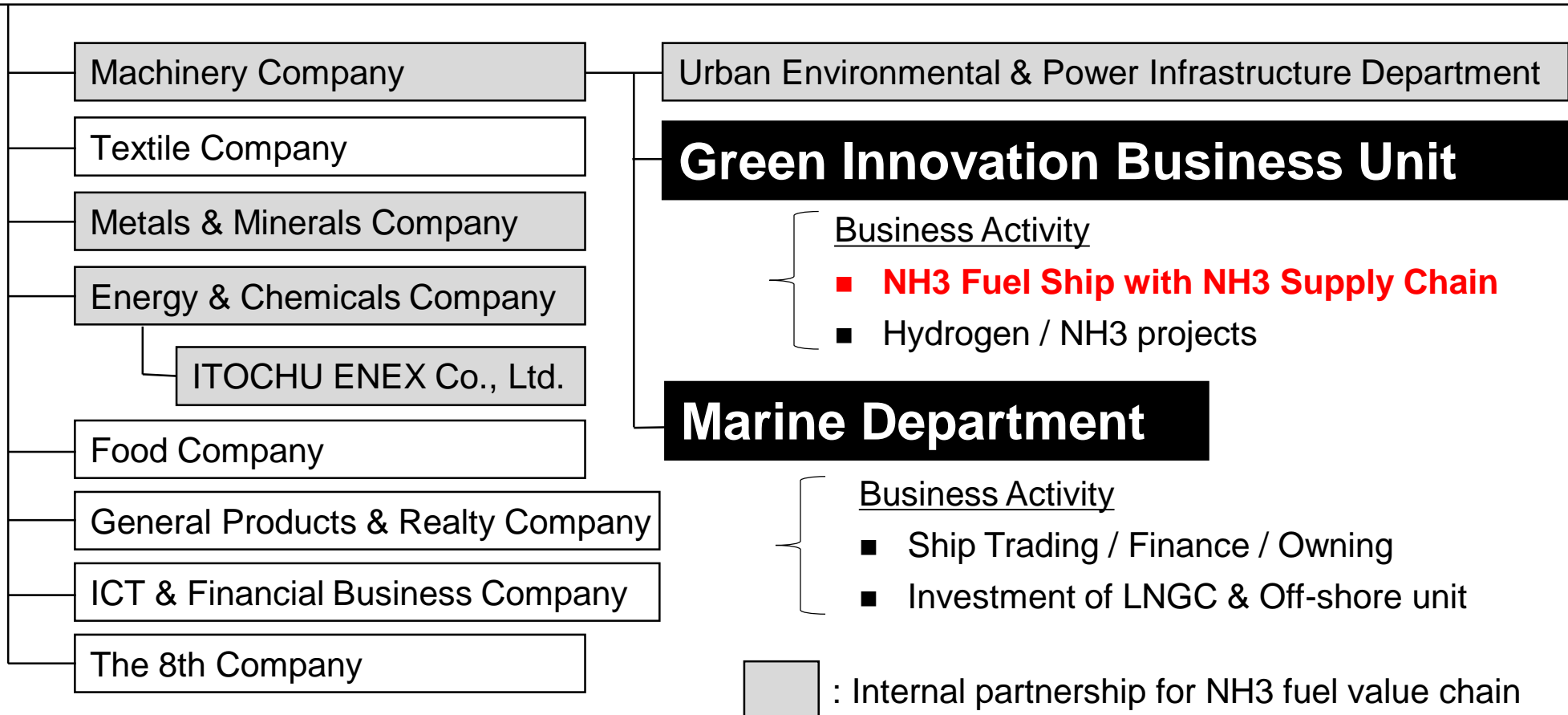


Founded : 1858 (incorporated 1949)

Number of employees : 4,319

Number of offices: 94 (oversea) & 9 (domestic)

Website: <http://www.itochu.co.jp>



2. Option for Zero-Emission Fuel

Fuel		CO2 Emission	Liquid	Tank Capacity	Status
Existing	LSFO	1	-	1.0	■ Slow speed under EEXI / CII
	LNG	0.74	-163°C	1.7	■ 25% reduction
	Methanol	0.90	-	2.3	■ 10% reduction
	Biofuel	NET 0	-	~1.2	■ Limited supply volume



Hydrogen base fuel	Hydrogen	0	-253°C	4.4	<ul style="list-style-type: none"> ■ Fuel Tank with low temperature ■ Coastal ship as pilot project
	Carbon recycle fuel ■ E-methanol ■ E-LNG	NET 0	-	-	<ul style="list-style-type: none"> ■ Definition of “NET 0” ■ Carbon recycle with <ul style="list-style-type: none"> • CCS on board ; or • Direct Air Capture
	Ammonia	0	-33°C	3.0	<ul style="list-style-type: none"> ■ Engine Development ■ Safety Guideline (Toxicity) ■ CO2 emission at production (grey)

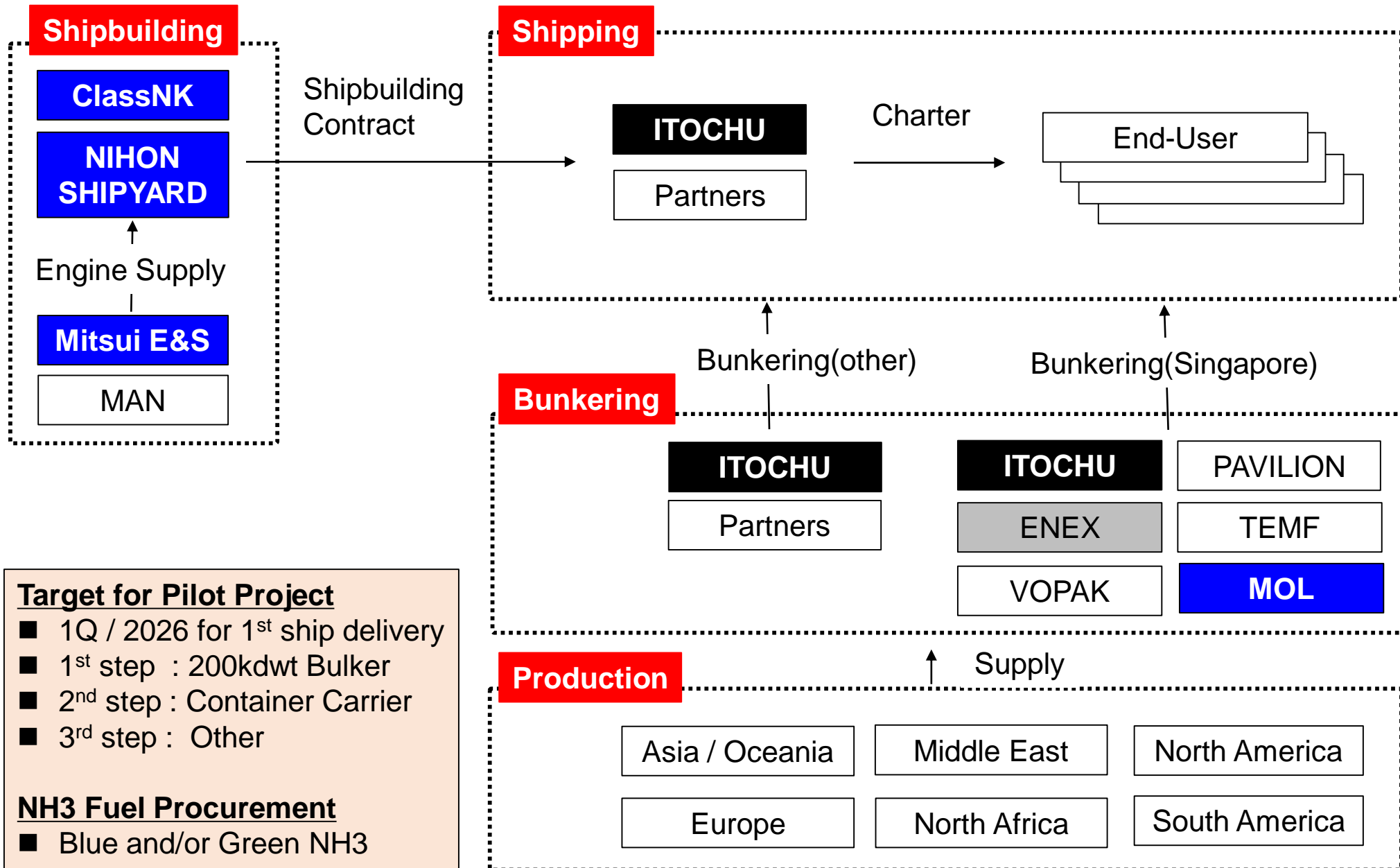
3. General Information for NH3 Fuel Ship

Item	Party	Up-dated Status
Engine Development	MAN Energy Solutions Future in the making MITSUBISHI E&S	<ul style="list-style-type: none"> ■ Engine Test from 2nd half of 2022
Safety Guideline	ABS BUREAU VERITAS Lloyd's Register ClassNK DNV	<ul style="list-style-type: none"> ■ Issuance of Guideline for NH3 Fuel Ship in 2021 ■ Commencement of discussion as to International Guideline for NH3 Fuel Ship at IMO from 2022
	IAPH International Association of Ports and Harbors SGMF the society for gas as a marine fuel	<ul style="list-style-type: none"> ■ Execution of MOU for NH3 Bunkering in 2021
	M P A SINGAPORE	<ul style="list-style-type: none"> ■ Under preparation of Safety Guideline for NH3 Bunkering in Singapore

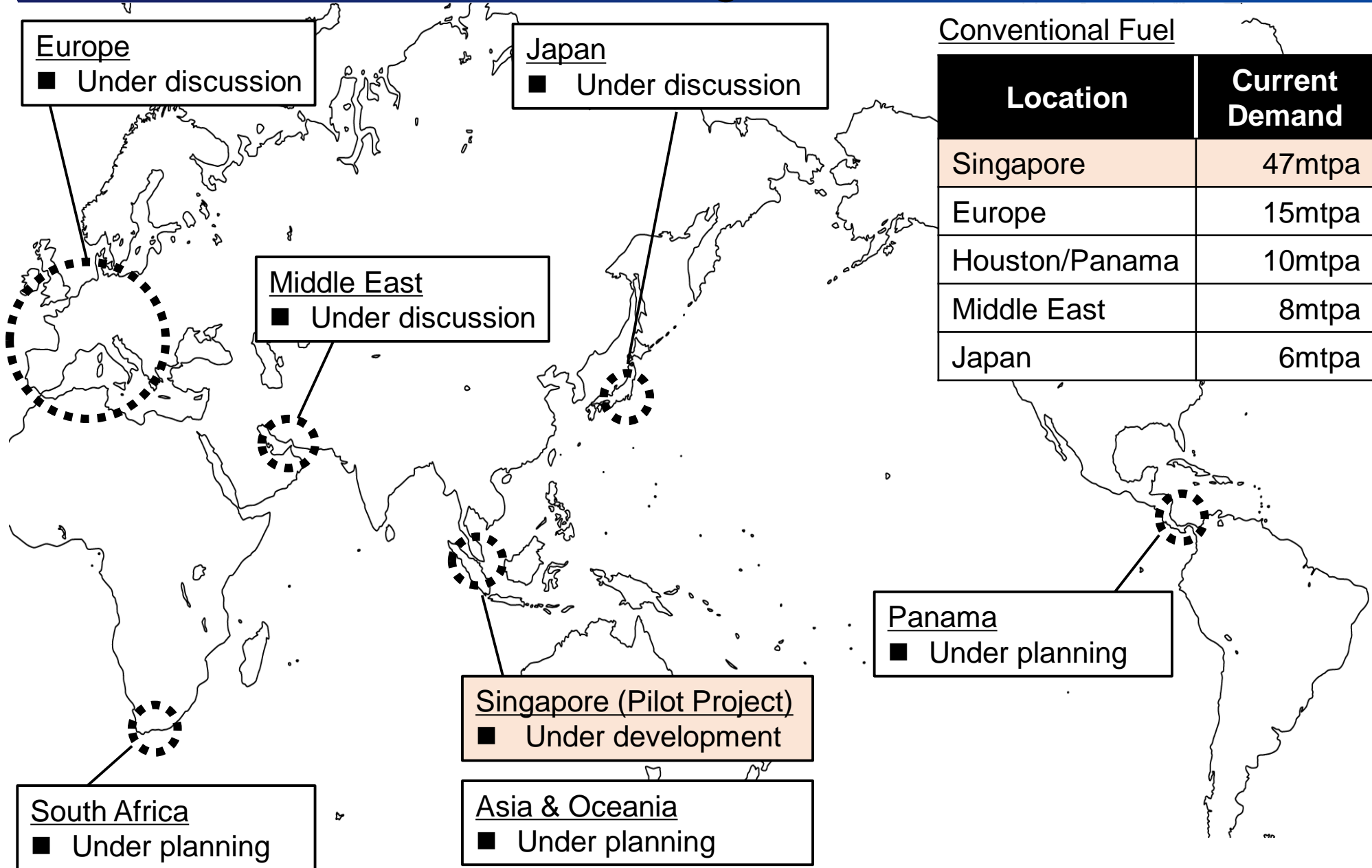


Economics	IMO INTERNATIONAL MARITIME ORGANIZATION MLIT Ministry of Land, Infrastructure, Transport and Tourism	<ul style="list-style-type: none"> ■ Commencement of discussion as to MBM at MEPC 78 (June 2022) with target of adoption in June 2023 ■ MLIT in Japan proposed their own proposal
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4. Integrated Project with partnership



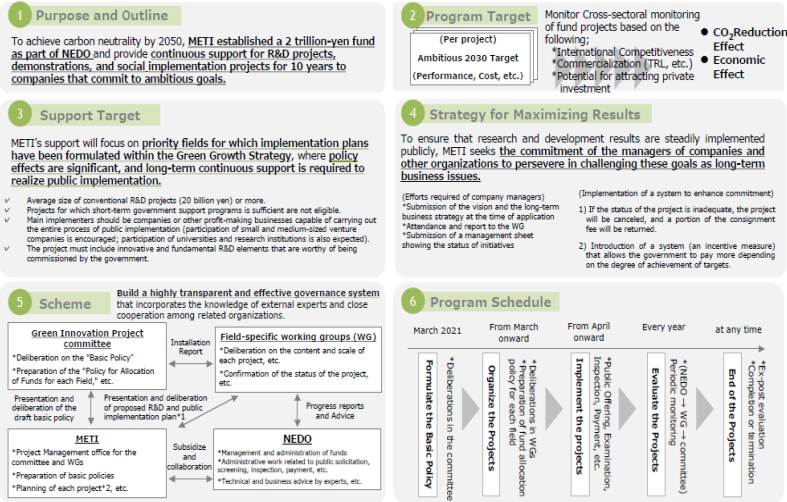
5. Plan for NH3 Bunkering Global Network



6. Support from “Green Innovation Fund”

Basic Policies for Green Innovation Fund (Summary)

The Ministry of Economy, Trade and Industry (METI) formulated the “Basic Policies,” which stipulate the policies for implementation of the fund projects commonly applied to the respective R&D fields, including the target of support in the funded projects, the mechanism for maximizing the results, and the implementation system. The contents of the Basic Policy will be reviewed flexibly based on the progress of the projects.



¹ A plan describing the project's goals for 2030, R&D items, maturity level of the target technologies (TRL, etc.), budget scale, etc. (A draft of the plan is discussed by the WG.)
² Including the division office in charge of the project in the relevant ministry or agency.

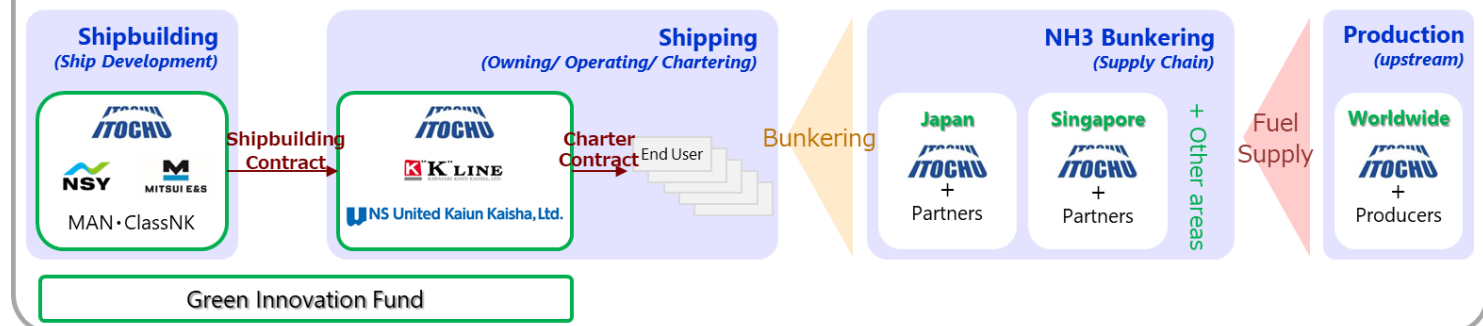
2 trillion-yen fund for supporting R&D projects, demonstrations, and social implementation projects for 10 years to companies that commit to ambitious goals, to achieve carbon neutrality by 2050

“Integrated Project” was selected as one of the potential projects of “zero-emission ship” and announced on Oct 2021

ITOCHU announced that it has been adopted to the “Green Innovation Fund Project / Development Project for Next-Generation Ships / Development of NH3 Fuel Ship”, a project publicly offered by NEDO to which ITOCHU applied jointly with K-LINE, NS UNITED, NIHON SHIPYARD and MITSUI E&S MACHINERY.

[from ITOCHU's press release]

Integrated Project for Development of NH3 Fuel Ship



7. Release for NH3 Bunkering in Singapore

January 11, 2022

TOKYO-Mitsui O.S.K. Lines, Ltd. (MOL; President & CEO: Takeshi Hashimoto) today announced that the company, along with ITOCHU Corporation (ITOCHU, President & COO: Keita Ishii; Headquarters: Minato-ku, Tokyo) acquired Approval in Principle (AIP) from the American Bureau of Shipping regarding an ammonia bunkering vessel.

The project is part of a joint development study on ammonia fuel supply chain in Singapore (Note 1). MOL, which already has acquired experience and knowledge of LNG bunkering vessels, will play a leading role in this project together with its partners in the LNG bunkering business in Singapore-TotalEnergies Marine Fuels Pte. Ltd. and Pavilion Energy Singapore Pte. Ltd.

MOL and ITOCHU jointly designed the ammonia bunkering vessel in cooperation with Sembcorp Marine Integrated Yard Pte. Ltd., and after conducting a risk assessment (Hazard Identification Study: HAZID) (Note 2) with the partners in Singapore, applied for and received the AIP. The vessel's design incorporates extensive safety measures in consideration of ammonia's toxicity.

Marine engine manufacturers around the world are working to develop an ammonia-fueled engine. Delivery of the first ammonia-fueled vessel is expected in the late 2020s at the earliest. The ammonia bunkering vessel, which we jointly developed, will supply these next-generation-fueled vessels.

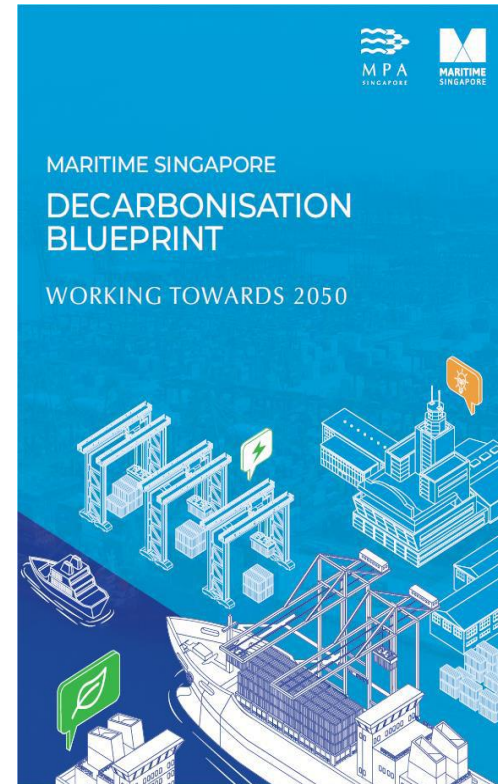
Ammonia is in the spotlight as a promising next-generation clean energy source that produces no carbon dioxide (CO₂) during combustion. MOL is working to develop ammonia-fueled vessels and create an ammonia transport business, in the hopes of launching net zero emission ocean-going vessels during the current decade and achieving net zero greenhouse gas (GHG) emissions by 2050, (Note 3) as stated in the "MOL Group Environmental Vision 2.1." (Note 4) At the same time, MOL will contribute to the reduction of GHG emissions not only in our group business but also in society through initiatives such as the development of an ammonia fuel bunkering vessel that supplies ammonia fuel to other vessels and establishing an ammonia supply chain (Note 5).



AIP for
NH3 Bunkering Ship



証書授与の様子
左 : 商船三井 燃料部 プロジェクトリーダー 田口 真一
中央左 : ABS 日本支店副支店長 大塚 亮介
中央右 : 商船三井 技術部長 杉本 義彦
右 : 伊藤忠商事 船舶燃料部 斎藤 健雄 アンモニア燃料船開発担当部長



MOU for NH3 Bunkering



MPA
SINGAPORE



8. Frameworks of JOINT STUDY



✓ Original JOINT STUDY (established in 2021) for Common Issues which are :-

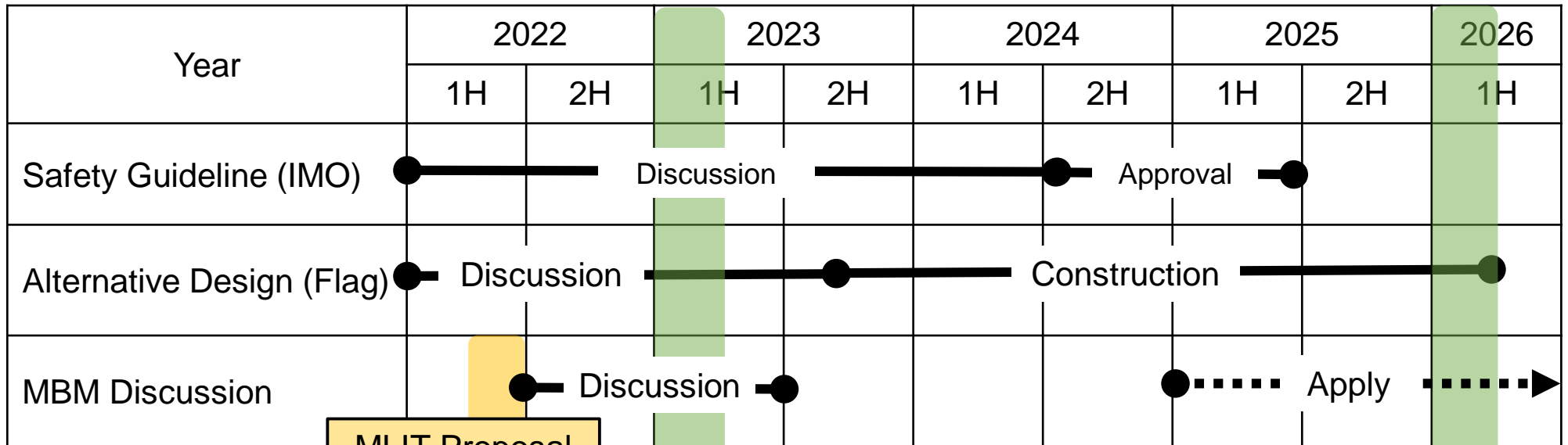
- A) Safety for NH3 Fuel Ship
- B) Safety for NH3 Bunkering
- C) NH3 Fuel Specification
- D) NET CO2 emission of NH3

✓ After Original JOINT STUDY program in 2021, ITOCHU proposed “Joint Session” as to item B) with separated framework of JOINT STUDY with port authorities for NH3 Bunkering Safety (established in 2022).

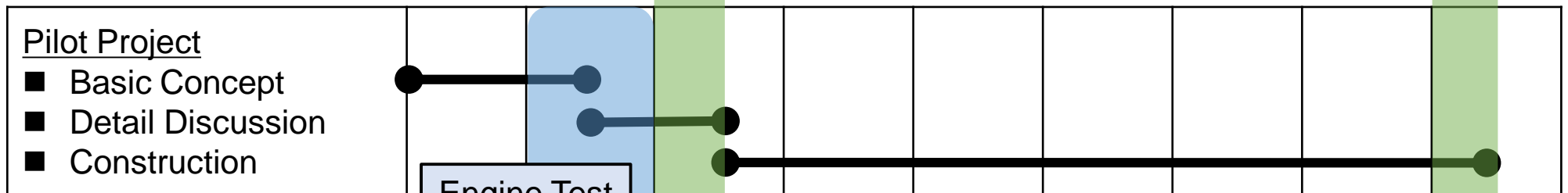
✓ ITOCHU also proposed “Working Group” for “Key Factors”.

✓ Sessions for “Key Factors” were made among Working Group on Jun / July with participation of several companies / organizations in Japan.

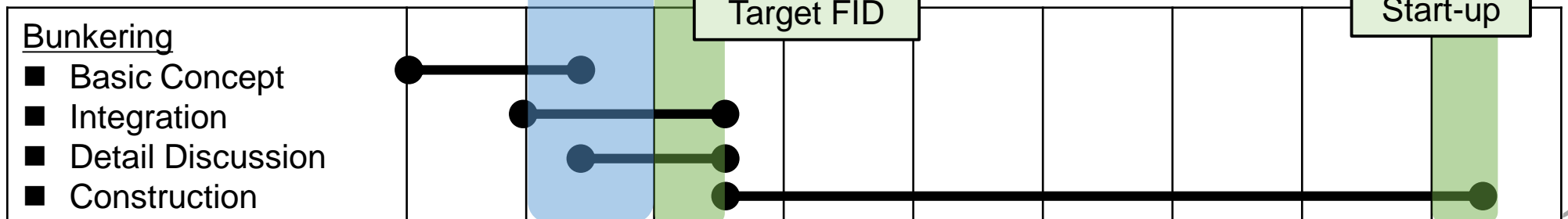
9. Road Map for Pilot Project



MLIT Proposal



Engine Test



Target FID

Start-up

10. Challenges for Integrated Project

item		Challenges
Technical	Ship Design	<ul style="list-style-type: none"> ■ Ship Design Development in parallel with (i) Engine Development and (ii) Establishment of Safety Guideline ■ Alternative Design Approval with Flag country
	Safety Guideline	<ul style="list-style-type: none"> ■ Safety Guideline at IMO for NH3 Fuel Ship ■ Local Guideline for NH3 Bunkering at each bunkering port
Commercial	Certificate	<ul style="list-style-type: none"> ■ Scope of CO2 emission (Life Cycle Assessment) ■ Trade Structure with Certificate
	Price Mechanism	<ul style="list-style-type: none"> ■ Price INDEX ■ CO2 Premium for Blue / Green NH3

THANKS