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Ammonia Energy Conference 2022

Moderator: Sofia Fürstenberg Stott, Maritime Director, Ammonia Energy Association

AEA Maritime Ammonia Workshop: Maritime Green Corridors – The Case For Ammonia

Phoenix
15 November 2022

Workshop: Ammonia Green Corridors Feasibility

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1:00 pm Workshop starts:
Setting of Scene and introduction to the Green Corridors Concept

1:20 Introduction to Green Corridor Feasibility Blueprint

1:30 Workshop discussions related to:
- Corridor Baseline
- Ammonia Fuel Supply Chain
- Port, Storage and Bunkering Infrastructure
- Cargo Demand Dynamics

2:00 Plenary session key takeaways
- And what is missing?

2:30 Workshop ends

Key feedback from the pioneering use of blueprint to be shared back with Maersk Mc-Kinney Møller Centre for Zero Carbon Shipping

Who Is In The Room?

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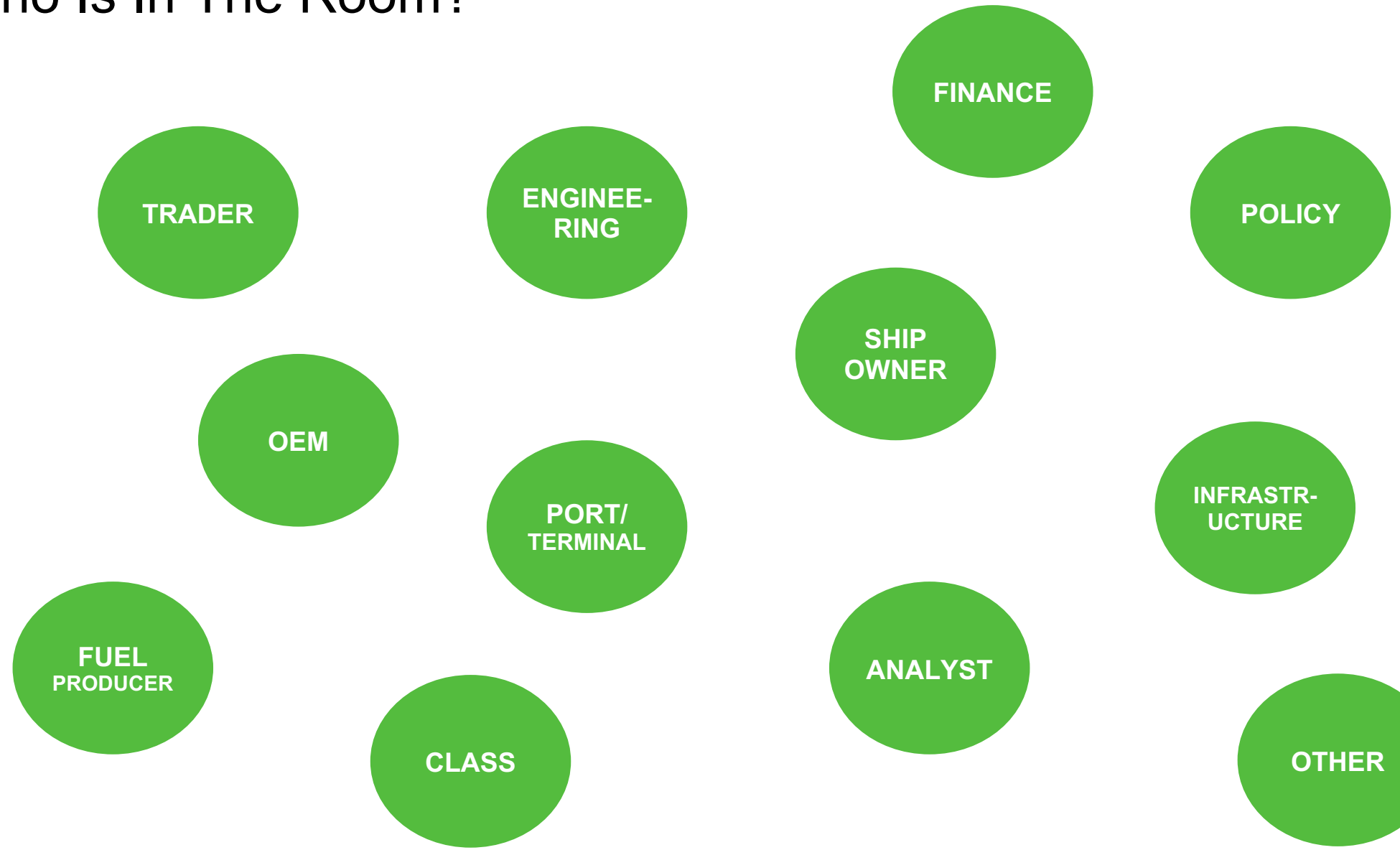

The Clydebank Declaration - Mission

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"The signatories of the Declaration are to support the establishment of green shipping corridors – ***zero-emission maritime routes between 2 (or more) ports.***

It is our collective aim to support the establishment of ***at least 6 green corridors*** *by the* ***middle of this decade****, while aiming to scale activity up in the following years, by inter alia supporting the establishment of more routes, longer routes and/or having more ships on the same routes.*

It is our aspiration to see ***many more corridors in operation by 2030****. We will assess these goals by the middle of this decade, with a view to increasing the number of green corridors."*

The Clydebank Declaration – 24 Signatories

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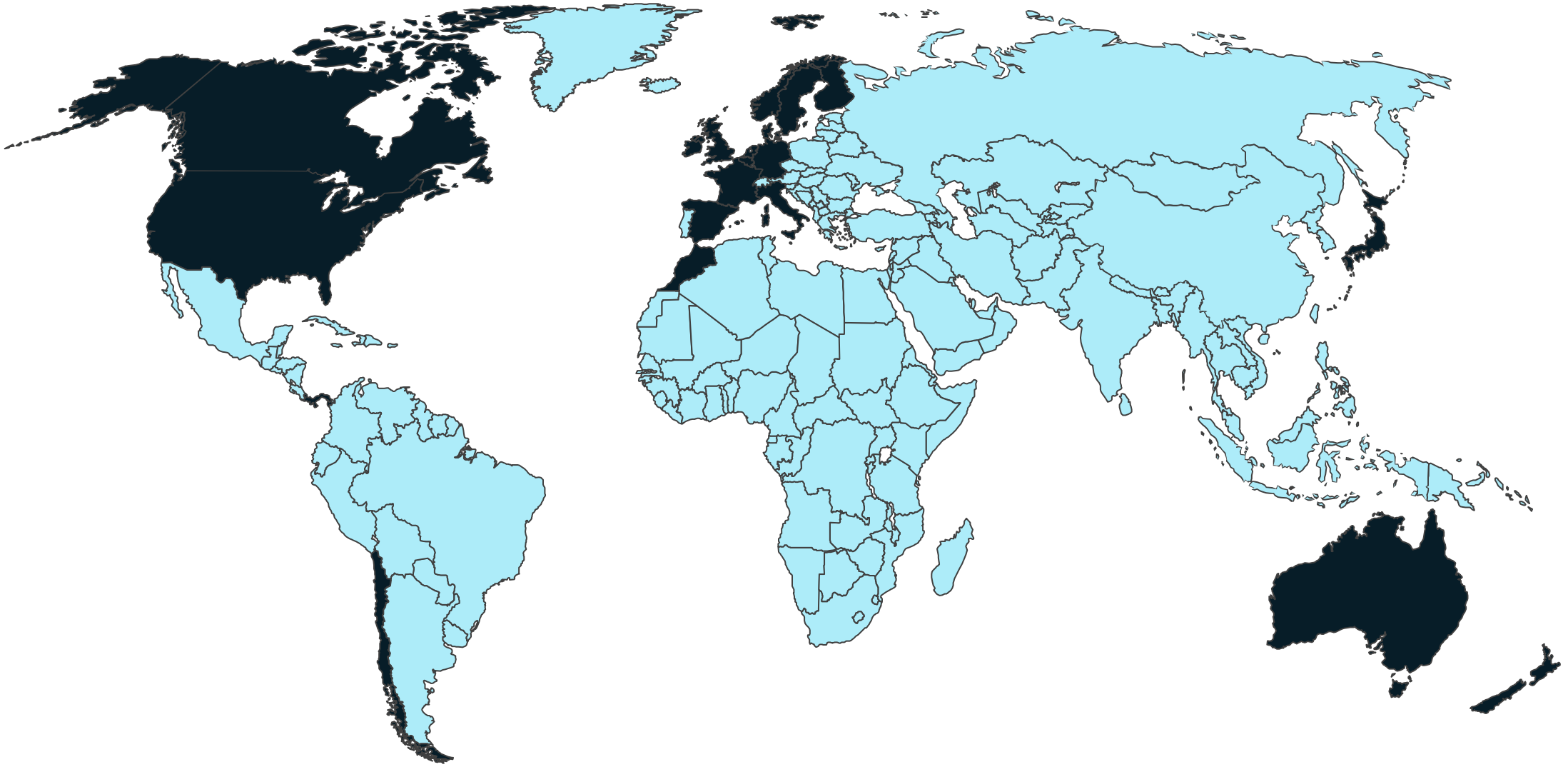
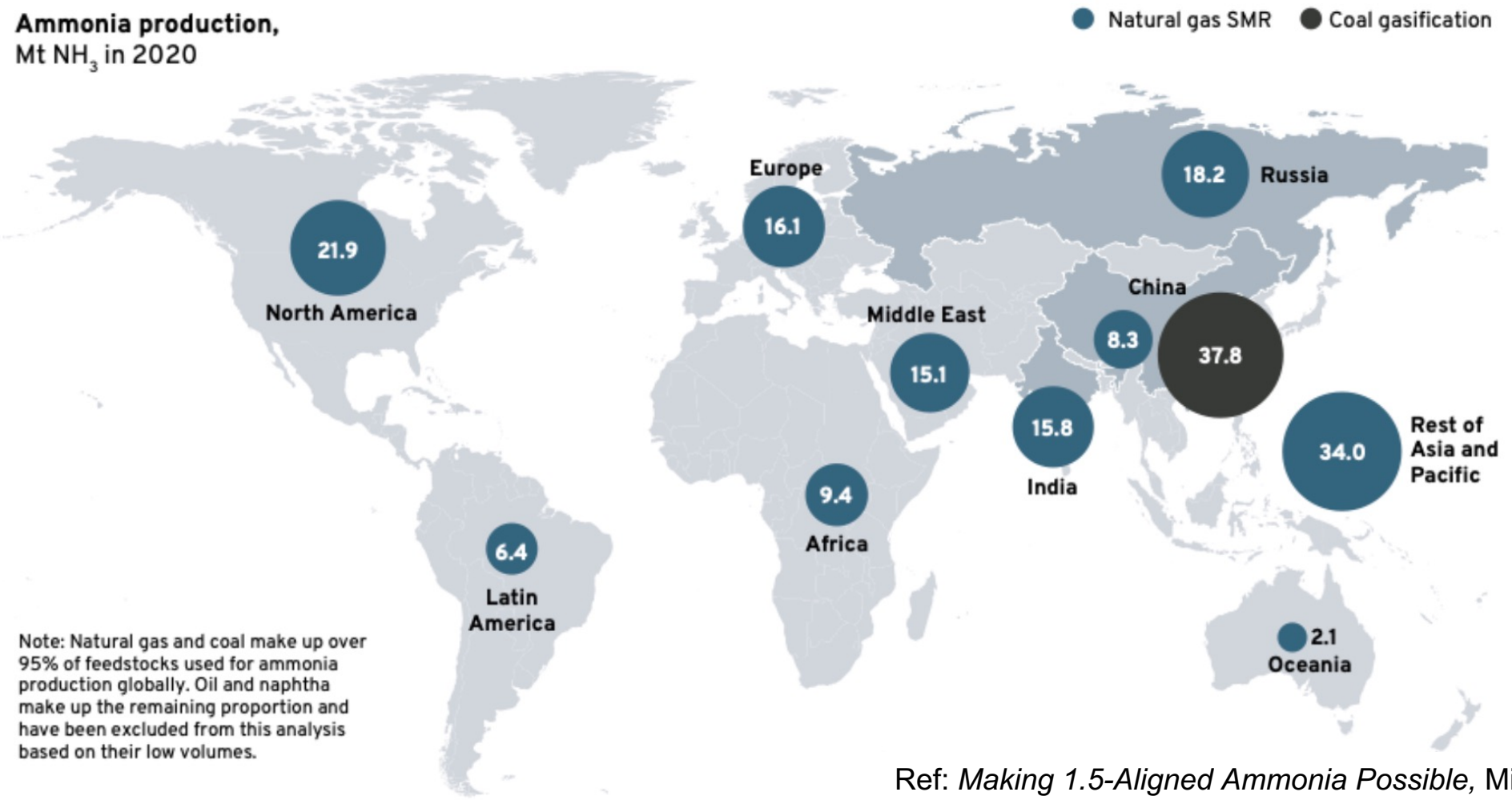


Ammonia Production 2020



Ref: *Making 1.5-Aligned Ammonia Possible,* Mission Possible, 2022

COP 27 – The Green Shipping Challenge

Production / At Port
Production of zero-emission fuels; demonstration / development of zero-emission bunkering and recharging capabilities; development of renewable energy infrastructure

At Sea
Demonstration / deployment of low- or zero-emission vessels; launch / advancement of green shipping corridors

Policy Context
Participation in initiatives such as the Clydebank Declaration, Declaration on Zero-Emission Shipping by 2050, First Movers Coalition shipping component, or Zero Emission Shipping Mission; national actions or action plans to reduce emissions from domestic shipping / vessels

COP 27: US Announce National Plan for Maritime Decarbonization

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United States: Creating a U.S. National Action Plan for Maritime Decarbonization

In early 2023, the Department of Energy, the Department of Transportation, the Environmental Protection Agency, and the Department of Housing and Urban Development will **release a transportation sector decarbonization blueprint**, which will serve as a roadmap for expanding federal agency priorities to create options for traveling smarter, more efficiently, and cleaner.

After the release of the blueprint, and as a key component of this effort, these departments and agencies will **commence in 2023 the development of a U.S. maritime decarbonization strategy**, which will identify the pathways for—and the agency-specific actions that can support—decarbonization of the domestic maritime sector.

COP 27: US Announce Launching Of Green Shipping Corridors Initiation Project And Green Shipping Corridor Hub

United States: Facilitating Green Shipping Corridors Worldwide

The U.S. Department of State is launching the **Green Shipping Corridors Initiation Project** with $1.5 million, subject to Congressional notification and the completion of domestic procedures, to **support feasibility studies for green shipping corridors** involving developing countries and **symposia to bring together country representatives and non-state actors**, including ports and companies, on green shipping corridor opportunities and implementation.

In addition, the United States and its partners in the Zero-Emission Shipping Mission are announcing the launch of a **Green Shipping Corridor Hub**, an online platform with resources and tools that aim to streamline the formation and deployment of green shipping corridors globally. The Hub will feature a **green shipping corridor route tracker**, a **matchmaker tool** to help stakeholders connect, and a **library of green shipping corridor reports and analyses**.

COP 27: US Announce Launching Of Three Bilateral Workstreams: Republic of Korea, Canada and UK

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United States: Facilitating National Green Shipping Corridors

- The Republic of Korea and the United States are announcing **technical cooperation to help facilitate establishment of a green shipping corridor.** We will undertake a feasibility study to explore the potential of creating a green shipping corridor between major cargo ports in the Republic of Korea and the United States.
- Canada and the United States are announcing the **Great Lakes/Saint Lawrence Seaway System Green Shipping Corridor Network Initiative**. The U.S. Department of Transportation, U.S. Department of State, and Transport Canada will work with state, provincial, local, private-sector, non-governmental leaders, and Indigenous Peoples in Canada and the United States to host consultations with ports and other stakeholders, with the goal of facilitating the establishment of such a network.
- The United Kingdom and the United States are announcing our intention to support the establishment of green shipping corridors between our countries. To advance this intention, we are **launching a UK-US green shipping corridor task force**.

15 Green Corridor Initiatives Announced Through GSC

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Australia: Australia-Singapore Cooperation on Green Shipping Corridors
Belgium: Green Corridor Between Belgium and Sweden in a Very Advanced Stage
Blue Sky Maritime Coalition and American Bureau of Shipping: Gulf of Mexico Green Shipping Corridor
Chile: The Chilean Green Corridors Network Pre-Feasibility Study and the General Strategy of Maritime Administration to Effectively Implement IMO Instruments
Finland, Rauma Marine Constructions, Viking Line, and Kempower: Scalable Green Maritime Transport Corridor Based on Locally Produced Renewable Fuel
Republic of Korea: Collaboration on Green Shipping Corridors
Lloyd's Register Group Limited: Silk Alliance Identifies Its First Baseline Fleet for Singapore Cluster and Calls for Further Collaborators
Los Angeles-Long Beach-Singapore Green & Digital Shipping Corridor: Commencement of Discussions for Los Angeles-Long Beach-Singapore Green & Digital Shipping Corridor
Los Angeles-Shanghai Green Shipping Corridor Partnership: Los Angeles-Shanghai Green Shipping Corridor Partnership and Implementation Plan
Mærsk Mc-Kinney Møller Center for Zero Carbon Shipping: Blueprint for Green Corridors Pre-Feasibility Studies
Northwest Seaport Alliance: Toward a Zero-Emission Cargo Gateway in Seattle-Tacoma
Port of Seattle: The Alaska British Columbia Washington Green Cruise Corridor is Underway
United Kingdom: UK Joins Forces with the United States, Norway, and the Netherlands to Roll Out End-to-End Green Shipping Corridors
United States: Facilitating Green Shipping Corridors Worldwide
United States: Facilitating U.S. Green Shipping Corridors

Blueprint for Green Corridors Feasibility Phase

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Green Corridors: Feasibility phase blueprint

Blueprint
August 2022

Mærsk Mc-Kinney Møller Center for Zero Carbon Shipping

McKinsey & Company

Blueprint for Green Corridors Feasibility Phase

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Green Corridors: Feasibility phase blueprint

Blueprint
August 2022

SCAN ME

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Pre-Feasibility Studies: Example Northern Europe

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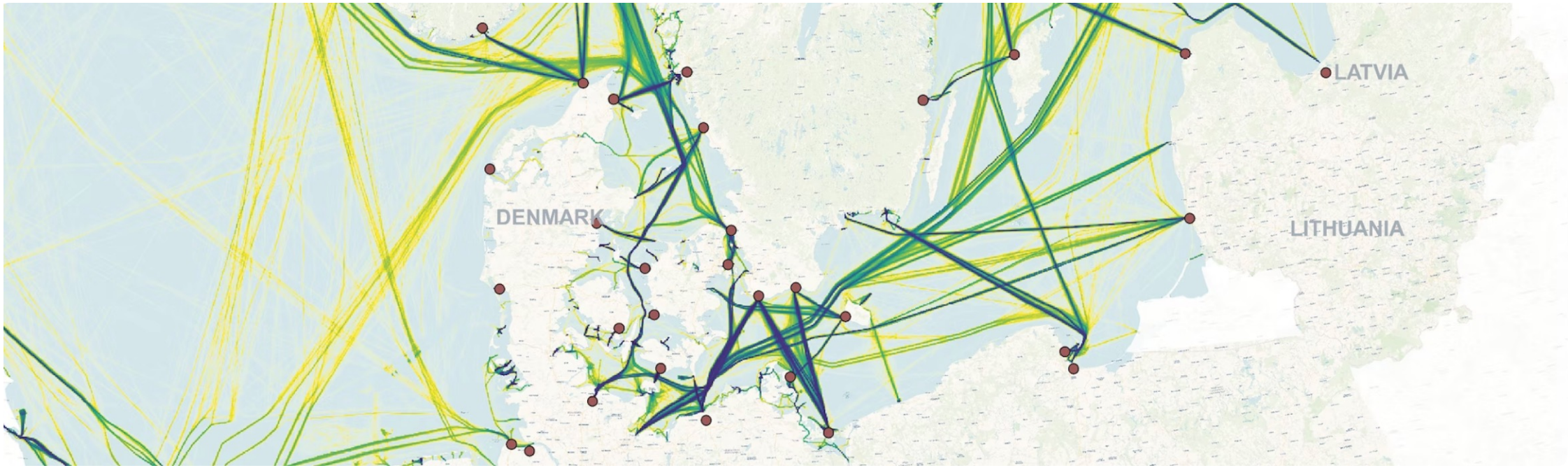

Northern European & Baltic Green Corridor Prefeasibility Study

PORT GDYNIA
PORT OF ROENNE Together we create
Port of Rotterdam
Mærsk Mc-Kinney Møller Center for Zero Carbon Shipping
Port of Hamburg
PORT OF TALLINN

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That was the introduction done – now let's move into the workshop!

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Workshop: Ammonia Green Corridors Feasibility

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Green Corridors: Feasibility phase blueprint

Blueprint
August 2022

Mærsk Mc-Kinney Møller Center for Zero Carbon Shipping

McKinsey & Company

Workshop: Ammonia Green Corridors Feasibility

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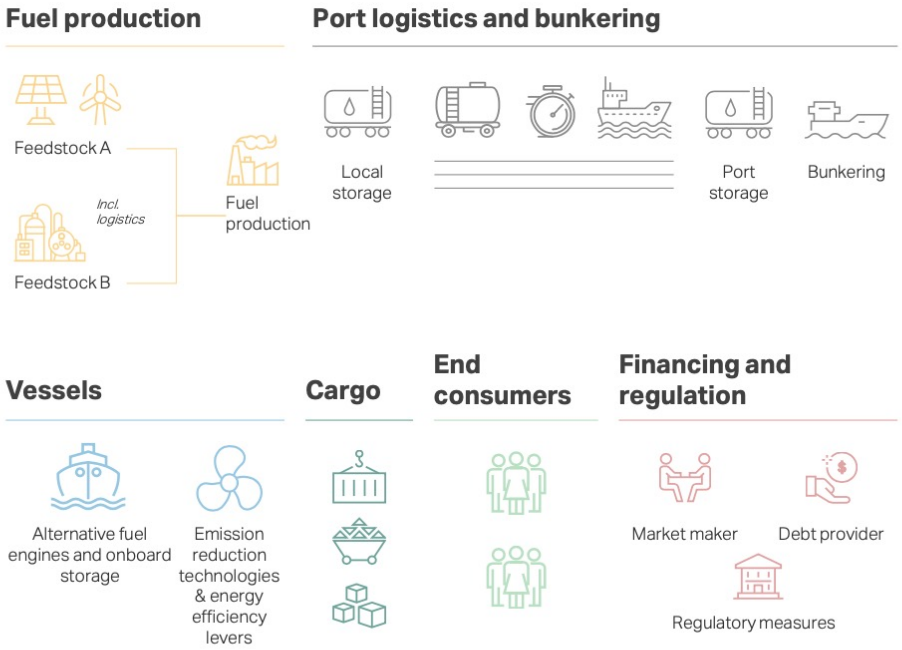
What are green corridors, and why is proving their feasibility important?

What are green corridors?

Green corridors are shipping routes on which there are commercially operating ships using exclusively[1] **alternative fuels**[2]



Why are green corridors important?

1. **Provide an approach and design** for industry players to gain confidence and embark on an accelerated decarbonization journey
2. **Initiate end-to-end decarbonization** within a supply chain
3. **Promotes closer dialogue and collaboration** between public and private stakeholders involved in the overall ecosystem

1. The definition distinguish between definition and implementation of a green corridor. In practice, a green corridor may be implemented as a transitory phased approach, where the use of alternative fuels evolve gradually, and design is made scalable to ensure flexibility and the realization of the green corridor.
2. Alternative fuels defined on the following page

Workshop: Ammonia Green Corridors Feasibility

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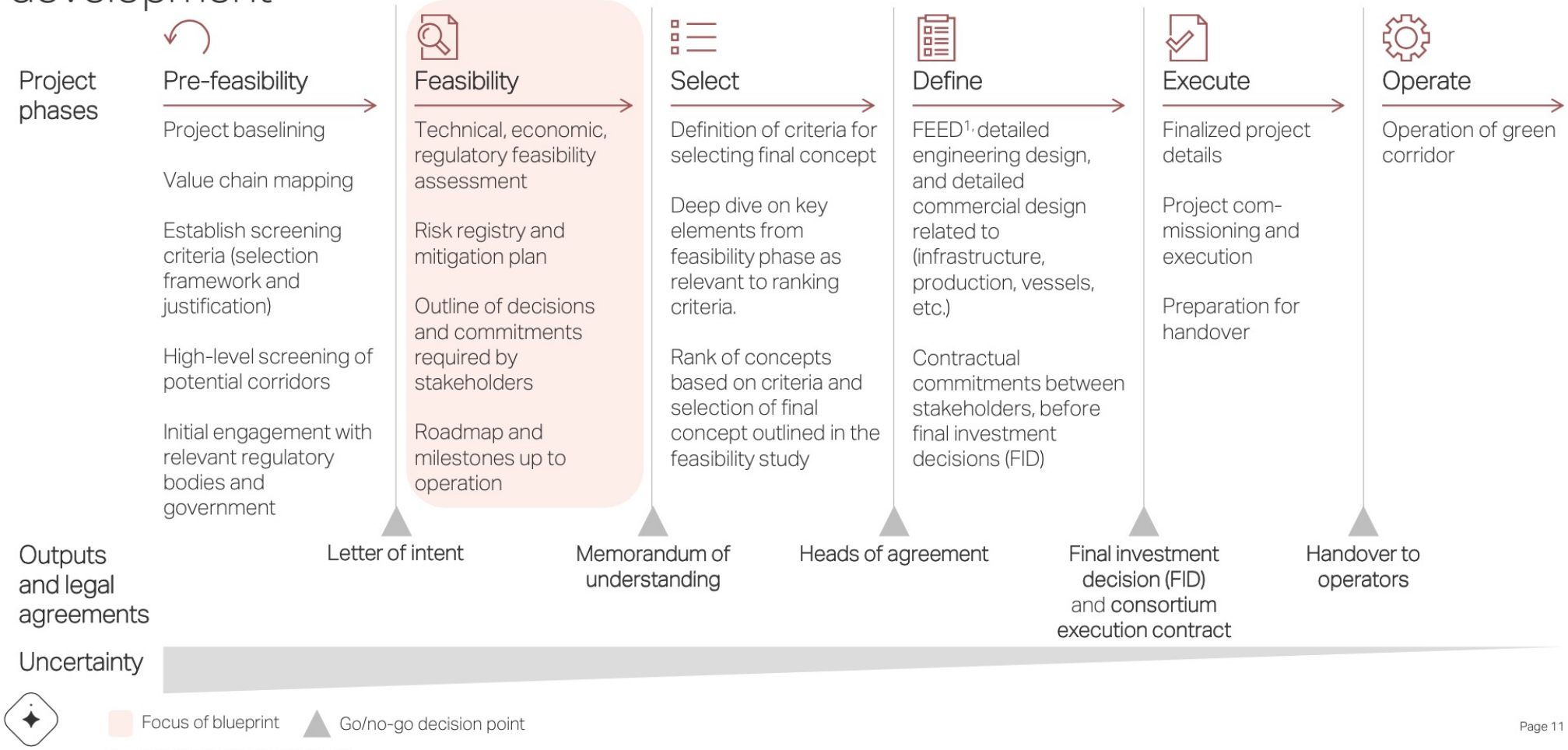
This document focuses on the feasibility phase of the green corridor project development



1. Front-end engineering and design

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The feasibility blueprint is structured into seven chapters to assess the technical, regulatory, and economic feasibility of green corridors

	1	2	3	4	5	6	7
Chapters	**Corridor baseline**	**Alternative fuels supply chain**	**Port and bunkering infrastructure**	**Vessel decarbonization pathway**	**Cargo demand dynamics**	**Summary of technical, economic, and regulatory feasibility assessments**	**Roadmap and commitments**
Stakeholders	All stakeholders	Fuel producers	Port and bunkering operators	Shipowners and operators	Cargo owners	All stakeholders	All stakeholders
Scope	High-level output from pre-feasibility phase: – Shortlist of potential alternative fuels – Vessel and voyage character-istics – Trade flows – Regulatory framework	Feasibility assessment for each decarbonization pathway along value chain: Technical feasibility Economic feasibility Regulatory feasibility				Feasibility assessment summary, highlighting: – Main gaps to address – Cross-cutting opportunities (e.g., gaps in economic feasibility could be addressed with consortium commitments) Risk registry	Development of **roadmap** and **required commitments** for the next phases of the project, up to operation

Workshop: Decide A Scribe For Your Table

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Corridor Baseline

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Chapter 1: Corridor baseline (historical and forecast)

Chapter 1 summarizes the high-level output on chosen corridor that would be expected from a pre-feasibility study

Key questions

I. What is the **decarbonization potential** and **timeline** for this green corridor? Who are the **main stakeholders in the corridor** ecosystem across the value chain?

II. What are the **potential alternative fuels and sources** best suited for corridor?

III. What is the **port and bunkering infrastructure like?**

IV. What are the key **technical and emissions characteristics of the vessels** trading there?

V. What is the nature of the **trade flows** and the end-customer **characteristics** along the corridor?

VI. What are the key **market and commercial enablers** in this corridor?

Chapter analyses

Embedded in chapter analyses 1.1 through 1.5

1.1 Identify **sources of alternative fuel** best suited to meet future demand, considering import options, announced projects, renewable energy/feedstock availability

1.2 Identify the current and expected **storage and bunkering infrastructure** along the corridor (based on geography, fuels, segment, volume, etc.)

1.3 Specify the **characteristics of vessels** in the corridor (incl. types, sizes, ages, fuel consumption, voyage characteristics), **technical profile, and emissions**

1.4 Develop a holistic understanding of the trade flows incl. **type** (cargo types), **nature** (e.g., origin-destination, trans-shipment), and **ownership** (BCO, FF[1])

1.5 Assess the high-level **financing and regulatory** characteristics on this route

1.Beneficial cargo owner, freight forwarder

Corridor Baseline: Discussion

30 min

I. How can/should *Ammonia Stakeholders* help answering questions related to decarbonization potential and timeline for a specific green ammonia corridor? What conversations need to happen and how do we need to share information?

II. How can/should *Ammonia Stakeholders* assist identifying market and commercial enablers?

III. How can/should *Ammonia Stakeholders* help identify trade flow synergies along an ammonia green corridor?

Alternative Fuels Supply Chain

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Chapter 2: Alternative fuels supply chain

Key questions

I. What is the **required volume of alternative fuel** for this corridor, given voyage and vessel characteristics?

II. What is the **range of expected production of alternative fuels** relevant to the corridor, based on import options, announced project, feedstock availability, regulation, etc.?

III. Is the **available fuel volume sufficient** to match expected demand by shipping?

IV. How much **additional production capacity** will be required? Where should it be built?

V. What are the main **drivers impacting the cost of alternative fuels** and price for shipowners, and how will they evolve over time?

VI. What is the **investment/financing required** for alternative fuel production to supply the corridor, and what are **commercial/funding models** (e.g., offtake agreements, subsidies, government guarantees) to make investment feasible?

Chapter analyses

2.1 **Estimate fuel demand** for the corridor

2.2 Define **expected production centers** for alternative fuels considering **announced projects** (capacity, developers, timelines) **and import options,** and identify **potential demand-supply gaps** and opportunities **for new potential locations and capacity**

2.4 Identify and quantify cost and **cost-down trajectories** for drivers of fuel costs (e.g., technology capex, electricity prices)

2.5 Quantify **capex requirements and assess financing options,** considering offtake potential for producers

2.6 Assess **feasibility** of alternative fuel production for the corridor

Alternative Fuels Supply Chain: Discussion

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30 min

I. How can/should *Ammonia Stakeholders* support with information about existing and planned production volumes of ammonia, and engage in exploration of future capacity development dedicated for shipping fuel?

II. How can/should *Ammonia Stakeholders* assist with estimating future fuel demand?

III. How can/should *Ammonia Stakeholders* assist with establishing an overview of required fuel production investment and financing?

Port, Storage, and Bunkering Infrastructure

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Chapter 3: Port, storage, and bunkering infrastructure

Key questions

I. What is the expected **required capacity** for storage and bunkering in this corridor?

II. What are the **expected port and bunkering sites** for the green corridor?

III. How much of the required capacity can be covered by **retrofitting existing infrastructure** and how much **additional infrastructure** is required?

IV. Will it be **feasible from a regulatory perspective to develop** storage and bunkering infrastructure?

V. What are the **required investments and financing potential** for retrofitting/developing infrastructure?

Chapter analyses

3.1 Estimate the current **demand and capacity for alternative fuels** and identify potential storage and bunkering ports based on:

- Expected demand from alternative fuels (inside and outside the corridor)
- Capacity for alternative fuels
- Existing and planned infrastructure
- Regulatory frameworks for port and bunkering sites

3.2 Estimate the required **investments for retrofitting/building** new storage and bunkering infrastructure to meet corridor demand

3.3 **Assess the feasibility** of alternative fuel storage and bunkering infrastructure development

Port, Storage and Bunkering Infrastructure: Discussion

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30 min

I. How can/should *Ammonia Stakeholders* assist with insights related to planned and existing ammonia (port, bunkering and storage) infrastructure, and any retrofitting of these?

II. How can/should *Ammonia Stakeholders* assist with developing insights related to bunkering capacity requirements?

Cargo Demand Dynamics

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Chapter 5: Cargo demand dynamics

Key questions

I. What are the **trade patterns** for the cargo types in the corridor? Who **owns the cargo**?

II. What is customers' and end consumers' **willingness to pay** for decarbonized shipping services, and how is this expected to change over time?

III. What **levers can support customer/end consumer willingness to pay** for decarbonized shipping services?

Chapter analyses

Chapter 1 output (cargo by type, current, and expected volume/ value, cargo owners, regulatory environment overview)

5.1 Assess the cargo's **sensitivity to changes in shipping/transportation costs** over time (elasticity of demand, trade fluctuations, share of shipping as part of overall product cost and emissions)

5.2 Identify the corridor's potential **competing routes and transportation modes** (alternative transportation/routes)

5.3 Estimate customer and end consumer **willingness to pay** (decarbonization commitments, commercial alliances, customer surveys, etc.)

5.4 Identify **mechanisms that would support customer/end consumer willingness to pay** (long-term offtake agreements, green cargo credits, etc.)

5.5 Assess cargo owners' **feasibility of adopting decarbonized shipping**

Cargo Demand Dynamics: Discussion

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30 min

I. How can/should *Ammonia Stakeholders* assist with cargo demand analysis? Are there synergies to be explored with ammonia transport sector?

II. How can/should *Ammonia Stakeholders* help identify mechanisms to support demand for decarbonized trade?

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Shared Learnings Plenary Session

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Corridor Baseline: Key Takeaways

5 min

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What Is Missing: Key Takeaways

10 min

- What is missing in this blueprint from an ammonia perspective? The blueprint currently has little emphasis to issues related to e.g., Safety, Environmental Impact, Cross-sectoral collaboration, or Societal Impact.
- How are these issues especially important for progressing ammonia green corridors?
- How can AEA as a membership organization support?

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Workshop End

You can reach me at fma@ammoniaenergy.org

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