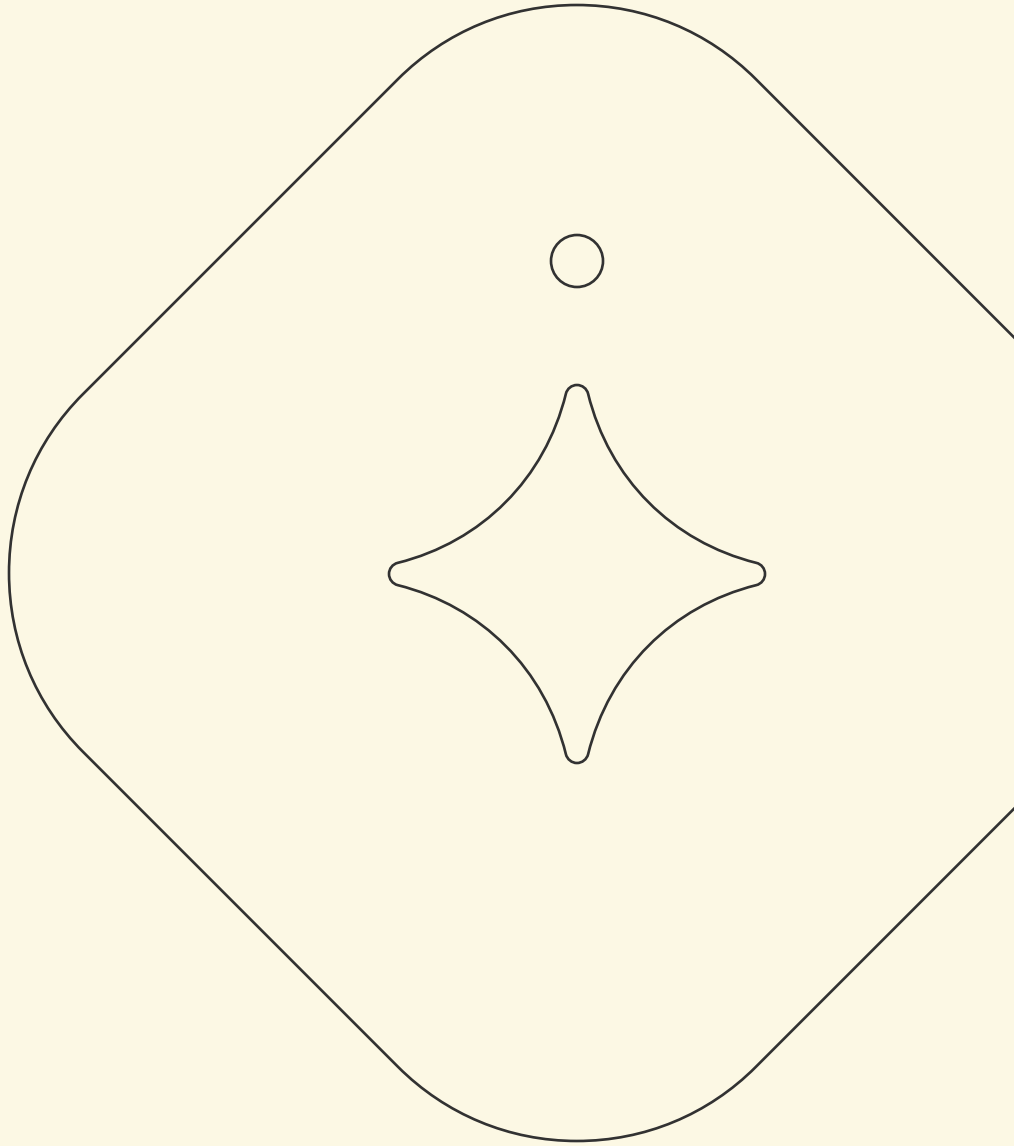
METHODOLOGY

Green Corridors
Pre-Feasibility Study Phase



Mærsk Mc-Kinney Møller Center
for Zero Carbon Shipping

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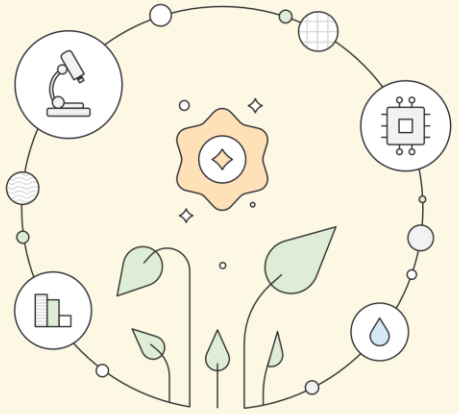
Expected outcomes of the Pre-Feasibility Study

- The Pre-Feasibility Study phase aims to initiate Green Corridors maturation projects. It seeks to conduct a preliminary assessment of potential Green Corridors within a region (or focus area) by utilizing available public data. The method will outline the most promising and viable corridors (provides initial estimates of costs, CO_2 abatement, as well as Just & Equitable assessments for the 1st Wave corridors).
- At the end of the Pre-Feasibility Study phase, the project team will identify the most promising corridors (1st Suite), based on a technologically agnostic approach. This approach allows for a transparent evaluation.
- At the Consortium Incubation Workshop (CIW), the project team presents the 1st Suite corridors to relevant stakeholders within the commercial and public sphere. Through a democratic process, the list of 1st Suite corridors is refined to a list of 1st Wave corridors — these are corridors which receive the most commitment.
- Following the CIW, the project team and stakeholders will engage in discussions based on the assessment findings. Subsequently, they will confidently select and decide to proceed to the Feasibility phase, ensuring a well-informed and strategic progression of the Green Corridors maturation projects.



Summary of Pre-Feasibility Scoping Phase

- During the Scoping phase, a consortium was established, where project goals were defined to foster a shared understanding of the project's objectives.
- Roles within the consortium were designated, and a robust project governance structure was established. The scope of work was clearly outlined, with the option to customize the suggested approach, facilitating a streamlined and expedited process for the Pre-Feasibility Study phase.
- The consortium was formalized through the issuance of a Letter of Intent (LOI), which delineates the terms, conditions, and responsibilities of each party involved in the Pre-Feasibility Study.
- As a result, all prerequisites were met, paving the way for the Pre-Feasibility Study phase to begin.

Methodology for Center pre-feasibility studies

Key questions	**Why** do we want the knowledge	**How** do we get the knowledge	**What** knowledge do we want
Overall sections	Introduction	Data, interviews and results	Interpretation and discussion
Chapter insights	Introduction to Area / Region & Constraints Decarbonization Vision for Area / Region Objectives and Project Governance	Relevant insight into: • Fuel • Port & Bunkering • Cargo, Services, Trade Routes & Vessel • Regulatory Landscape / Just & Equitable	Selection criteria and a ranking of these List of recommenced corridors based on selection criteria → 1st Suite corridors Consortium Incubation Workshop Estimate CO_2eq emission for relevant corridors 1st Wave corridors Final report including necessary Appendix
Workstream	1	2 3 4 5	6A 6B 7

Scene is set

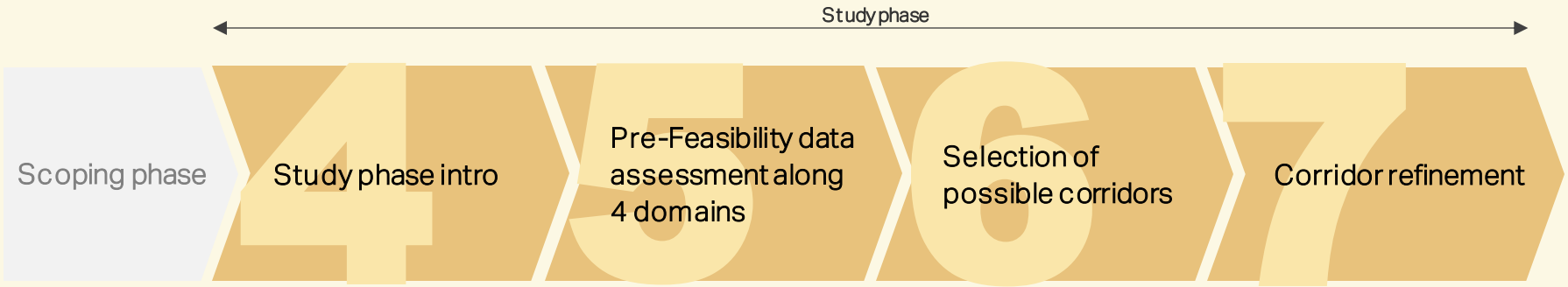
Data is gathered and selection criteria defined

The Pre-Feasibility Study phase in detail

This phase consists of 4 main stages. Throughout this document, all main stages are explained step by step.

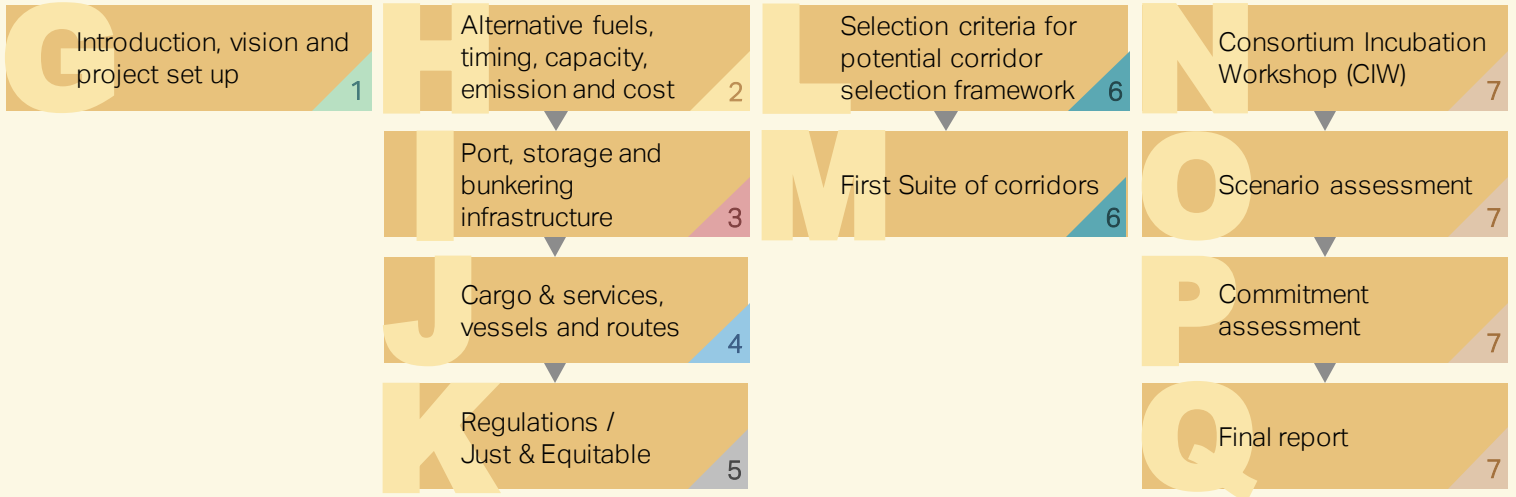
Overview of the different Pre-Feasibility Study stages:

Serves as a point of reference throughout the document and guides the sequencing of activities



Key activities in each of the stages and their related analyses and guidelines:

Provides an overview of the methodology and selected illustrative examples



Workstream 1

4 Study phase Intro

- C Introduction, vision and project set up — 1

5 Pre-Feasibility data assessment along 4 domains

- H Alternative fuels, timing, capacity, emission and cost — 2
- I Port, storage and bunkering infrastructure — 3
- J Cargo & services, vessels and routes — 4
- K Regulations / Just & Equitable — 5

6 Selection of possible corridors

- L Selection criteria for potential corridor selection framework — 6
- M First suite of corridors — 6

7 Corridor refinement

- N Consortium Incubation Workshop (CIW) — 7
- O Scenario assessment — 7
- P Commitment assessment — 7
- Q Final report — 7

4G. Introduction, vision and project set up

Purpose

- Introduction to area / region & constraints.
- Decarbonization vision for area / region.
- Objectives and project governance to conduct the study.

Key questions

- **Why** do we want to have green corridors in the defined area of interest?
- Which **key results** and focus areas for the corridors are important in the upcoming phases?
- What is the **region-specific baseline** and are there any **particularities?**
- **How** do possible green corridors support the **area's overall social, ecological or economical goals** and **ambitions** described in the **vision**?
- How is the **pre-feasibility project governed**? **When** and **how** do we take **which** action? **Who** is involved?

Importance

- **Area specific overview** and **constraints**
- Vision of possible green corridors in the defined area (basis for selection criteria).
- Specified objectives of possible green corridors in the defined area (basis for selection criteria).
- Project specific information – **timeline, governance (project plan), involved stakeholders, agreements, methodology.**

4G. Introduction, vision and project set up

Proposed work

- Write introduction to defined area of interest, and highlight essential characteristics, as well as possible constraints. Be specific and make sure to define the borders of your defined area of interest carefully to ease the data collection in following chapters.
- State the overall decarbonization vision for the area and highlight how green corridors can contribute to realizing this vision.
- Link the implementation of green corridors to specific, overall social, ecological or economic objectives of the region e.g. UN Global Compact, sustainability goals, climate action.
- Create a short description of the proposed execution of the project, including governance, agreements, timeline and project partners.

Assessment along 4 domains

Work-streams	1 Introduction, vision and project setup	2 Alternative fuels	3 Port, storage, and bunkering infrastructure	4 Trade routes, vessels, cargo and services	5 Policy, regulation, Just & Equitable	6 Selecting 1st Suite of corridors	7 Consortium Incubation Workshop
Stake-holders	All stakeholders	Fuel producers	Port and bunkering operators	Shipowners and operators	All stake-holders, including regulators	Highest strategical level for the area of interest	All stakeholders
Scope	Introduction to area and **constraints** **Decarbonization vision** for area **Objectives** and introduction to project **governance**	**Data assessment** of the main components of possible green corridors in a region allow for **outlining the most promising and viable corridors.**				List of **recommended corridors** based on selection criteria: 1st Suite corridors	List of 1st Suite corridors to be updated based on CIW Refine 1st Suite to 1st Wave through democratic process **Final report** including necessary Appendix, initial cost estimate and CO_2 abatement potential **Initial engagement with stakeholders** for potential green corridors **Proposed way of moving forward** into Feasibility Phase

Workstreams 2-5 run in parallel

Pre-Feasibility assessment

4-step process to move from Work Scope Definition to data collection using the data collection template

Scoping → Pre-Feasibility assessment

Define work scope

Define the work scope based on the customized method

See Work Scope Definition guideline

Adjust data collection template

Workstream lead to use the standard data collection template as guidance and make adjustments, if necessary, based on the Work Scope Definition

Share data collection template

Workstream Leads share the adjusted data collection template with other Workstream Leads to create alignment and transparency on data points required to conduct the analyses in the Pre-Feasibility assessment

Collect data as part of Pre-Feasibility assessment

Workstream Leads collect necessary data to run analyses outlined in the Work Scope Definition, e.g., fuel project maturation, port readiness level assessment, etc.

4 Study phase Intro

5 Pre-Feasibility data assessment along 4 domains

6 Selection of possible corridors

7 Corridor refinement

G Introduction, vision and project set up 1

H Alternative fuels, timing, capacity, emission and cost 2

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N Consortium Incubation Workshop (CIW) 7

O Scenario assessment 7

P Commitment assessment 7

Q Final report 7

5H. Alternative fuels, timing, capacity and cost

Purpose

Fuel can be supplied from the area of interest (intra-regionally) or sourced from outside. Following points of attention apply for both **area of interest and outside:**

- **Fuel choice and supply** – supply possibilities within the region in a given **timeframe**.
- Current and future **production capacity** with expected competition for fuels considered
- **Fuel cost** – if possible, show the expected cost and explain the main drivers behind it.

Key questions

Intra-regional:

- What is the source of **renewable energy** (Wind, solar PV, …) and **amount** (MW)?
- What is the **range of expected production capacity of alternative fuels** relevant for a corridor, based on announced projects, feedstock availability, regulation, and timeline?
- What are the main **drivers impacting the cost of alternative fuels and price**?

Extra-regional:

- What is the **range of expected import of alternative fuels** relevant to the corridor, based on announced projects, feedstock availability, regulation, timeline, etc.?
- What are the main **drivers impacting the cost of alternative fuels** and price?

Importance

Identifying the amount of **fuel available** in a green corridor is a **key decision factor**:

- ⇨ This factor is crucial when pre-selecting potential green corridors (1st Suite)
- ⇨ Insights from Workstreams 3-5 complement this information.
- ⇨ The combined data allows the project team to compare and choose the most promising potential green corridors.
- ⇨ Project maturity and sectoral competition

5H. Alternative fuels, timing, capacity and cost

Proposed work

- **Fuel choice** (table 2.1):
  List of relevant alternative fuels to be assessed in the defined area.
- **Energy supply** (Table 2.2 / Table 2.3 / Table 2.6 / Table 2.7):
  Access database to find relevant renewable energy projects announced and generate overview of the source, capacity over time, intra-regional (Table 2.2 / Table 2.3) and extra-regional (Table 2.6 / Table 2.7). Estimate the expected amount of energy available for shipping.
- **Fuel supply** (Table 2.2 / Table 2.3 / Table 2.6 / Table 2.7):
  Access database to find fuel projects announced and generate overview of the source, capacity and availability of fuels over time, intra-regional (Table 2.2 / Table 2.3) and extra-regional (Table 2.6 / Table 2.7). Estimate the expected amount of fuel available for shipping.
- **Assess project maturity and sectorial competition**
- **Fuel cost** (Table 2.4 / Table 2.8):
  If possible, get view on fuel cost – either through publicly available data or through interviews with stakeholders. Insert data from the area (Table 2.4) and from outside the area (Table 2.8), e.g. electricity price, fuel production cost (CAPEX, OPEX)

Why collect this data

- **Fuel choice:**
  Align on which fuel you want to focus. This is critical as the following data collection depends on this choice.
  - **Fuel supply:**
    Availability of alternative fuels over time will determine green corridors in your later selection. If an alternative fuel is not available within the region it might be possible to import it.
  - **Fuel cost:**
    Needed input to inform investment decisions throughout the value chain. Both regarding fuel from within the area of interest and imported fuel.

Fuel supply

Fuel for a region can be supplied in different ways

Context

While some regions have easy access to **intra-regional fuel supply**, other regions may choose to **import fuel from abroad**

Reasons for this can be, among others:

- Unavailability of fuel supply locally
- More cost-economic fuel supply from the global market

	Options for fuel supply	Rationale
Intra-regional	1 **Co-location of production and bunkering** Fuel supply from local energy and fuel projects which could be operational within the next few years[1]	• Proximity to Green Corridor • Timely availability of fuel • Increased political support for Green Corridor • Leverage multi-modal synergies for transport • Potential to improve local energy access
	2 **Fuel production in region** Fuel supply from projects that could be developed in the region within the next few years[1]	• Relative proximity to Green Corridor • Higher uncertainty about the development and completion of fuel projects • Increased political support for Green Corridor • Potential to improve local energy access
	3 **Fuel production in country** Fuel supplied from project that could be developed elsewhere in the country within the next few years[1]	• Relative proximity to the Green Corridor • Higher uncertainty about development and completion of fuel projects • Depending on the country, costs and the regulatory environment in different regions can be discriminating factors • Increased political support for Green Corridor • Creation of new green jobs and economic diversification
Extra-regional	4 **Fuel production globally – physical trade** Fuel imports from projects elsewhere in the world, enabled by the low cost of shipping the fuel	• More complicated stakeholder environment across countries • Depending on the countries, costs and regulations can be discriminating factors • Not improving local energy access • Added emissions through transport
	5 **Fuel production globally – book & claim** Use of 'swapped volumes' in a book & claim system, leveraging international fuel production	• More complicated stakeholder environment • No clear book & claim standards as of today – potentially a lack of transparency • Not improving local energy access • Added emissions through transport

Inspired from: GMF_WA-East-Asia-Iron-Ore-Green-Corridor-Feasibility-Study.pdf (globalmaritimeforum.org)

1. Specify timeframe for the specific project, e.g., 2028-2030

Estimating fuel availability for shipping

Intra-regional

Map energy and fuel projects in region

Collect key data and map **intra-regional energy and fuel projects** (existing and planned) for the selected fuel by year, volume, fuel type, and location *(refer to data collection guideline)*

Maturity Index

Estimate total fuel production by fuel type and evaluate project maturity

Apply the Maturity Index (see slide #19) to estimate fuel availability

Sector Competition Factor

Apply the Sector Competition Factor (see slide #20) to the fuel availability estimated in step 2 to assess fuel availability for shipping

Extra-regional

<u>If necessary:</u> Estimate extra-regional fuel availability

In case intra-regional fuel availability is insufficient, estimate extra-regional fuel availability

Consider capacity and cost competitiveness of alternative regions

Estimate high-level costs associated with the fuels

Estimate high-level costs associated with the fuels to be used in the green corridor (intra and extra-regional)

TEMPLATE

Map energy and fuel projects in region - Example data template

	Project 1	Project 2	Project 3
Company name	…	…	…
Site (location)	…	…	…
State (region)	…	…	…
Renewable source (e.g., sun, wind, hydro)	…	…	…
Renewable energy amount (MWh/year)			
Fuel type	…	…	…
Capacity (KT/Year)	…	…	…
Project status[2]	…	…	…
Renewable supply (e.g., underway, in place)	…	…	…
Financing (e.g., underway, in place)	…	…	…
Groundwork (e.g., underway, completed)	…	…	…
Construction (e.g., underway, completed)	…	…	…
Commencement target year/forecast	…	…	…
Production volume in 2025 (KT)	…	…	…
Production volume in 2030 (KT)	…	…	…
Production volume in 2035 (KT)	…	…	…
Production volume in 2040 (KT)	…	…	…
Production volume in 2045 (KT)	…	…	…
Production volume in 2050 (KT)	…	…	…
Offtake agreements	…	…	…

2. Options: (1) In operation, (2) final investment decision (FID), (3) sanction, (4) Feasibility Study (F/S), (5) idea (speculative)

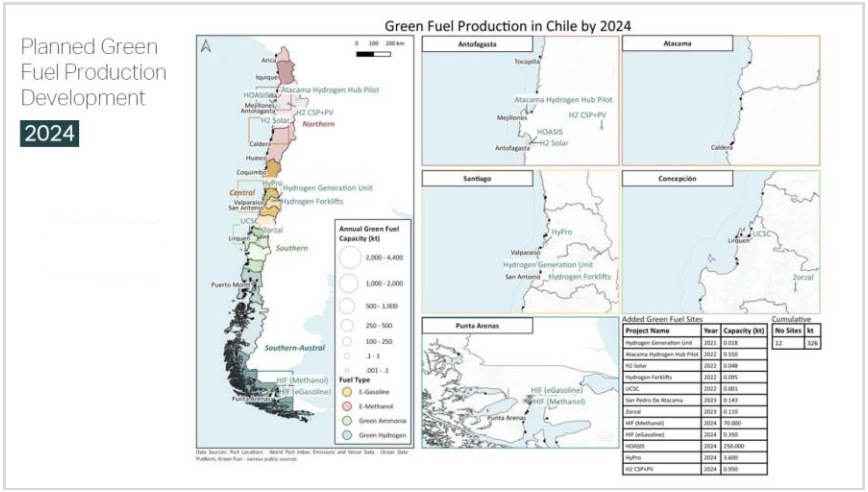
EXAMPLE

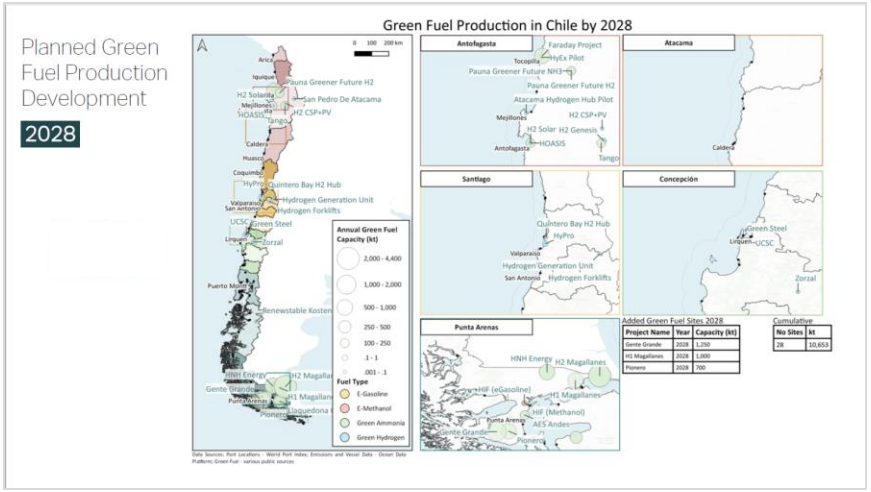
Map energy and fuel projects in region - Example output (1/2)

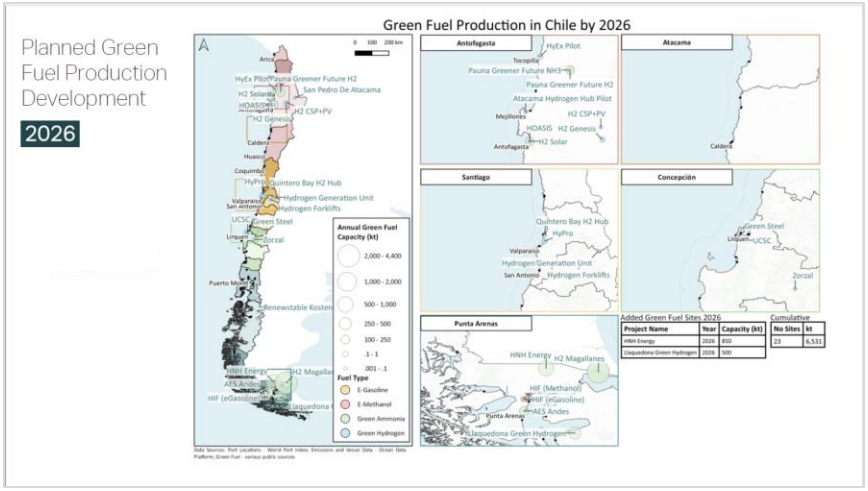
Deep dive follows

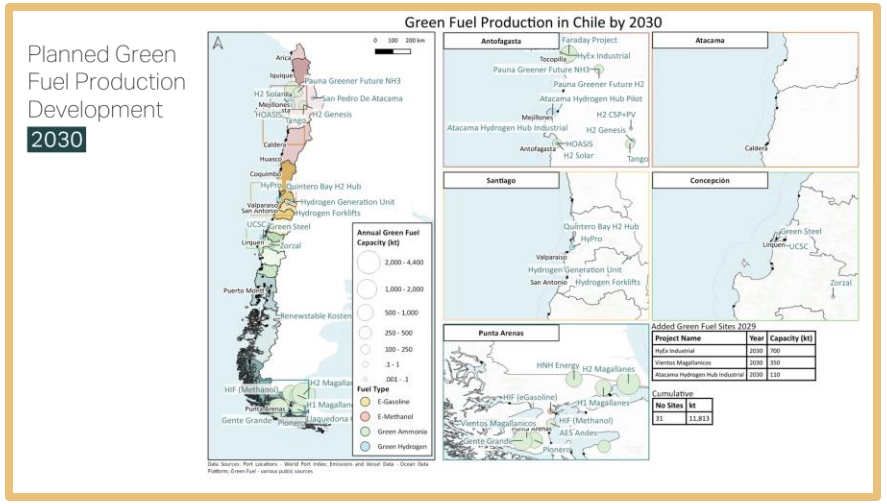
Example output

Planned fuel production development by year, capacity, fuel type, and location *(developed based on data template on previous page)*









EXAMPLE

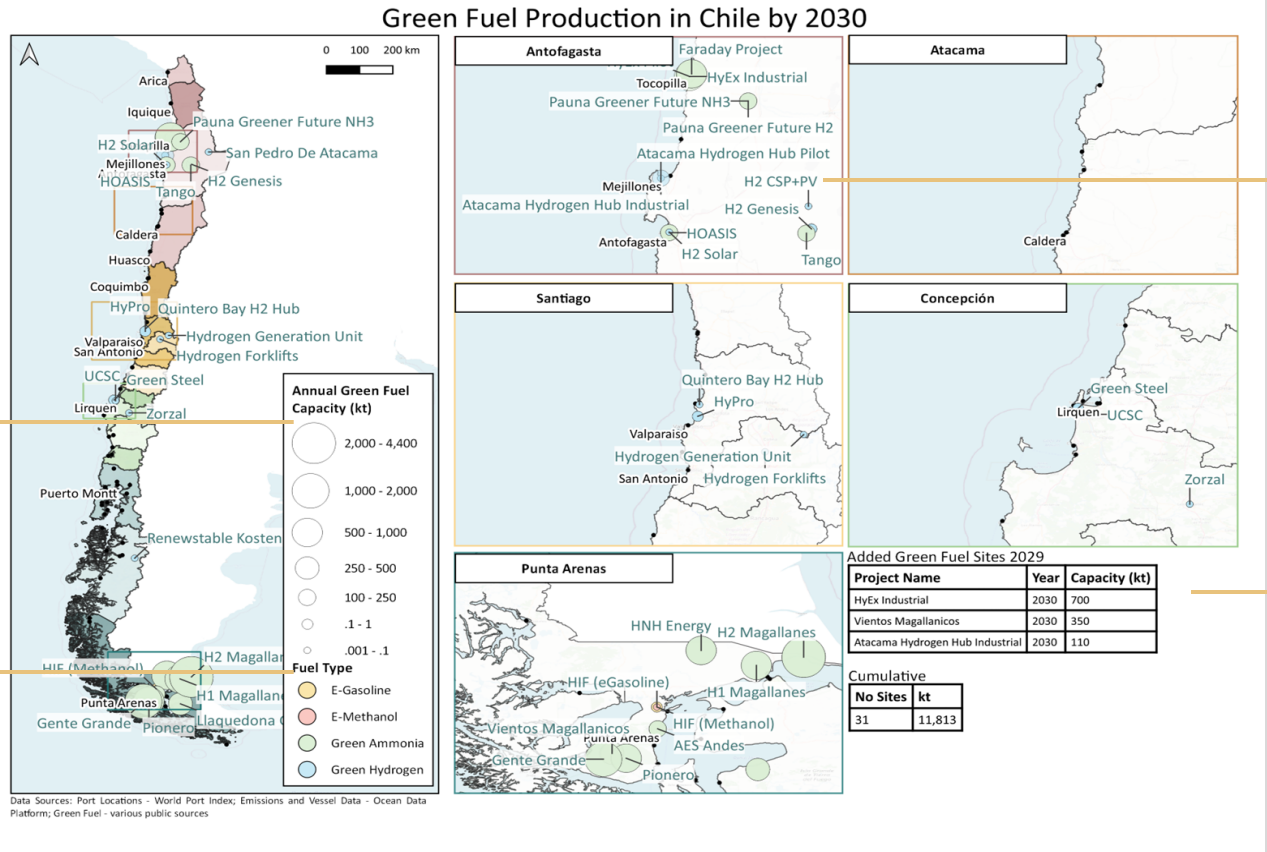
Map energy and fuel projects in region - Example output (2/2)

A larger bubble size indicates a higher annual green fuel capacity

Different colors indicate different types of fuel

Planned Green Fuel Production Development

2030



Added Green Fuel Sites 2029

Project Name	Year	Capacity (kt)
HyEx Industrial	2030	700
Vientos Magallanicos	2030	350
Atacama Hydrogen Hub Industrial	2030	110

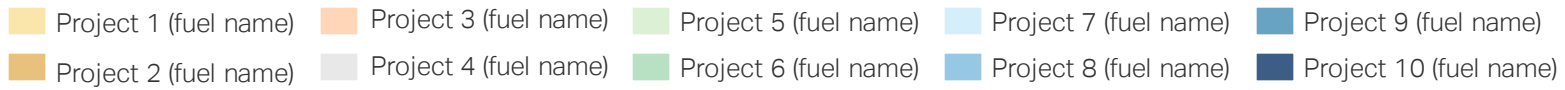
Cumulative

No Sites	kt
31	11,813

Deep dives on regions provide deeper insight into the geographical distribution, fuel capacity and fuel type of the green fuel sites

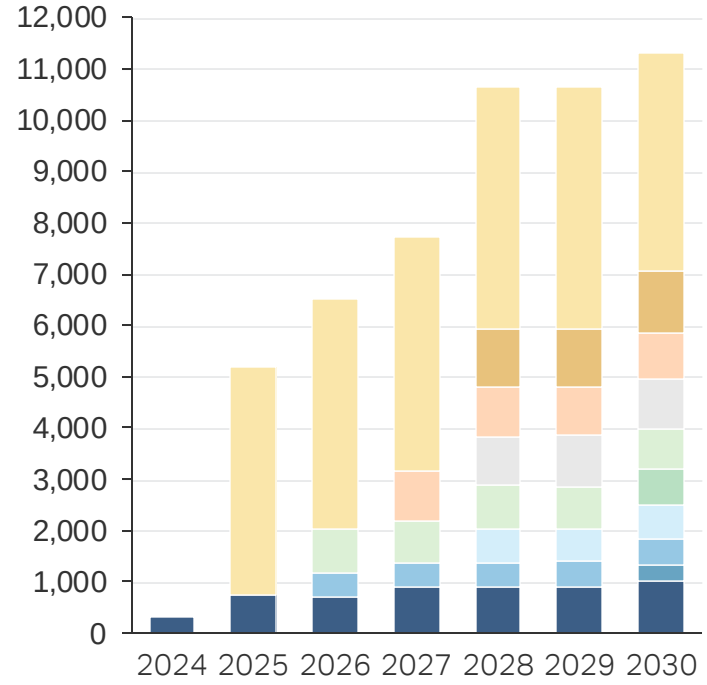
Table outlines green fuel sites that have recently been added / developed

Estimate total intra-regional fuel availability – Project maturity



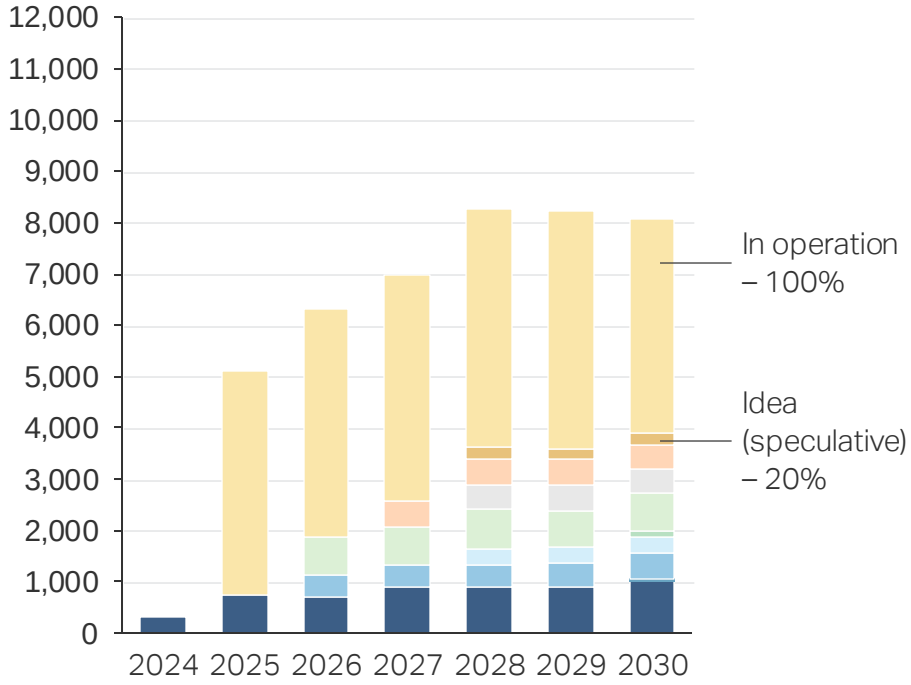
A. Intra-regional fuel production by fuel projects

Exemplary overview of fuel projects[3] , kilotons



B. Estimated intra-regional fuel availability with Maturity Index applied

Exemplary overview of fuel projects [3] with **Maturity Index** applied, kilotons



3. Assessment can alternatively also be made by fuel type

Maturity Index

The Maturity Index is applied to the total intra-regional fuel capacity to estimate how much of the fuel will be available for use within a specific timeline

Example: If project is in operation, 100% of the fuel is estimated to be available. If it is only an idea, it is estimated that 20% will become available

Percentages can be adjusted as per the Project members' judgement

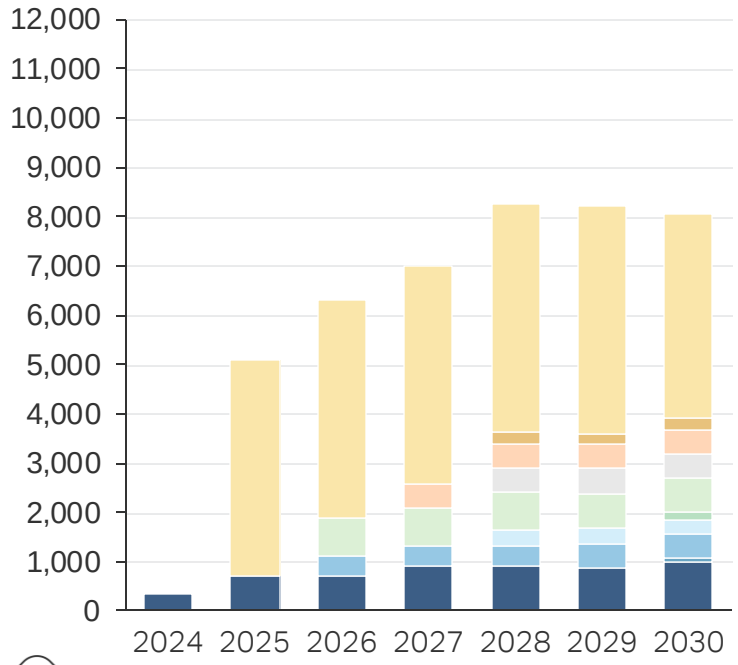
In Operation	100%
Final Investment Decision (FID)	98%
Sanction	90%
Feasibility Study (F/S)	50%
Idea (Speculative)	20%

Estimate intra-regional fuel availability for shipping – Sectorial competition

Project 1 (fuel name) Project 3 (fuel name) Project 5 (fuel name) Project 7 (fuel name) Project 9 (fuel name)
Project 2 (fuel name) Project 4 (fuel name) Project 6 (fuel name) Project 8 (fuel name) Project 10 (fuel name)

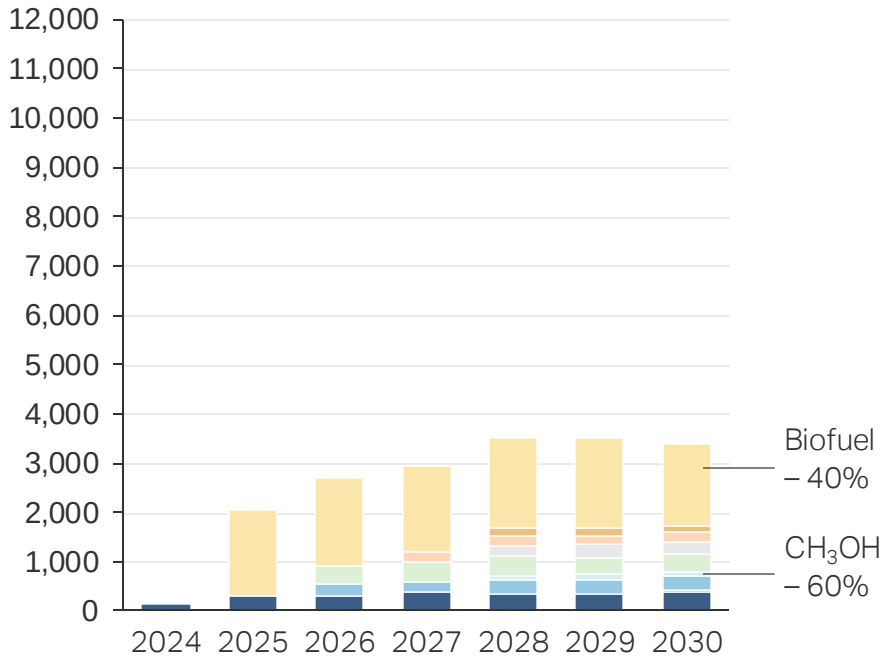
A. Estimated intra-regional fuel availability with Maturity Index applied (from step 2.B)

Exemplary overview of fuel projects [4] with Maturity Index applied, kilotons



B. Estimated intra-regional fuel availability for shipping with Maturity Index and Sector Competition Factor applied

Exemplary overview of fuel projects [4] with Maturity Index and Sector Competition Factor applied, kilotons



4. Assessment can alternatively also be made by fuel type

Sector Competition Factor

The Sector Competition Factor is applied to the total fuel production for each of the fuels to estimate how much of the fuel will be available for shipping

Percentages are to be adjusted as per the Project members' judgement of the expected fuel offtake for a specific fuel project. Percentages below are only exemplary

H_2	10%
NH_3	50%
CH_3OH	60%
CH_4	30%
Biofuel	40%

Workstream 3

4 Study phase Intro

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L Selection criteria for potential corridor selection framework 6

M First suite of corridors 6

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O Scenario assessment 7

P Commitment assessment 7

Q Final report 7

5l. Port, storage and bunkering infrastructure

Purpose

- **Identify ports** in the defined area; analyze and describe crucial, **port specific restrictions and trade.**
- Identify **current** potential import, storage and bunkering of relevant chemicals at ports in the defined area.
- Do a '**port readiness level'** assessment for relevant ports, to compare different ports in the area independently - including cargo handling, bunkering port calls of traditional and alternative fuels.
- Estimate **timing** for ports being **ready** for green corridors.
- **Compare** ports in region by using their port chemical score.

Key questions

- Which **potential ports** can support the green corridor?
- What type of cargo are they handling and are there any **port specific restrictions**?
- What is the **current storage** and **bunkering infrastructure** in the area?
- What is the current **port readiness** level and what is the **expected outlook**?
- Compare ports in region by using their port chemical score.

Importance

Current infrastructure:

Handling relevant chemicals today can give an indication of readiness levels related to specific alternative fuels and indicate if a port should be favored against another (cf. Port chemical score assessment).

Future infrastructure:

The Port Readiness Level Assessment for cargo, port call and bunkering indicates a potential timeframe for establishing a green corridor with specific alternative fuel.

5l. Port, storage and bunkering infrastructure

Proposed work

- **Identify ports**:
  Make list of all relevant ports – Option to use port chemical score as initial screening.
- **Port specific restrictions** (Table 3.1):
  Populate data sheet with relevant objective data: water depth, degree of congestions, etc. The list of examples is for reference only, so please add any characteristic relevant for ports in your defined area such as but not limited to:
  - ownership and operation
  - location,
  - water depth,
  - congestion degree,
  - current and predicted handling (limited number of ships per day, limited storage capacity, etc.),
  - port infrastructure (limited number of cranes, limited handling of cargo, transport type from port to destination, etc.),
  - ecological or social regulations (limited port growth, etc.)
- **Current infrastructure** (Table 3.2):
  Map the current ability to handle fuel oils, LNG, ammonia, methanol and other relevant chemicals in your area of interest. Assess the infrastructure in place and estimate the technical development stage to make ports comparable.
- **Future infrastructure** (Table 3.3 / Table 3.4):
  For each port to be considered, make Port Readiness Level Assessment for cargo handling, port call and bunkering to assess the current and future ability to handle alternative fuels
- **Port specific trade** (Table 3.5 / Table 3.6):
  Map cargo segments and trade patterns of the selected ports under the categories of import and export

Why collect this data

- **Identify ports**:
  Get a baseline overview and deselect non-relevant ports
- **Port specific restrictions:**
  Identify discriminating factors that will influence your choice of ports and the actual feasibility of green corridors e.g. water depth limits, the number of vessel segments entering the port.
- **Current infrastructure:**
  Handling relevant fuels and chemicals today can give an indication of readiness levels related to specific alternative fuels and indicate if one port should be favored over another.
- **Future infrastructure:**
  The Port Readiness Level Assessment for bunkering and port call indicates a potential timeframe for establishing a green corridor with specific alternative fuel.
- **Port specific trade:**
  Get an understanding of trade and cargo type, e.g. if you want to select your green corridor based on which ports carry out the highest volume / value of trade.

Port selection process in Pre-Feasibility

The port readiness level assessment (for cargo, call, bunkering) is part of the port selection process in Pre-Feasibility

Define area of interest

Refer to **project vision, goals, and requirements defined in the Scoping Phase**, e.g.,

- Specified region
- Specified use of fuels

Select relevant ports for further assessment

Select relevant ports for further assessment based on, e.g.,

- Highest level of port chemical score
- Existing infrastructure (storage, loading/ unloading bunkering options)
- Location (proximity to large fuel projects)
- Announced ambitions

Collect data through **literature/desktop search** and refer to Workstream 3 data collection template

Factors to select ports may vary depending on the project

Send GCPQ[5] to relevant port stakeholders

Share the Green Corridor Port Questionnaire (GCPQ) with relevant port stakeholders together with an overview of the Port Readiness Level indicator developed by the IAPH/ WPCAP[6] to **understand the port readiness related to bunkering and calling of alternative fuels**

Set up meetings and interview relevant port stakeholders as required

Assess the port's readiness level

Based on the port stakeholders' response, **assess the port's readiness level** by fuel type and year

Ports for Green Corridor

Based on port readiness level assessment as well as the physical set up, ports will be deemed relevant for corridors in Workstream 6

Port readiness level assessment

If quantitative assessment is not possible, turn to the alternative qualitative assessment as outlined in the section "Qualitative port assessment"

5: Green Corridor Port Questionnaire – See next slide
6: International Association of Ports and Harbours/World Ports Climate Action Program

EXAMPLE

Green Corridor Port Questionnaire – Example (1/2)

Introductory questions

	Alternative fuels			
	Methane	Methanol	Ammonia	Hydrogen
Do you expect to be either a bunker port or port of call for any of these alternative fuels? (Please fill in "bunker" or "port of call" or "cargo")				
Cargo	☐	☐	☐	☐
Call	☐	☐	☐	☐
Bunker	☐	☐	☐	☐

Is your port, as of today, ready to receive ships carrying alternative fuels as chemical cargo? (Please fill in "yes" or "no")

Will your port, as of 2025, be ready to receive ships carrying alternative fuels as chemical cargo? (Please fill in "yes" or "no")

Will your port, as of 2030, be ready to receive ships carrying alternative fuels as chemical cargo? (Please fill in "yes" or "no")

Is your port, as of today, ready to receive ships fueled with alternative fuels? (Please fill in "yes" or "no")

Will your port, as of 2025, be ready to receive ships fueled with alternative fuels? (Please fill in "yes" or "no")

Will your port, as of 2030, be ready to receive ships fueled with alternative fuels? (Please fill in "yes" or "no")

Is your port, as of today, ready to bunker ships with alternative fuels? (Please fill in "yes" or "no")

Will your port, as of 2025, be ready to bunker ships with alternative fuels? (Please fill in "yes" or "no")

Will your port, as of 2030, be ready to bunker ships with alternative fuels? (Please fill in "yes" or "no")

EXAMPLE

Green Corridor Port Questionnaire – Example (2/2)

Port Readiness Levels (quantitative)	Alternative fuels			
	Methane	Methanol	Ammonia	Hydrogen
Using the scale outlined on the next page, what is your current Port Readiness Level for the handling of each chemical as cargo? (Please fill in the corresponding number, ranging from 1-9)				
Using the scale outlined on the next page, what is your expected Port Readiness Level for the handling of each chemical as cargo in 2025? (Please fill in the corresponding number, ranging from 1-9)				
Using the scale outlined on the next page, what is your expected Port Readiness Level for the handling of each chemical as cargo in 2035? (Please fill in the corresponding number, ranging from 1-9)				
Using the scale outlined on the next page, what is your current Port Readiness Level to receive vessels fueled with each alternative fuel? (Please fill in the corresponding number, ranging from 1-9)				
Using the scale outlined on the next page, what is your expected Port Readiness Level to receive vessels fueled with each alternative fuel in 2025? (Please fill in the corresponding number, ranging from 1-9)				
Using the scale outlined on the next page, what is your expected Port Readiness Level to receive vessels fueled with each alternative fuel in 2035? (Please fill in the corresponding number, ranging from 1-9)				
Using the scale outlined on the next page, what is your current Port Readiness Level to bunker vessels with each alternative fuel? (Please fill in the corresponding number, ranging from 1-9)				
Using the scale outlined on the next page, what is your expected Port Readiness Level to bunker vessels with each alternative fuel in 2025? (Please fill in the corresponding number, ranging from 1-9)				
Using the scale outlined on the next page, what is your expected Port Readiness Level to bunker vessels with each alternative fuel in 2035? (Please fill in the corresponding number, ranging from 1-9)				

Port Readiness Level indicator for Alternative Fuels for Ships (PRL-AFS)

Context

The PRL-AFS is an **indicator ranging from 1-9**, where 9 is the best possible result

It helps assess a **port's call and bunkering services** related to alternative fuels and thus serves as a tool to understand a **port's suitability for a green corridor**

Ports participating in a green corridor need to be at **minimum PRL7** for Port of Call. For bunkering to happen, **PRL of minimum 7 for Bunkering** is required

Port Readiness Level indicator for Alternative Fuels for Ships (PRL-AFS[7]), 1-9

Deployment	9	Vessel cargo, call or bunkering service readily available
	8	Vessel cargo, call or bunkering system complete and qualified
	7	Vessel cargo, call or bunkering system established on a project basis in an operating environment
Development	6	Vessel cargo, call or bunkering framework demonstrated in a controlled environment
	5	Vessel cargo, call or bunkering framework designed
	4	Vessel cargo, call or bunkering approach decided
Research	3	Sufficient information gathered
	2	Interest of port stakeholders determined
	1	Fuel relevance assessed

7: Source: WPCAP : https://sustainableworldports.org/wpcap/

EXAMPLE

PRL-AFS - Example output

A. Example output: Table[8]

Illustrative port readiness level assessment by port and fuel, [year]

Future infrastructure – Port Readiness Level - **Bunkering**

	Port and Fuel type	2023	2025	2030	2040	2050
Ammonia	Port 1 – Ammonia	4	7	9	9	9
	Port 2 – Ammonia	2	5	7	8	9
	Port 3 – Ammonia	2	5	7	8	9
	Port 4 – Ammonia	2	3	3	5	6
	Port 5 – Ammonia	3	5	7	7	8
Methanol	Port 1 – Methanol	7	9	9	9	9
	Port 2 – Methanol	2	5	7	7	7
	Port 3 – Methanol	2	5	7	8	9
	Port 4 – Methanol	2	5	9	9	9
	Port 5 – Methanol	3	5	7	9	9

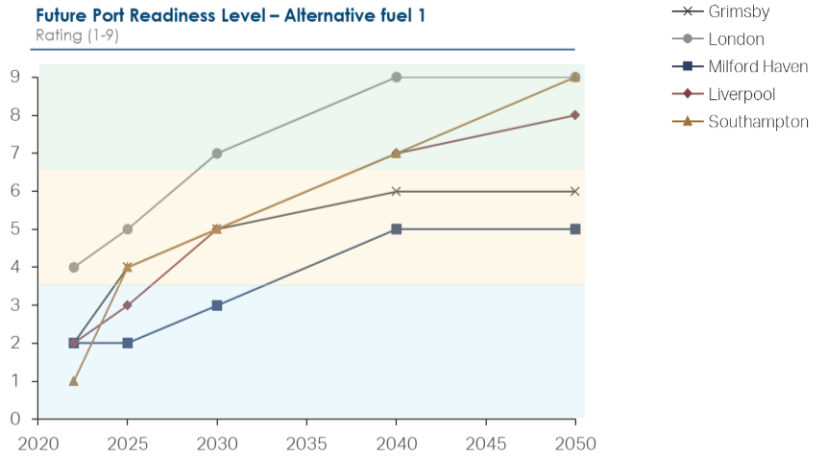
Future infrastructure – Port Readiness Level – **Call**

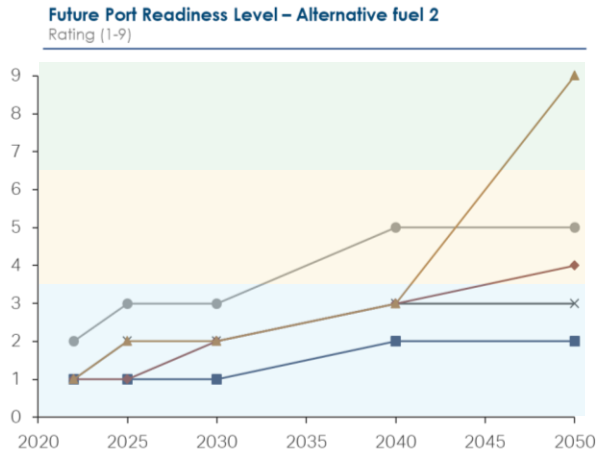
	Port and Fuel type	2023	2025	2030	2040	2050
Ammonia	Port 1 – Ammonia	4	7	9	9	9
	Port 2 – Ammonia	2	5	7	8	9
	Port 3 – Ammonia	2	5	7	8	9
	Port 4 – Ammonia	2	3	3	5	6
	Port 5 – Ammonia	3	5	7	7	8
Methanol	Port 1 – Methanol	7	9	9	9	9
	Port 2 – Methanol	2	5	7	7	7
	Port 3 – Methanol	2	5	7	8	9
	Port 4 – Methanol	2	5	9	9	9
	Port 5 – Methanol	3	5	7	9	9

Fill table with numbers 1-9 from the PRL indicators based on input from port authorities (conduct this assessment for multiple years to evaluate the port's expected trajectory) and **compile the average score** in order to be able to prioritize certain ports and fuel types

B. Example output: Time-series data graph by port and fuel

Illustrative port readiness level assessment by port, fuel, and year





Identify ports that have a PRL above 7 for the selected fuel[9]

8 : Excel template available
9: PRL above 7 indicates deployment of call/bunkering system (1-3 indicates the research phase, 4-6 refers to the development phase). See previous page for context

Alternative: Qualitative port assessment (QPA)

Context

In some projects, a **quantitative assessment may not be possible** in Pre-Feasibility

In those cases, the **qualitative assessment provides an alternative** and can help **facilitate the dialogue** with relevant port stakeholders

Port Readiness Levels (qualitative)

	Alternative fuels				
	2023	2025	2030	2040	2050
By when do you expect the port to be able to handle methane as a chemical cargo?					
By when do you expect the port to be able to bunker methane?					
By when do you expect the port to be able to receive methane-fueled vessels?					
By when do you expect the port to be able to handle methanol as a chemical cargo?					
By when do you expect the port to be able to bunker methanol?					
By when do you expect the port to be able to receive methanol-fueled vessels?					
By when do you expect the port to be able to handle ammonia as a chemical cargo?					
By when do you expect the port to be able to bunker ammonia?					
By when do you expect the port to be able to receive ammonia-fueled vessels?					
By when do you expect the port to be able to handle hydrogen as a chemical cargo?					
By when do you expect the port to be able to bunker hydrogen?					
By when do you expect the port to be able to receive hydrogen-fueled vessels?					

Workstream 4

4 Study phase Intro

- G Introduction, vision and project set up — 1

5 Pre-Feasibility data assessment along 4 domains

- H Alternative fuels, timing, capacity, emission and cost — 2
- I Port, storage and bunkering infrastructure — 3
- J Cargo & services, vessels and routes — 4
- K Regulations / Just & Equitable — 5

6 Selection of possible corridors

- L Selection criteria for potential corridor selection framework — 6
- M First suite of corridors — 6

7 Corridor refinement

- N Consortium Incubation Workshop (CIW) — 7
- O Scenario assessment — 7
- P Commitment assessment — 7
- Q Final report — 7

5J. Cargo & services, vessels and routes

Purpose

- Analyze **import** and **export** by **cargo type**, **volume**, **value**, (vessel / operator specific) **trade routes** and **vessel segments** for defined region.
- Analyze **service activities**, volume and **value** for defined region.
- Analyze **emissions** and **fuel consumption** in the region by segment in a reasonable timeframe – including **emission factor**[1] of ships.

1. Vessel emissions divided by number of ships in region. This to identify the vessel segment with the highest impact on emissions reduction.

Key questions

- Which are the **main cargo types** and **services** in the area (volume and value)?
- Which are the **main trade routes** in the defined area (where from / where to)?
- Which **types of vessels** are **mainly operated**?
- Which **vessel segment** is responsible for which **emissions** and **fuel consumption** within the area?
- Which (unique) vessels **appear on regular basis** in the area?

Importance

- Understand most important trade flows and service activities.
- To **identify suitable vessels** for operation within the green corridor.
- The vessel selection process is used to **narrow down potential green corridors** in the pre-selection phase (1st Suite).

5J. Cargo & services, vessels and routes

Proposed work

Cargo and trade: List products (export and import) per volume, value and vessel segments relevant to the cargo type.

Vessel specific service: Make overview of international and domestic service handling (ferries, cruises, RoPAX, tugboats etc.), and map service against vessel segments.

Vessel analysis: Create overview of vessel segments operating in area of interest, including number of vessels, voyages, fuel consumption and CO_2 emissions in a reasonable timeframe.

Why collect this data

Cargo and trade (Table 4.1 / Table 4.2): Get a product-specific commercial overview of the defined area to select green corridors with specific products or cargo type profiles.

Vessel specific service (Table 4.3 / Table 4.4): Get a service-specific commercial overview of the defined area, to select green corridors with specific service types.

Vessel analysis (Table 4.5): Understand which vessels appear in the area, how often they appear and what their emissions are.

Vessel selection process in the Pre-Feasibility assessment

1 Conduct cargo and trade services analysis

Which vessel segments are relevant for the most important trades?

Example: *When commodity type is known, assess which vessel type and size are predominantly used to ship that specific commodity. For example, if the cargo is grain, the vessel segment of interest is dry bulk and size could be Panamax. If the cargo is iron ore, the vessel segment of interest could be Capsize.*

2 Create gross list of vessels in segments of interest

Based on the outcome of step 1 (the defined vessel type and size), list **existing vessels in region that comply within segment of interest**

3 Identify vessels for green corridor

Shortlist vessels based on selection factors, e.g., age, carrier size, etc.

Assess the option for **retrofitting existing vessels** or alternatively **new-builds**

Out of the shortlist, identify vessels that are **suitable for the green corridor,** depending on consumption profile, speed, operator, etc.

4 Assess performance of selected vessels

For selected vessels, assess **performance of selected vessels** based on parameters, e.g.,

- Fuel consumption
- Emissions

5 Consolidate

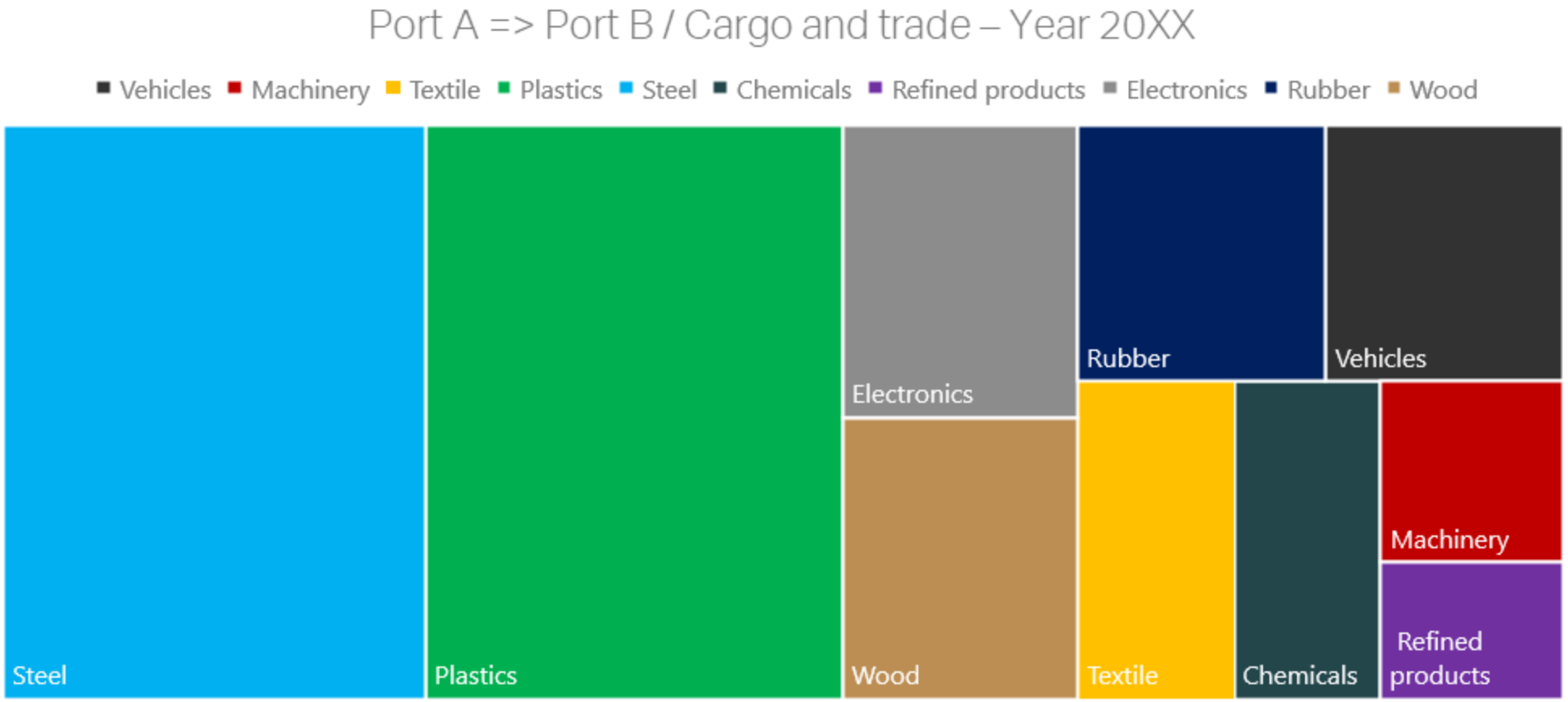
Consolidate vessel selection outcomes

For each identified existing and emerging trade

EXAMPLE

1 Conduct cargo and trade analyses

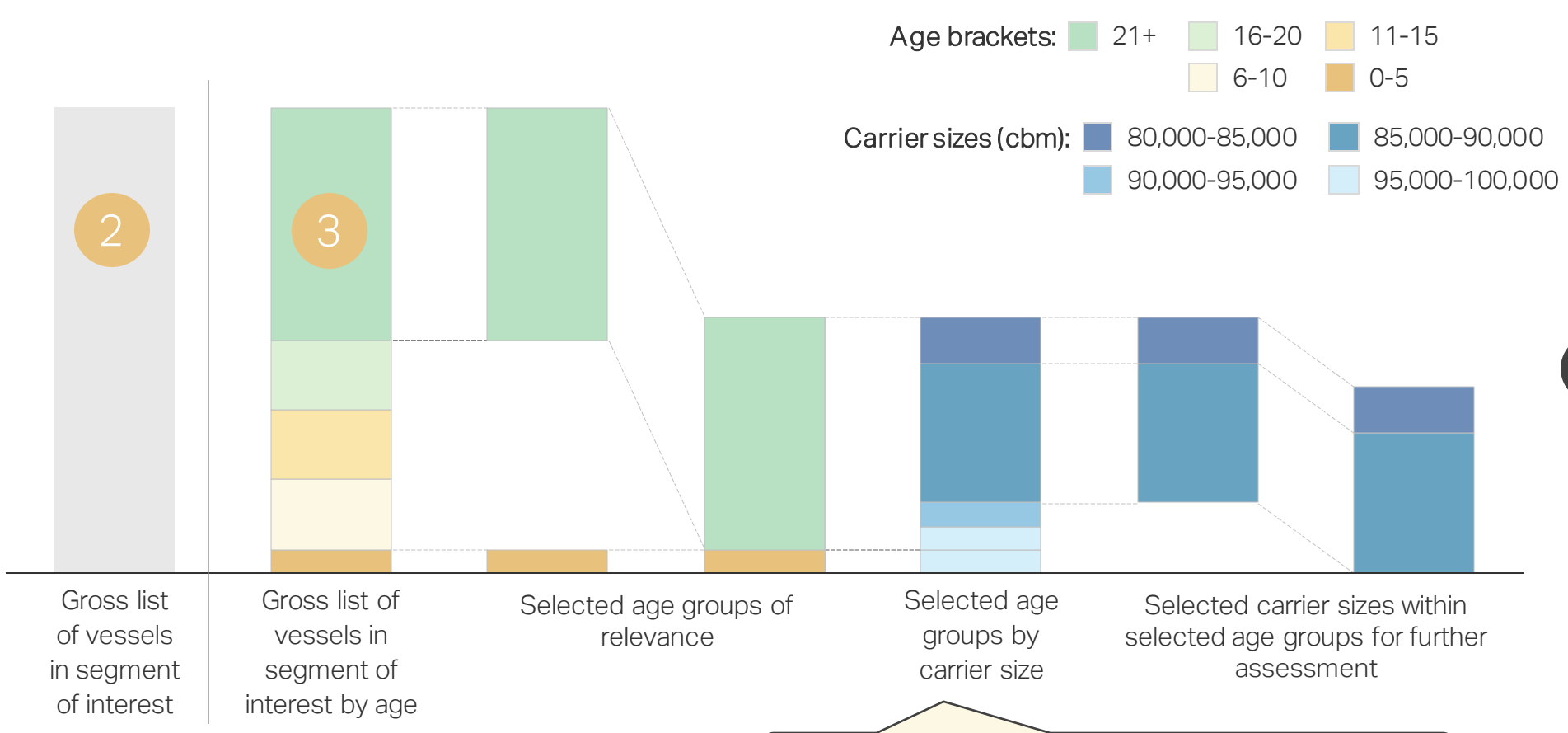
Can be done for a country, region, or port and be both import and export



EXAMPLE

2 Create gross list of vessels in segments of interest & 3 Identify vessels for green corridor

Illustrative shortlisting of vessels based on age and carrier size as example parameters



Age and carrier size are just example parameters. Other parameters can also be used to shortlist vessels

Selected vessel **sub-group** serves as input for **green corridors** assessment

For selected vessels, assess **performance** based on

- Fuel consumption
- Emissions

EXAMPLE

4 Assess performance of selected vessel segments

	Segment 1 E.g.: Bulkers	Segment 2 E.g.: Containers	…
E.g.: Number of ships	…	…	…
E.g.: Engine output	…	…	…
E.g.: Total fuel consumption	…	…	…
E.g.: Total CO_2 emission	…	…	…
…	…	…	…

EXAMPLE

Assess performance of selected vessel segments – Example Northern European & Baltic green corridor pre-feasibility study

Summary of fuel consumption and CO_2 emissions (tank-to-wake) for the Baltic Sea fleet during 2019.[6]

	4 RoPax	4 Tanker	4 Bulk	4 Container	4 Vehicle	4 Cruise	4 Passenger	4 Service	4 Fishing	Total
Ships (#)	211	1,981	4,035	492	264	87	465	388	784	**8,772**
Fuel Main (kT/yr)	1,070	649	720	420	374	130	46	36	21	**3,466**
Fuel Aux (kT/yr)	181	363	274	247	62	39	25	41	21	**1,253**
Total fuel (kT/yr)	1,251	1,012	994	667	436	169	71	77	42	**4,719**
CO_2 (kT/yr)	3,804	3,074	3,021	2,027	1,325	515	217	233	130	**14,346**

5 Consolidate

When all relevant existing and emerging trades (import and export) and services have been assessed, and their relevant vessel segments identified, a consolidated list of identified routes, their involved ports, the likely fuel, the CO_2 emission potential etc, can be created

Cargo Type	Cargo Status	Segment	Ports involved		Alternative Fuel(s)	Emission per route tCO_2eq	Emission for one vessel per year tCO2eq/y
Cargo 1	Existing	Vessel Segment 1	Port A	Port B	Ammonia		
			Port A	Port C	Ammonia		
			Port D	String	Ammonia		
Cargo 2	Existing	Vessel Segment 2	Port A	Port F	Ammonia/Methanol		
			Port B	Port ?	Ammonia/Methanol		
		Vessel Segment 3	Port G	Port H	Methanol		
Cargo 3	Existing	Vessel Segment 4	Port A	String	All		
			Port J	String	All		
		Vessel Segment ?	Port A	Port ?	All		
Cargo 4	Emerging	Vessel Segment 5	Port L	Port C	Ammonia/Methanol		
		Vessel Segment ?	Port M	Port N	Hydrogen		
Service 1	Existing	Vessel Segment 6	Port B	Port K	Methanol		
			Port G	Port ?	Methanol		
			Port C	Port M	Methanol		
Service 2	Emerging	Vessel Segment ?	Port B	Port ?	Methanol/Hydrogen		
		Vessel Segment ?	Port ?	Port ?	Methanol/Hydrogen		

Workstream 5

4 Study phase Intro

5 Pre-Feasibility data assessment along 4 domains

6 Selection of possible corridors

7 Corridor refinement

G Introduction, vision and project set up — 1

H Alternative fuels, timing, capacity, emission and cost — 2

I Port, storage and bunkering infrastructure — 3

J Cargo & services, vessels and routes — 4

K Regulations / Just & Equitable — 5

L Selection criteria for potential corridor selection framework — 6

M First suite of corridors — 6

N Consortium Incubation Workshop (CIW) — 7

O Scenario assessment — 7

P Commitment assessment — 7

Q Final report — 7

5K. Regulations / Just & Equitable

5K.1: The regulatory assessment is initiated with the collection of data on policies and regulations of the green corridor within the focus area. With this, it is possible to assess the impact of the policies and regulations on the value chain and identify factors that favor green corridors in certain areas.

5K.2: The Just & Equitable assessment consists of a question catalogue to guide research and reflection on the socio-economic opportunities and risks related to the focus area. It is the basis for addressing existing risks and opportunities. The following section provides guidance as to which resources can/will address the questions, and context around Just & Equitable consolidation within green corridors.

5K.1 Regulations

Purpose

- In the defined area of interest, map social, ecological, commercial, technical (e.g. electric poles in the area, incentive programs, nature reserve) relevant landscape within:
  - **regulations**,
  - **policies**
- Identify factors within the above-mentioned landscape for defined area of interest which can impact the decisions on green corridors.

Key questions

- Which **policies and regulations** can possibly affect establishing a green corridor?
- Which factors need to be considered when assessing green corridors in this area?

Importance

- Evaluation of the impact of regulations on the potential formation of a green corridor.
- To combine insights from Workstreams 2-4 with the regulatory assessment results.
- Use the regulatory assessment findings to (de-)select potential green corridors based on their viability.

5K.1 Regulations

Proposed work

Identify policy and regulatory factors, which will have impact on type, location, fuel leading to preference for green corridors in one area over another.

Assessment insights Consolidate relevant information in tables and maps depending on your level of assessment (Tables 5.1.1, 5.1.2, 5.1.3, 5.1.4).
Assess area-specific information regarding, e.g. social or ecological incentives, supporting development in infrastructure, climate targets and ambitions.

Why collect this data

Assessment insights (Tables 5.1.1, 5.1.2, 5.1.3, 5.1.4):
Identifying policy, regulatory and funding (discriminating) factors in defined area will help pinpoint the most optimal green corridor options.

3-step process to assess the regulatory environment of the green corridor

1. Understand the level at which assessment is required

Evaluate at **which level the policy / regulatory assessment should take place** based on project vision, goals, and requirements:

- Port level
- Region level
- Country level
- Continent level

2. Collect data

Collect data on key policies and regulations either from **project members**, where applicable, or through **desktop research** (refer to data collection guideline)

3. Assess the impact on value chain and green corridor

Review the regulations and their **impact on the value chain** (fuel production, ports, vessel operations) and identify **factors** that either act as drivers or barriers for a green corridor

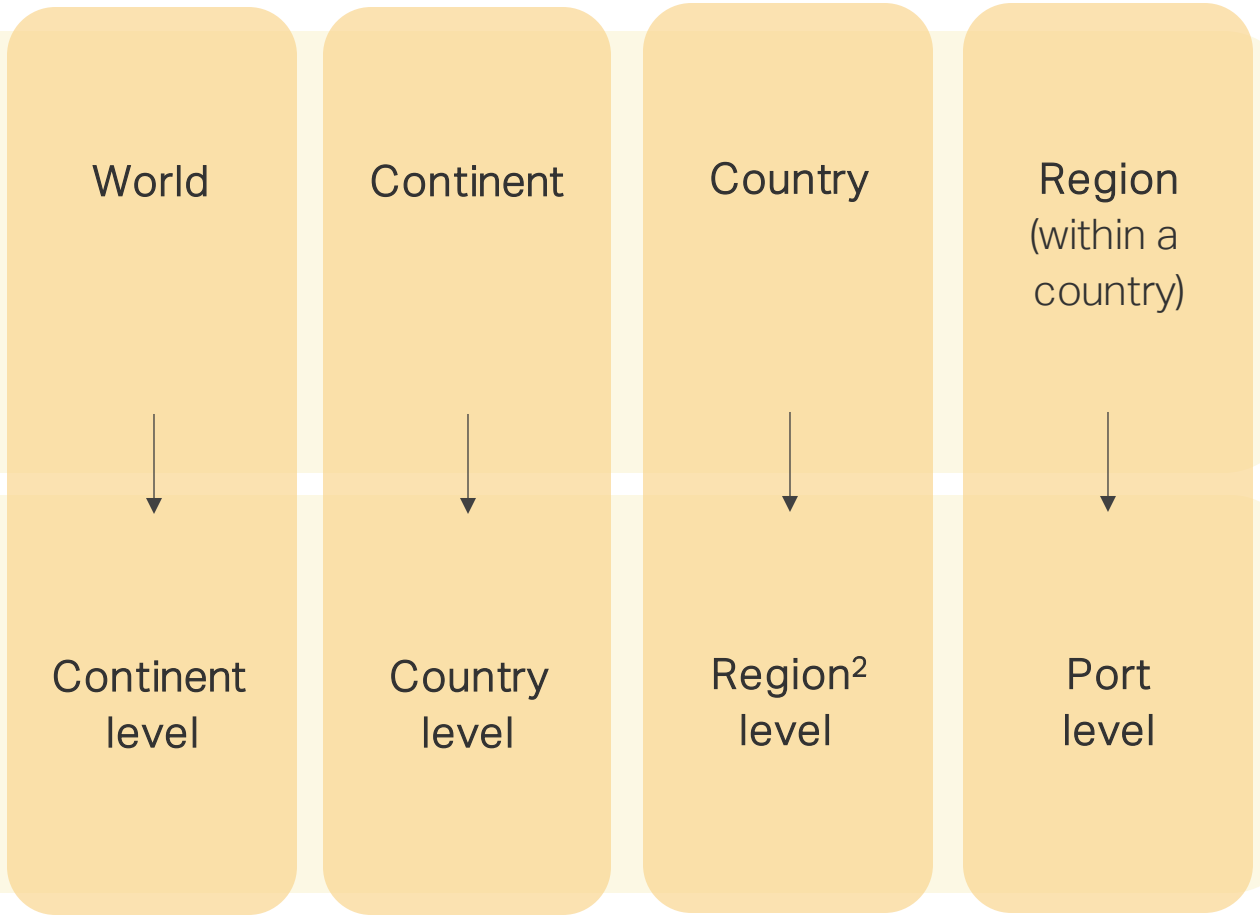
1. Understand the level of detail required in the regulatory assessment

1 Area of focus

Derive area of focus from the project vision, goals, and requirements. Area of focus refers to the overall area that is investigated in terms of establishing 1st Suite green corridors

2 Level of regulatory assessment

Based on the area of focus, identify the level of regulatory assessment required (port, region, country, or continent level)[10]



Example:
If the chosen area of focus is a country, e.g., Chile, the regulatory assessment should be conducted on region level, e.g., Magallanes

10 : It is suggested to choose only one regulatory assessment level due to the limited scope of the Pre-Feasibility Study and to avoid unnecessary detailing of regulations before moving into Feasibility. For example, if the focus area is a continent, the regulatory assessment should only be conducted at country level (not at region or port level)

TEMPLATE

2. Collect data for regulatory assessment: Data template

Type of regulation	Regulator	Key statements	Source
…	…	…	…
…	…	…	…

Indicate the type of regulation. Examples:
- Law
- Policy
- Guidance
- Rule

List the respective regulators. Examples:
- Name of government
- Name of ministry

Include key insights from the regulation. Examples by level of regulatory assessment[11]:

Port level	• Infrastructure restrictions
Region[12] level	• Social, ecological incentives in specific region • Similar incentives in same region • Supporting development in infrastructure
Country and continent level	• Limits funding for specific fuels • Supporting development of infrastructure • Ramp-up speed of renewable energies • Climate targets / ambitions

Indicate the source for the regulation and its key statements. Examples:
- Link to website
- Link to report

11: Only one regulatory assessment level can be chosen. For example, if your focus area is a continent, only conduct the regulatory assessment on country level (not on region or port level)
12: Region level means regions within one country

EXAMPLE

2. Collect data for regulatory assessment: Data template - Examples

EXAMPLES HAVE BEEN TAKEN FROM VARIOUS PROJECTS

Level of regulatory assessment[13]	Type of regulation	Regulator	Key statements	Source
Port-level assessment	Law	Chilean government	Publicly owned ports cannot operate terminals	Chilean Green Corridor Network
Region-level assessment[14]	Law	Chilean government	Development poles to improve grid connection	Chilean Green Corridor Network
Country-level assessment	Price	Market	Tariffs on electricity are under revision	Northern European Green Corridor Network
Continent-level assessment	Law	European governments	EU ETS; Country-specific carbon taxes	Carbon Tax: "laboratory" Europe shows U.S. it has no effect on aggregate jobs, growth - Energy Post

13: Only one regulatory assessment level can be chosen. For example, if your focus area is a continent, only conduct the regulatory assessment on country level (not on region or port level
14: Region level means regions within one country

3. Evaluate whether factors are drivers or barriers for a green corridor

1 Barrier for green corridor 2 Neutral 3 Driver for green corridor

Context

For each factor, assess at the required port / region / country / continent level (whichever applies[15]), whether the factor acts as a driver or barrier for the development of a green corridor

Exemplary analysis of discriminating factors on country level

Type of regulation	Regulator	Key statements	Source	Discriminating factor for green corridor	Impact score of discriminating factor (1-3)
Price	Market	Tariffs on electricity are under revision	Northern European Green Corridor Network	Electricity price	1
Rule	tbd	No standards for ammonia as alternative fuel	Northern European Green Corridor Network	Ammonia handling	2

Impact score allows for analyses of discriminating factors for green corridors at country level (illustrative)

Country	Discriminating factors for green corridor: Ammonia handling	Discriminating factors for green corridor: Electricity price	Average score
Germany	2	1	1.5
Netherlands	2	2	2.0
Denmark	2	2	2.0
Poland	1	2	1.5
Estonia	1	2	1.5

15: Only one regulatory assessment level can be chosen. For example, if your focus area is a continent, only conduct the regulatory assessment at country level (not at region or port level)

5K.2 Just & Equitable

Purpose

The Just & Equitable assessment is an important tool for creating awareness and later address potential socio-economic risks and opportunities associated with the geographic location of a green corridor.

The J&E assessment is a desk-research exercise following a set of pre-defined questions in the data collection template.

The J&E assessment is not intended to be used to (dis)qualify a specific corridor. The Just & Equitable assessment concerns the area of interest and is meant to serve as a foundation for further research, discussion and prioritization that go beyond technical, financial and regulatory feasibility.

The exercise will be repeated in Workstream 7 for 1st Wave corridors.

Key questions

- What are the key socio-economic risks and opportunities and derived implications for potentially creating a green corridor in the area of interest?
- Are there any Just & Equitable concerns for the most promising corridors (1st Wave)?

Importance

To ensure that a green corridor is created in a just and equitable way, it is crucial to extend considerations beyond technical, regulatory, and cost factors.

By creating awareness of and addressing potential socio-economic risks and opportunities at an early stage, these can be either mitigated or leveraged as part of further developing the corridor, thereby increasing the chance of success and positive impact on the surrounding communities.

5K.2 Just & Equitable

Proposed work

Just & Equitable assessment of the focus area.

Collect data through desk research on:

- Any existing Just Transition regulations
- Country's income level and identification with the Global South
- The human rights situation in the area
- Level of electricity access
- Level of dependence on fossil fuels in the area.

Why collect this data

Just & Equitable assessment of the focus area (Table 5.2.1): This data gives high-level insight into the situation in the area of interest and acts as an initial identification of potential socio-economic risks and opportunities, and considerations on how to address these. Additionally, this data also informs directions of deeper research in the Feasibility phase.

The J&E assessment of the focus area follows a simple 4-step process

1. Understand the level of detail required

Understand the level of detail required for the Just & Equitable assessment of the focus area (see next slide).

2. Familiarize yourself

Become acquainted with the questions, the context and guidance on where to find appropriate data.

3. Collect data

Collect the relevant data by following the question catalogue, including risks and opportunities.

Collect data in data collection sheet "Just & Equitable XX.X"

4. Reflect on the implications for corridors in these areas

Reflect on the implications of the collected data for the creation of a Just & Equitable Transition in each area.

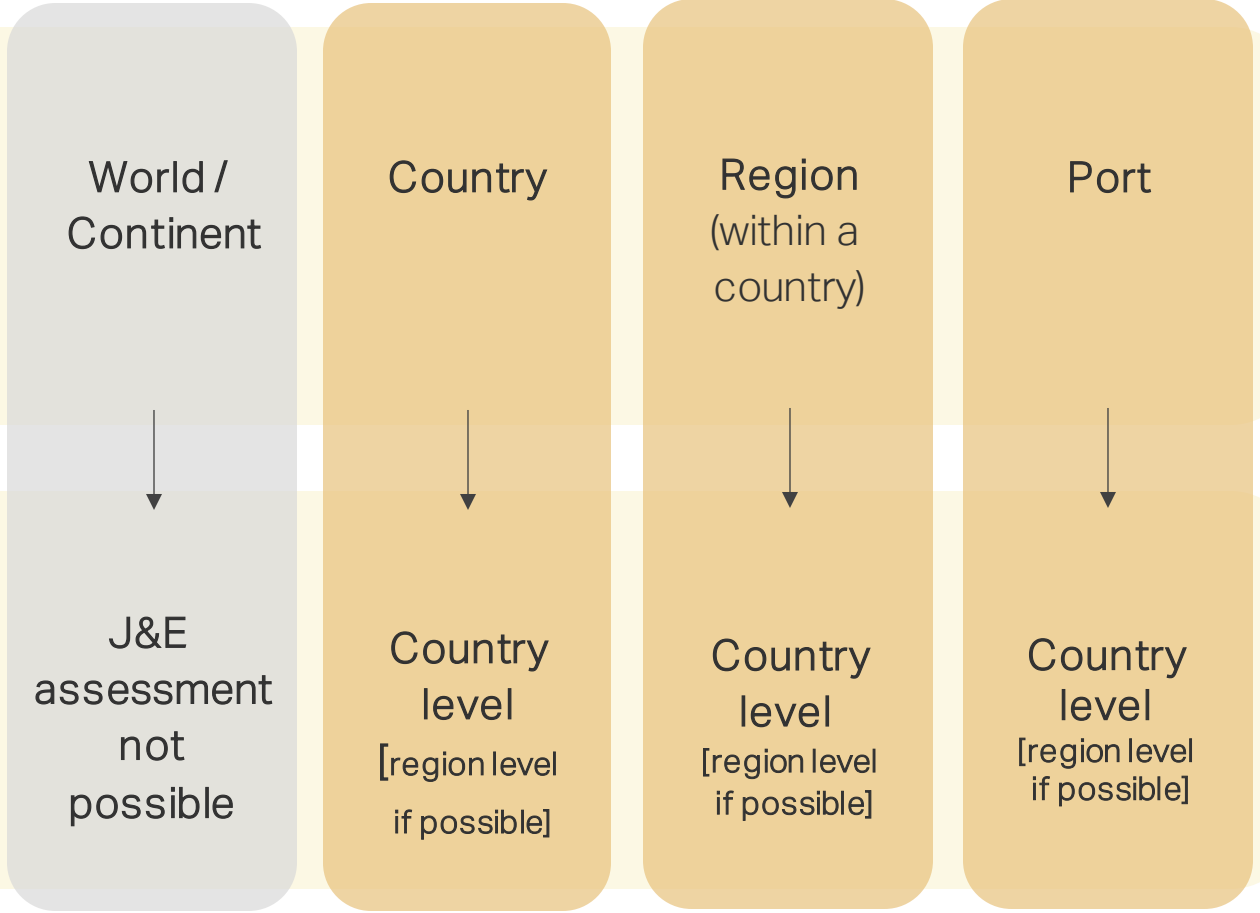
The area of focus informs the level of detail needed for the J&E assessment

1 Area of focus

Derive area of focus from the project vision, goals, and requirements. Area of focus refers to the area that is investigated in terms of establishing a green corridor

2 Level of J&E assessment

Based on the area of focus, identify the level of J&E assessment required.



Example:

If the focus area is the Port of San Antonio, the J&E assessment is done for Chile, with special attention to the Valparaíso Region, if possible.

If the focus area is South America, the J&E assessment is not possible.

Dimensions, questions and implications to consider as part of Just & Equitable

Existing Just & Equitable Transition ambitions or regulation	Does the area have a Just Transition vision or any regulations, laws, or working programs around Just Transition and/or social sustainability?	If so, the green corridor could be anchored within this.
Global inequalities	At what income level is the country categorized and is it within the Global South?	Socio-economic benefits from the corridor might be maximized if one or more country of low- or middle-income is included, rather than a corridor exclusively connecting high-income countries.
	How dependent is the country on fossil fuels?	A high dependence on fossil fuels for the national economy can be an indicator that the country might especially benefit from a green corridor project, as it involves a diversification of the energy sector.
Human Rights & Corruption	What is the human rights situation in the country? Are there any particular risks or opportunities to be aware of?	It is critical for a green corridor consortium to be aware of any human rights challenges and be ready to address these throughout the development of the corridor, especially in conversation with regional authorities.
Access to essential resources	What is the level of electricity access? What share of produced energy is from renewables?	If electricity access below 100%, special attention should be paid to opportunities of increasing electricity access through means of the green corridor.
Decent green jobs	What share of the working population is employed in jobs directly linked to the fossil fuel industry?	If a large share of the working population is employed in jobs directly linked to the fossil fuel industry, then their jobs are threatened in the mid-term. In such cases, special attention should be paid to creating opportunities for re-and upskilling of workers.

EXAMPLE

Questions to consider as part of the J&E assessment: Example from Chile

Dimension	Pillar	Questions to consider	Answers (and reference to sources)	Implications
Nation	Existing Just & Equitable Transition ambitions or regulation	**Does the area have any regulations, laws, or goals, or working programs around Just Transition and/or social sustainability?**	Yes. Chile has a Just Transition Strategy for Energy, published in 2021 and anchored in their NDC (NDC registry).	Further research into the Just Transition Strategy for Energy could be helpful in the next stage to potentially identify relevant subsidies, etc. The existence of a national Just Transition Strategy could also be used to gain support for the corridor from stakeholders in Chile.
	Global inequalities	**At what income level is the country categorized and is it within the Global South?**	Chile is classified as a high-income country by the World Bank (World Bank).	With the focus area being a high-income country, efforts should be made to identify ways of how this corridor could also benefit lower income countries, e.g. through knowledge and technology transfer, in an attempt to avoid exacerbating the existing global inequity.
		What percentage of annual GDP is based on fossil fuels?	About 26% of total electricity generation through renewables in 2020 (hydro, biofuels, wind, solar PV, geothermal). Relatively small export of oil or natural gas goal compared to import. (source: https://www.iea.org/countries/chile , Sustainabe development goals/share of renewable energy).	This suggests that Chile is not extremely strongly dependent on fossil fuel. However, there is a large opportunity to increase the share of renewables in electricity generation.
	Human Rights, Conflict & Corruption	**What is the human rights situation in the country? Are there any particular risks or opportunities to be aware of?**	Consult Human Rights Watch for information	In the Feasibility and Implementation phases of the corridor, the existing human rights challenges should be addressed. This could include addressing them with the national public stakeholders, e.g. governments, who are involved in the consortium. Further, processes like hiring processes and labor conditions should try to counteract potential gaps in human rights, e.g., by encouraging and actively searching out the employment of people with disabilities in the fuel plant/ports related to the green corridor.
Community	Access to essential resources	**What is the level of electricity access?**	100% (World Bank)	Limited implications. If the electricity access is less than 100%, the green corridor should identify opportunities to increase the population's electricity access through the green corridor investments.
Workers	Decent green jobs	**What share of the working population is employed in jobs directly linked to the fossil fuel industry?**	No information could be found. Unemployment rate in 2022 was 7.8% (https://data.worldbank.org/indicator/SL.UEM.TOTL.ZS?locations=CL)	The green corridor could be harnessed to create new decent green jobs and lower the unemployment rate.

Workstream 6

4 Study phase Intro

5 Pre-Feasibility data assessment along 4 domains

6 Selection of possible corridors

7 Corridor refinement

G Introduction, vision and project set up 1

H Alternative fuels, timing, capacity, emission and cost 2

I Port, storage and bunkering infrastructure 3

J Cargo & services, vessels and routes 4

K Regulations / Just & Equitable 5

Selection criteria for potential corridor selection framework 6

M First suite of corridors 6

N Consortium Incubation Workshop (CIW) 7

O Scenario assessment 7

P Commitment assessment 7

Q Final report 7

6L. Selection criteria for potential corridor selection framework

Purpose

- Define and prioritize selection criteria for green corridors (might be related to vision and objectives).
- Provide 1-3 corridors for the selected and prioritized selection criteria subsets.
- Create list of possible green corridors including selection criteria.

Key questions

- Which parameters can be used as **selection criteria** and how are they **ranked and weighted**?
- Which are the **possible green corridors?**

Importance

- The **stakeholders in the region** establishing the **selection criteria** for green corridors is a **crucial stage gate**.
- Facilitate alignment within the project team on key criteria for green corridors.
- Transition from database to the **1st Suite of green corridors**.

6L. Selection criteria for potential corridor selection framework

Proposed work

Corridor selection criteria: Identify relevant Corridor Selection Criteria based on vision, objectives (as outlined in Chapter 1) and other insights related to the defined area of interest.

Rank Corridor Selection Criteria: A ranking of the criteria is based on insight and subjective (stakeholder-specific) choices (Table 6.1). The highest five will generally be used.

List green corridors: Each criteria configuration will lead to the identification of a series of prioritized green corridors (Table 6.2).

Why collect this data

Corridor selection criteria: Define the Corridor Selection Criteria for ranking / prioritization of potential green corridors.

Rank Corridor Selection Criteria (Table 6.1): Rank criteria against preferences.

List green corridors (Table 6.2): This is the final result of your decisions and prioritization.

Two options to generate selection criteria

Option 1: Selection criteria defined by Workstream Lead 6[16]

Option 2.1[17]**:** Initial selection criteria proposed by Project Lead – Reviewed by Workstream Lead 6

Option 2.2[18]**:** Initial selection criteria proposed by Project Lead – Possible conflict / contradictions identified by Workstream Lead 6

A. Define and prioritize Pre-Feasibility selection criteria subsets

Workstream Lead 6 **defines Pre-Feasibility selection criteria**[3] and prioritizes **2-5 selection criteria subsets**

A1. Propose an initial set of selection criteria

Project Lead **proposes initial Pre-Feasibility selection criteria**[3]

A2. Review and prioritize selection criteria subsets

Workstream Lead 6 **reviews** the selection criteria and **prioritizes** 5 selection criteria subsets

A1. Propose an initial set of selection criteria

Project Lead **proposes 5 Pre-Feasibility selection criteria**[3]

A2. Evaluate selection criteria subsets

Workstream Lead 6 **ensures** that the selection criteria subsets are **not conflicting with or contradicting** strategies and policies

B. Create preliminary suite of green corridors

Project Lead to generate a preliminary suite of green corridors which comply with the prioritized selection criteria subsets

C. List and map 1st Suite of green corridors

This shortlist should contain **10-30 green corridors**

Optional:
If needed, adjust selection criteria in an iterative way to capture relevant strategic insights

Sign-off on selection criteria subsets and corresponding suite of green corridors with relevant project members

16: Typically, an authority, ministry, or government. Has to be a stakeholder that has a holistic view on the ecosystem without commercial interests
17: Only relevant if Workstream 6 requests support on suggesting Pre-Feasibility selection criteria
18: Excel template available

Selection criteria options

Chapter analysis

Green Corridor **selection criteria** (might be related to vision and objectives) and **ranking** (stakeholder-specific) of criteria

Criteria	Example	Table
1	Transport of cargo / service	Table 3.5, 3.6 and 4.1 to 4.4
2	Domestic trade route	Table 4.3
3	International trade route	Table 3.2, 3.3, 4.2, 4.3 and 4.5
4	Transport of top 10 cargo	Table 3.2 and 3.3
5	Primary trade routes	Table 4.2 to 4.4
6	Any corridor from largest port	Table 3.2 and 3.3
7	CO_2 emissions	Table 2.5, 2.10 and 4.1
8	Any corridor until 2030	Table 2.2, 2.3, 3.5 and 3.6
9	Use of alternative fuel	Table 2.2, 2.3, 3.5 and 3.6
10	Regulatory feasible	Table 5.1.x

Selection criteria might not always be one-dimensional, meaning that you will have to combine data from different tables and include qualitative knowledge. In this case, an objective result is always difficult, and the list of corridors will be influenced by the ones executing the Pre-Feasibility assessment.

Please keep in mind that the **qualitative data**, which will be gathered during **interviews** with the relevant **stakeholders,** are equally important and can indicate what to focus on.

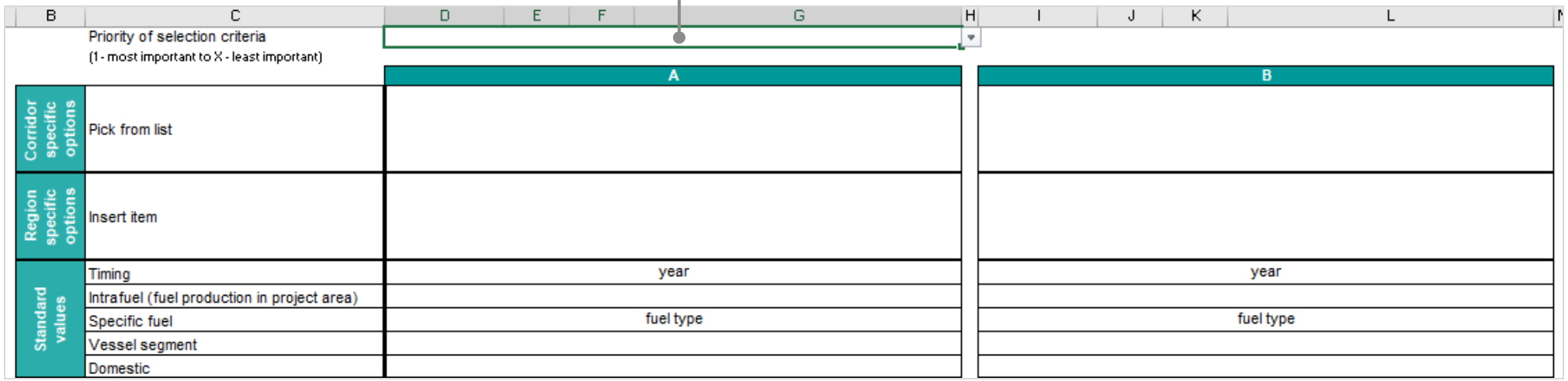
A. Define and prioritize selection criteria subsets in the Excel tool (1/2)

2 Prioritization
Prioritize selection criteria subsets A-X by numbering them from 1-3 (where 1 is highest priority)

1

Selection criteria
Insert selection criteria.

Choose from drop-down menu where applicable



	Priority of selection criteria (1 - most important to X - least important)		
		A	B
Corridor specific options	Pick from list		
Region specific options	Insert item		
Standard values	Timing	year	year
	Intrafuel (fuel production in project area)		
	Specific fuel	fuel type	fuel type
	Vessel segment		
	Domestic		

A. Define and prioritize selection criteria subsets in the Excel tool (2/2)

		A
Corridor specific options	Pick from list	
Region specific options	Insert item	
Standard values	Timing	year
	Intrafuel (fuel production in project area)	
	Specific fuel	fuel type
	Vessel segment	
	Domestic	

Elements	Corridor specific options
Trade and logistics	– Transport of cargo / service xy – Transport of top 10 cargo (volume) – Transport of top 10 cargo (value) – Primary trade routes (port A to port B) – Expected future growth, CAGR 2021-25 – Any corridor from largest port
Emissions	– CO_2 emissions
Corridor readiness	– Any corridor until 2030 – Alternative Fuel 1 readiness with specific amount – Regulatory feasible
Vessel	– Any corridor with specific vessel type – Primary vessel types in region

Add region-specific details related to corridor-specific options, e.g., type of cargo

Timing: Input first year of operation

Vessel segments: Container, bulk carrier, tanker, RoRo, gas carrier, cruise, general cargo, tug, ferry, not relevant

Fuel types: e-ammonia, e-methanol, e-hydrogen, blue ammonia, bio-methane, e-methane, bio-methanol, bio-diesel, e-diesel, non-ammonia, blue hydrogen, not relevant

EXAMPLE

From Excel tool to prioritized selection criteria

Template with selection criteria

		A
Corridor specific options	Pick from list	Transport of top 10 cargo (value)
Region specific options	Insert item	N/A
Standard values	Timing	2030
	Intrafuel (fuel production in project area)	yes
	Specific fuel	e-Ammonia
	Vessel segment	not relevant
	Domestic	no

High-level summary of prioritized criteria subsets (exemplary)

Proposed criteria for corridor selection in Chilean Pre-feasibility Study	AREA	CARGO	OTHER
– Criteria Sub-set 1 – **Domestic** use of **Ammonia as Cargo** and **Ammonia as fuel** before **2030**			
– Criteria Sub-set 2 – **Transport of People internally in Chile** on vessels **by non-Ammonia Alternative Fuel** before **2030**			
– Criteria Sub-set 3 – **International** Transport of a **Top 10 Export** (by value) good in **2030**			
– Criteria Sub-set 4 – One of the **Top 10 most CO_2 emitting vessels** (in 2020) to be on **Alternative Fuel** by **2030**			
– Criteria Sub-set 5 – **International transport** of **Ammonia** to enable ammonia as a future commodity before **2030**			
– Criteria Sub-set 6 – **Any vessels and cargos** which can sustain a corridor by **2027** by **5000 (?) t fuel/y**			small amount

Each column makes up one selection criteria subset. **All selection criteria subsets are prioritized and summarized** to serve as the basis for **further discussion**

Each of the **green corridors** selected for further discussion **corresponds to one of the prioritized selection criteria subsets**

1st Suite of green corridors (Section 6M)

Workstream 6

4 Study phase Intro

5 Pre-Feasibility data assessment along 4 domains

6 Selection of possible corridors

7 Corridor refinement

G Introduction, vision and project set up — 1

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M First suite of corridors — 6

N Consortium Incubation Workshop (CIW) — 7

O Scenario assessment — 7

P Commitment assessment — 7

Q Final report — 7

6M. First suite of corridors

Purpose

- **Identify potential green corridors** through a comprehensive listing process.
- Use the data gathered in Workstreams 2-5 and consider multiple criteria when deciding which green corridors to pursue.
- Repeat the process as necessary, ensuring a comprehensive evaluation.
- Decide the specific number of corridors considered viable for further exploration.

Importance

- While the goal is CO_2 emission abatement, the fastest way to achieve this may not involve addressing the largest emitters directly.
- In some regions, the availability of specific fuels may render a particular vessel segment more relevant, while in other areas, secondary attributes such as the availability of a local workforce, opportunities for infrastructure development, or the potential for increased technical insights may take precedence.
- Decisions may also be influenced by specific regulations or funding options, providing certain corridors or fuel segments with a strategic advantage.
- It is crucial to note that the dataset does not have to be exhaustive to form the foundation for deciding to proceed with the Feasibility assessment. If certain suggested data tables are not generated, it indicates that specific criteria cannot be activated.
- Conversely, the collection of additional data can generate supplementary selection criteria.
- The generation of 1st Suite corridor is data-driven and transparent.

Corridor generation based on the objective data (and subsequent data cube) and the Selection Criteria to determine areas for corridors

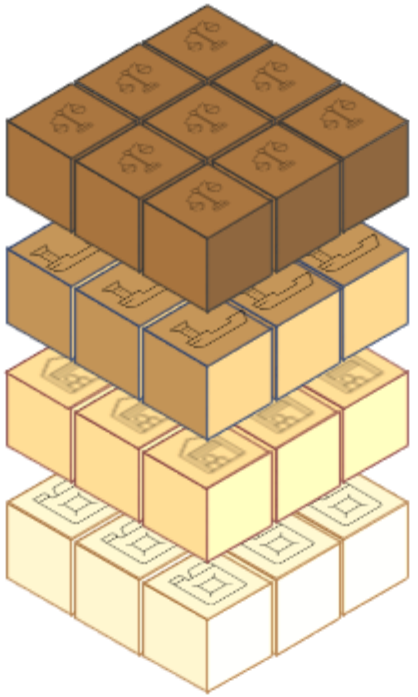
Data Gathering and Selection Criteria (WS 2-6A) → Develop Data Cube (WS 6B) → Generate corridors (WS 6B)

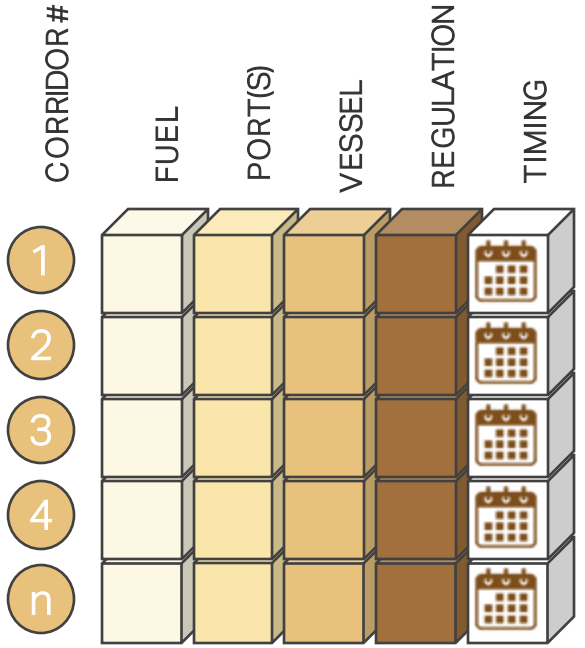
Gather data insight[19] on energy and fuel project – 'build fuel layer'
WHAT: Public information on projects is scaled according to maturity and mapped according to capacity and timing.
WHY: Ensuring balance between available fuel and proposed corridors wrt fuel type, timing, capacity.

Gather data insight[1] on ports – 'build port layer'
WHAT: Make assessment of port readiness wrt port of call and bunkering of fuel types.
WHY: Ensuring that proposed ports for corridors are ready in due time.

Gather data insight[1] on cargo and vessels – 'build cargo and vessels layer'
WHAT: Gather information on trades (import and export) and services. Map typical vessel segment.
WHY: Allow corridors selected to match relevant existing and emerging trade.

Gather data insight[1] on regulation, policies, Just & Equitable – 'build regulation layer'
WHAT: Gather information on relevant policies, regulations, Just Transition principles.
WHY: Identify relevant policies, regulation and funding options which can enable green corridors.





Selection Criteria
Based on national strategies, climate action plans, decarbonization targets, Just & Equitable philosophy. Criteria decide how the data cube is 'sliced' to generate corridors. Determining which optics to use to produce the corridors from the data cube.

19 : In accordance with principles outlined in the methodology

EXAMPLE

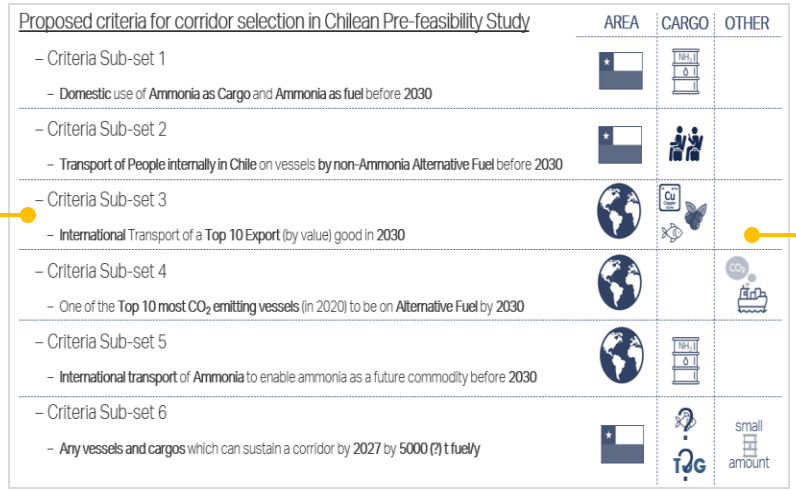
Desired outputs: The project team derives the 1st Suite of potential green corridors from the prioritized selection criteria subsets

Template with selection criteria

		A
Corridor specific options	Pick from list	Transport of top 10 cargo (value)
Region specific options	Insert item	N/A
Standard values	Timing	2030
	Intrafuel (fuel production in project area)	yes
	Specific fuel	e-Ammonia
	Vessel segment	not relevant
	Domestic	no

Each column makes up one selection criteria subset. **All selection criteria subsets are prioritized and summarized** to serve as the basis for **further discussion**

High-level summary of prioritized criteria sub-sets (exemplary)



Each of the **green corridors** selected for further discussion **corresponds to one of the prioritized selection criteria subsets**

Suite of green corridors (exemplary)

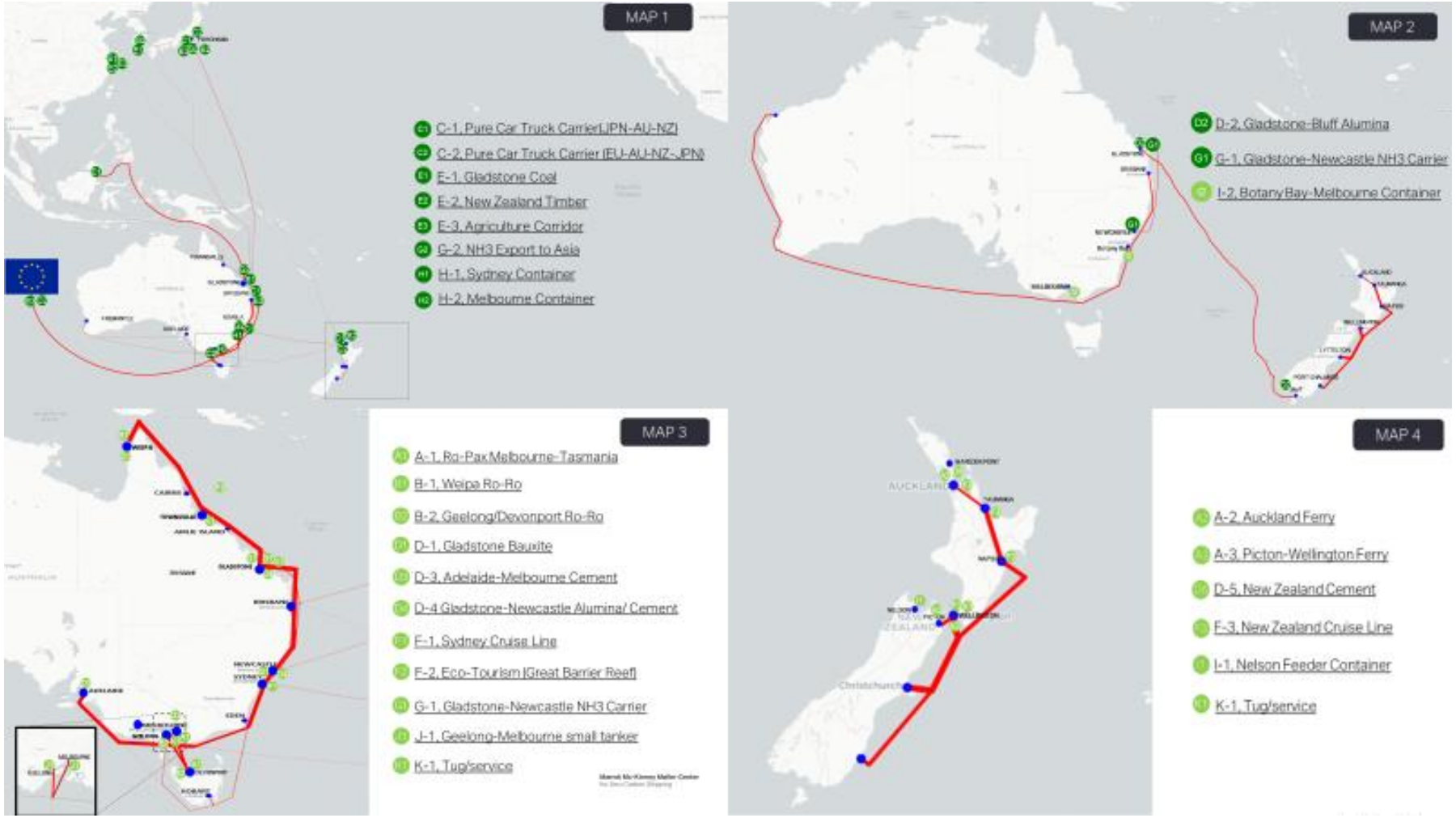
Loc.	ID	Short description
D	1	Chilean Powerplant Ammonia
D	2	Chilean Mining Explosives Ammonia
D	3	Austral Ferries
D	4	Austral Cruise
I	5	CuS Corridor
I	6	Copper China Corridor
I	7	Green Cupper Europe
I	8	Car Import from Japan
I	9	Agri/Aqua Culture Corridor
I	10	ContainEurope
I	11	CircumSouthAmericas
I	12	Ammonia Exp Japan
I	13	Ammonia Exp Rotterdam
I	14	Ammonia Exp Los Angeles
I	15	Ammonia Exp Singapore
D	16	Austral Fish/Aqua
D	17	Tug/service
D/I	18	H_2SO_4 Carrier for mining

Illustrate all proposed corridors

- Illustrating the proposed corridors is critical for the dialogue amongst stakeholders
- Type/design of maps for illustration is not critical. Can be real maps or sketches
- Important factors to include
  - Ports of relevance
  - Indicative route
  - Vessel segment
- Map can either cover subset of 1st Suite corridors or all proposed corridors
- If suite includes both domestic and international corridors, then it is recommended to develop more maps, to allow for the details to be covered

EXAMPLE

Illustrate all proposed corridors - Example of AUS-NZ



4 Study phase Intro

5 Pre-Feasibility data assessment along 4 domains

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7 Corridor refinement

- G Introduction, vision and project set up — 1
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- J Cargo & services, vessels and routes — 4
- K Regulations / Just & Equitable — 5
- L Selection criteria for potential corridor selection framework — 6
- M First suite of corridors — 6
- N Consortium Incubation Workshop (CIW) — 7
- O Scenario assessment — 7
- P Commitment assessment — 7
- Q Final report — 7

7N. Consortium incubation workshop (CIW)

Purpose

- Move from **1st Suite Corridors to 1st Wave Corridors.**
- Initiate **Consortium Incubation Workshop** with relevant stakeholders throughout the value chain in defined area to get their buy-in from relevant stakeholders.
- Expected outcomes of the CIW are that potential green corridors are identified and stake holders adequately committed to start Feasibility Scoping phase.

Key questions

- Which corridors have most strategic/commercial interest?
- Which **relevant stakeholders** throughout the value chain are interested / committed to working on the preferred green corridors?

Importance

- The CIW results serve as **input for the selection of 1st Wave** corridors.
- Indication of **potential consortia** and committed/ interested **stakeholders.**
- The CIW **unites relevant stakeholders** along the value chain to discuss the 1st Suite of green corridors and provide input on which of these have potential to become 1st Wave corridors.
- It also offers the chance for interested **stakeholders to initiate contact with each other** to form a consortium for driving the Feasibility Study of each of the corridors.

7N. Consortium incubation workshop (CIW)

Proposed work

I. Identify relevant participants for the Consortium Incubation Workshop (CIW) and prepare material (report, workshop agenda, etc.).

II. Conduct CIW and present results as well as identify relevant stakeholders for the upcoming Feasibility phase.

III. Describe 1st Wave Corridors including a preliminary Scenario Modelling

IV. Communicate the results of the Pre-Feasibility Study in accordance with planned communication strategy.

The Consortium Incubation Workshop preparation

Key workshop activities: the activities may vary based on the project

Week -20 to -10

- Set date for CIW in early part of project (3-6 months in advance of workshops) to secure the venue and ensure availability of stakeholders.
- Set an agenda for the workshop.

Week -10 to -8

- Identify potential participants (e.g., contributors to Pre-Feasibility, region-specific or project-specific organizations) and secure the venue.

Week -8 to -4

- Send invitations for the workshop with detailed agenda at least 8 weeks before the workshop.
- Prepare presentation to be given
- Send out pre-read

Week -2 to -1

- Confirm list of participants and coordinate with venue regarding seating arrangement, audio and video equipment, stationery, charts, stands, etc.
- Print posters of key figures from study, including maps of corridors. Prepare online voting form.

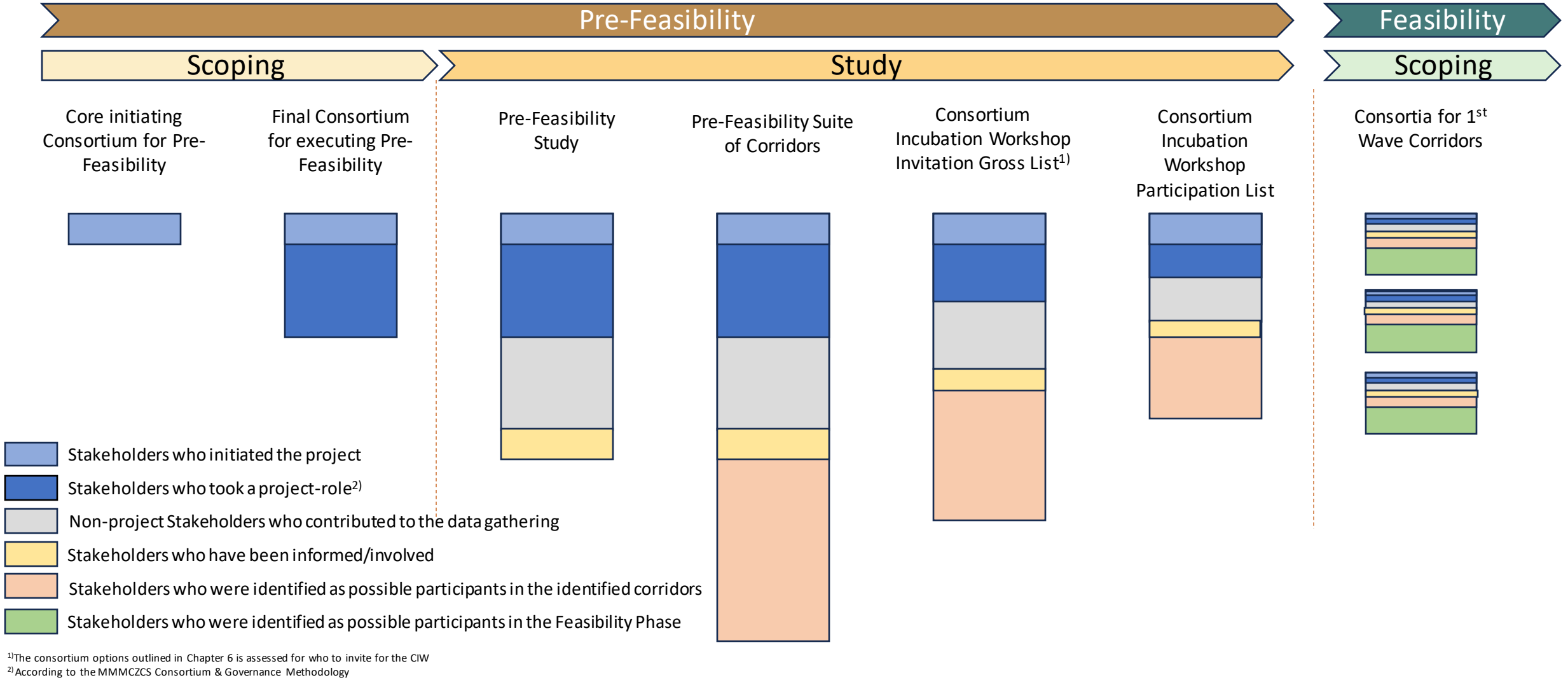
Consortium incubation workshop

- Present methodology used and findings.
- Hang posters on walls.
- Add more corridors to 1st Suite if needed.
- Conduct Prioritization Exercise.
- Document results using the online form.
- Prepare the online form, so that decided 1st Wave Corridors can be inserted during break at CIW.
- Conduct Commitment Level Exercise.

Week +1 to +2

- Send workshop material to CIW participants.
- Synthesize outcomes and share with participants.
- Incorporate workshop results in final report.

End of Pre-Feasibility Study Phase



1)The consortium options outlined in Chapter 6 is assessed for who to invite for the CIW
2) According to the MMMCZCS Consortium & Governance Methodology

Participants invitation process to the Consortium Incubation Workshop

Pre-Feasibility Suite of Corridors	Project Lead makes shortlist of stakeholders for CIW	Chapter 6 Participants add to shortlist where needed	Combined Invitation List is compiled by Project Lead	Invitations are sent by Project Lead
Possible consortium members are suggested for each identified corridor. May be a very long list of all possible stakeholders.	Project Lead identifies stakeholders appearing in several corridors and/or stakeholders who are fundamental for enabling the establishment of green corridors project.	Chapter 6 participants review the initial shortlist, and add to this if Project Lead has not seen all relevant stakeholders in the first process.	Project Lead compiles the total list of all stakeholders to be invited.	Project Lead sends invitations to the workshop to stakeholders. Each stakeholder can have up to three participants. Invitations include pre-read on CIW methodology, venue, timing, RSVP, etc.

The Consortium Incubation Workshop includes 3 main elements

Presentation

Present findings from study work and 1st Suite corridors.

Prioritization Exercise

Which of the green corridors identified from the decision criteria in the study are most interesting?

"Let the games begin"

In the room:

Scan QR code and vote and place stickers on map

Max 2 people per organization (incl. online)

Max 4 corridors per person

SAMPLE

Online

Scan QR code and vote

Max 2 people per organization (incl. room)

Max 4 corridors per person

Commitment level Exercise

Discuss the corridors with highest interest and commitment level in more detail.

EXAMPLE

Presentation: Example workshop presentation structure – to be adjusted for each workshop

Introduction and context

- Welcome and safety
- Why are you invited?
- Intro to Pre-Feasibility Methodology
- Consortium Incubation Workshop

Key findings from Pre-Feasibility Study and 1st Suite Green Corridors

- Methodology of Pre-Feasibility
- Energy & Fuels
- Ports & Bunkering
- Trade, cargo, and vessels
- Regulatory environment and Just & Equitable
- Selection Criteria
- 1st Suite Corridors

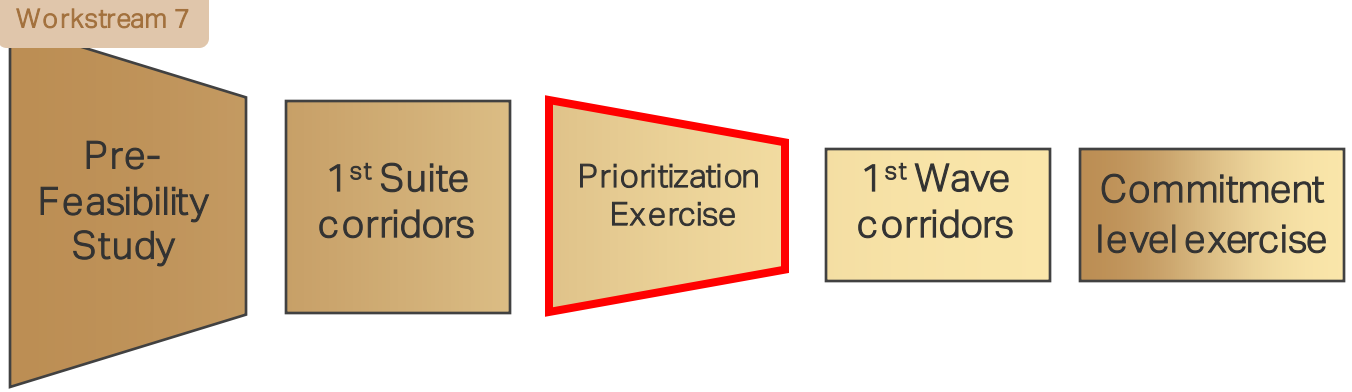
Next phase What could move into Feasibility

- Feasibility Methodology
- Prioritization Exercise

- 1st Wave Corridors
- Commitment level Exercise

Prioritization exercise

Workstream 7



Objectives

- A prioritization exercise is deployed to identify which of the projects in 1st Suite of corridors attracts the most interest from participants.
- This exercise provides an initial guidance of the corridors likely to progress into the feasibility stage and eventually become operational.
- This exercise also presents an opportunity to introduce corridor(s) that were not initially identified in the study through decision criteria.
- It is imperative to ensure a pertinent list of participants and encourage active engagement among workshop attendees during this step .

Voting organization

Organizers are encouraged to utilize the Forms® app and a sticker exercise during the meeting.

- Forms app:
  - Participants will connect via QR code to the session and choose their "top 5" corridor preferences.
  - All results are digitally aggregated and can be immediately displayed.
  - Remote participants can also participate in the voting process.
  - See example 1.
- Sticker exercise (optional but highly recommended):
  - This is a supplement to the Forms app.
  - Encourages interaction, discussion, and debate among participants.
  - See example 2 for further guidance.
- Outcome: A list of 2 to 5 corridors, referred to as the “1st Wave corridors”.

TEMPLATE

Prioritization exercise template

Follow the QR code and the subsequent instruction

1. Fill-in Name & Affiliation
   - Two (2) from each entity
2. Vote for up to X (X) corridors where you want to commit your resources for the Feasibility phase
3. Submit your input

3. In the following section, you are kindly asked to vote for the X **corridors** where you see your organization being ready **to invest hours and data** in maturing the work through Feasibility, in line with the principles of the MMMCZCS **Methodology**.

Dedicated insight needed for the suite of corridors

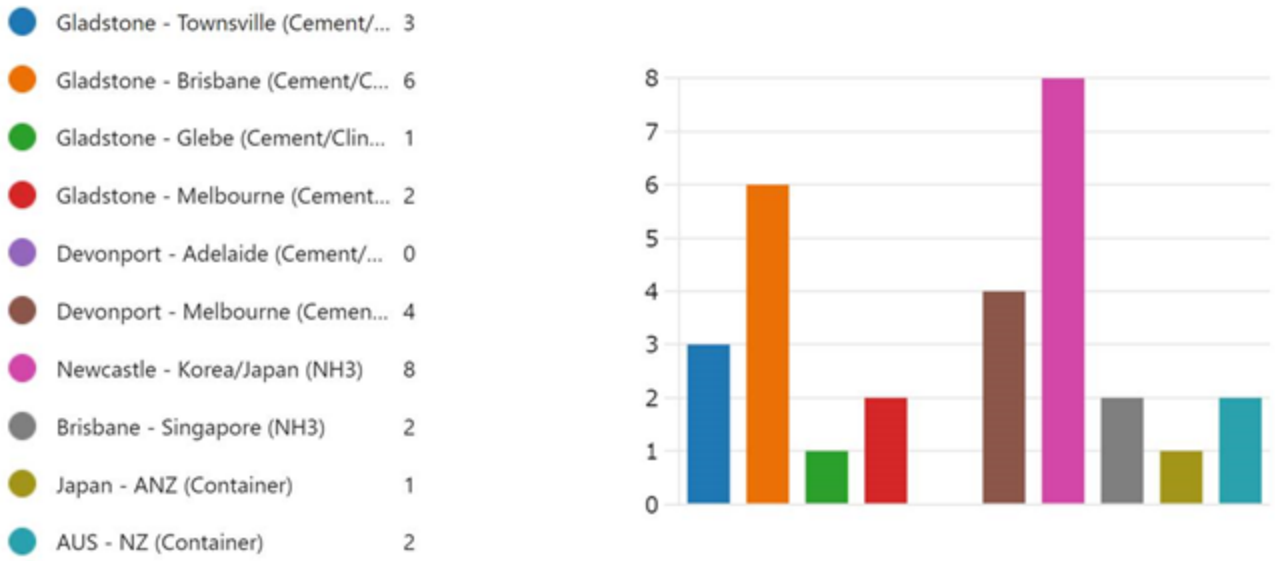
Please select X options.

- [ ] 1. Direct calling between ROK Ports* and US Ports* on shipping string for Container carrier on e-/biomethanol as fuel from 2028.
- [ ] 2. Direct calling between ROK Ports* and US Ports* on shipping string for Container carrier on green-/blue-ammonia as fuel from 2033.
- [ ] 3. Any ports calling between ROK ontainer carriers and e-/biomethanol as fuel from 2028.
- [ ] 4. Any ports calling between ROK ontainer carriers and green/blue ammonia as fuel from 2033.
- [ ] 5. Any ports calling between ROK d any type of clean fuel, which can start using as early as possible.
- [ ] 6. Any ports calling between ROK** and US** on shipping string for PCTC and any clean fuel from 2028.
- [ ] 7. Any ports calling between ROK** and US** on shipping string for PCTC and green/blue ammonia as fuel as early as possible.
- [ ] 8. Any ports calling between ROK** and US** for a new business not currently part of an existing business model. Could be related to the green transition.
- [ ] Other

SAMPLE

EXAMPLE

Prioritization exercise - Example



Forms® voting results

- Using an app-based form for the voting ensures that all participants – in-person attendees and online ones - can participate.
- The voting results can be easily and quickly shown at the workshop.
- All participants must fill in the app-based form
- It is optional/voluntary if the exercise also has a physical version (sticker exercise) which can only be run in the meeting room.
- In the sticker exercise, the participants vote by placing colorful stickers with their initials next to the names of the projects they prioritize
- Examples of both types of voting are below.

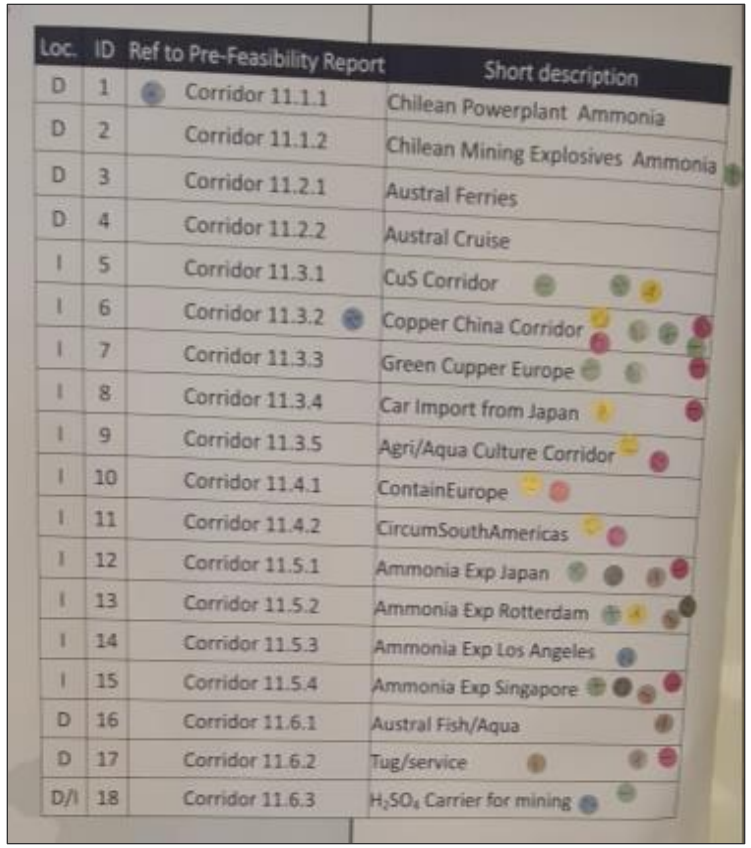
Sticker exercise
Workshop results

EXAMPLE

Prioritization Exercise – Analysis of results

Example

1. Document workshop results



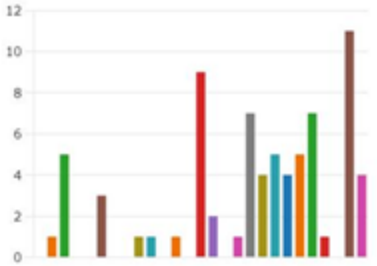
Loc.	ID	Ref to Pre-Feasibility Report	Short description
D	1	Corridor 11.1.1	Chilean Powerplant Ammonia
D	2	Corridor 11.1.2	Chilean Mining Explosives Ammonia
D	3	Corridor 11.2.1	Austral Ferries
D	4	Corridor 11.2.2	Austral Cruise
I	5	Corridor 11.3.1	CuS Corridor
I	6	Corridor 11.3.2	Copper China Corridor
I	7	Corridor 11.3.3	Green Cupper Europe
I	8	Corridor 11.3.4	Car Import from Japan
I	9	Corridor 11.3.5	Agri/Aqua Culture Corridor
I	10	Corridor 11.4.1	ContainEurope
I	11	Corridor 11.4.2	CircumSouthAmericas
I	12	Corridor 11.5.1	Ammonia Exp Japan
I	13	Corridor 11.5.2	Ammonia Exp Rotterdam
I	14	Corridor 11.5.3	Ammonia Exp Los Angeles
I	15	Corridor 11.5.4	Ammonia Exp Singapore
D	16	Corridor 11.6.1	Austral Fish/Aqua
D	17	Corridor 11.6.2	Tug/service
D/I	18	Corridor 11.6.3	H_2SO_4 Carrier for mining

2. Identify corridors with most stickers and derive focus corridors for the Feasibility phase and the Coffee Table Exercise

Loc.	ID	Short description	Number of stickers
I	6	Copper China Corridor	9
I	13	Ammonia Exp Rotterdam	9
I	12	Ammonia Exp Japan	8
I	15	Ammonia Exp Singapore	7
D	17	Tug/service	6
I	7	Green Copper Europe	5
D/I	18	H2SO4 Carrier for mining	5
I	5	CuS Corridor	4
I	9	Agri/Aqua Culture Corridor	3
I	8	Car Import from Japan	2
I	10	ContainEurope	2
I	11	CircumSouthAmericas	2
D	1	Chilean Powerplant Ammonia	1
D	2	Chilean Mining Explosives Ammonia	1
I	14	Ammonia Exp Los Angeles	1
D	16	Austral Fish/Aqua	1
D	3	Austral Ferries	0
D	4	Austral Cruise	0

4 focus corridors

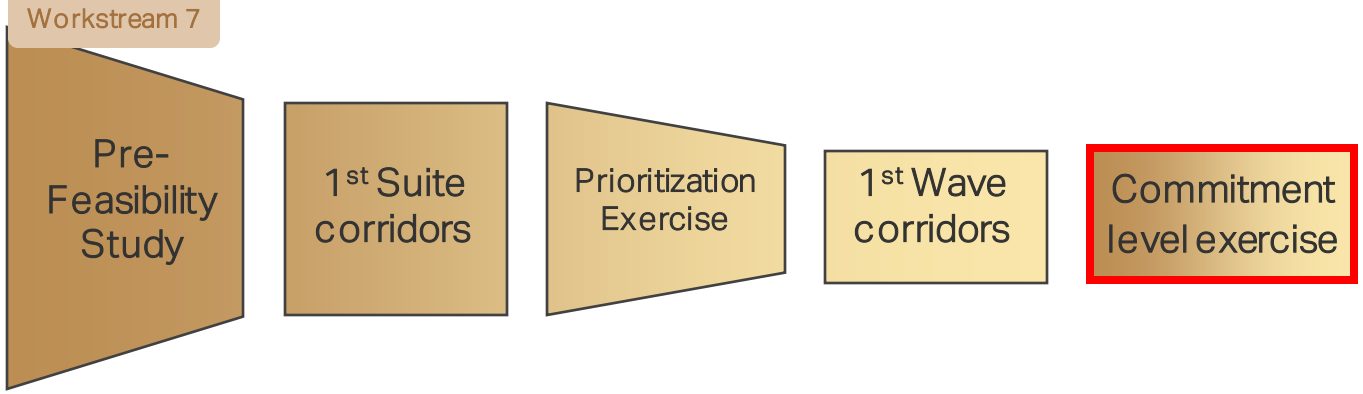
Copper Corridor
Ammonia Exp
H2SO4 Corridor
Tug/service



During the CIW, participants can suggest new corridors to the list. These new corridors are subsequently also up for selection as one of the focus corridors

Commitment level exercise

Workstream 7



Objectives and way forward

- Gather a variety of **perspectives and insights** to enrich discussions.
- Gain a deeper understanding of participants' priorities, preferences and especially, commitment to work hours for next phase.
- Solicit **feedback** on both **advantages and challenges** to informed decision-making.
- Engage individuals in discussions to cultivate a spirit of **collaboration and commitment**. Taking into account diverse opinions is crucial for acknowledging cultural and contextual differences.
- Delve into the rationale behind the final corridor selection, enabling a more comprehensive understanding.
- Identify, on an informed basis, the Green Corridors (GC) with the potential to be advanced successfully.

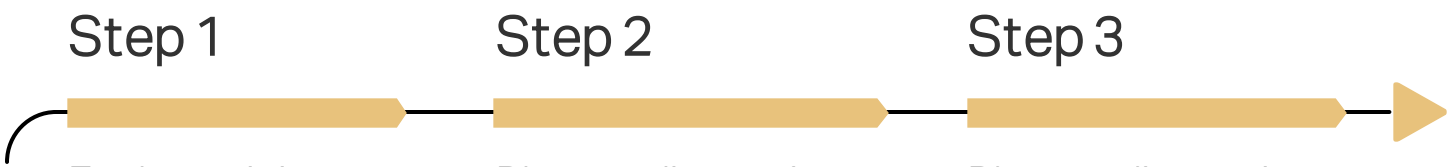
Input table exercise / key questions

For each 1st Wave green corridor, participants will be requested to **complete a form** and answer the following questions within 15 minutes:

- Where does this corridor exhibit a**dvantages**?
- What **challenges** are associated with this corridor?
- Any additional comments?
- Gauge my organization's **commitment** to this corrid
  - Workstream lead (hrs)
  - Workstream support (hrs)
  - Sounding board member (hrs)
- Responses will be accessible through an app-based form, and a subsequent plenary session will be dedicated to the 1st Wave corridors (e.g. 15 minutes per corridor) and to other corridors if needed.

SAMPLE

Commitment level exercise instructions



Step 1

Each participant to fill out form for:

a. 1st Wave Corridors

b. Others, which they, as organization, would like to considered for

15 mins

Step 2

Plenary discussion on the 1st Wave corridors

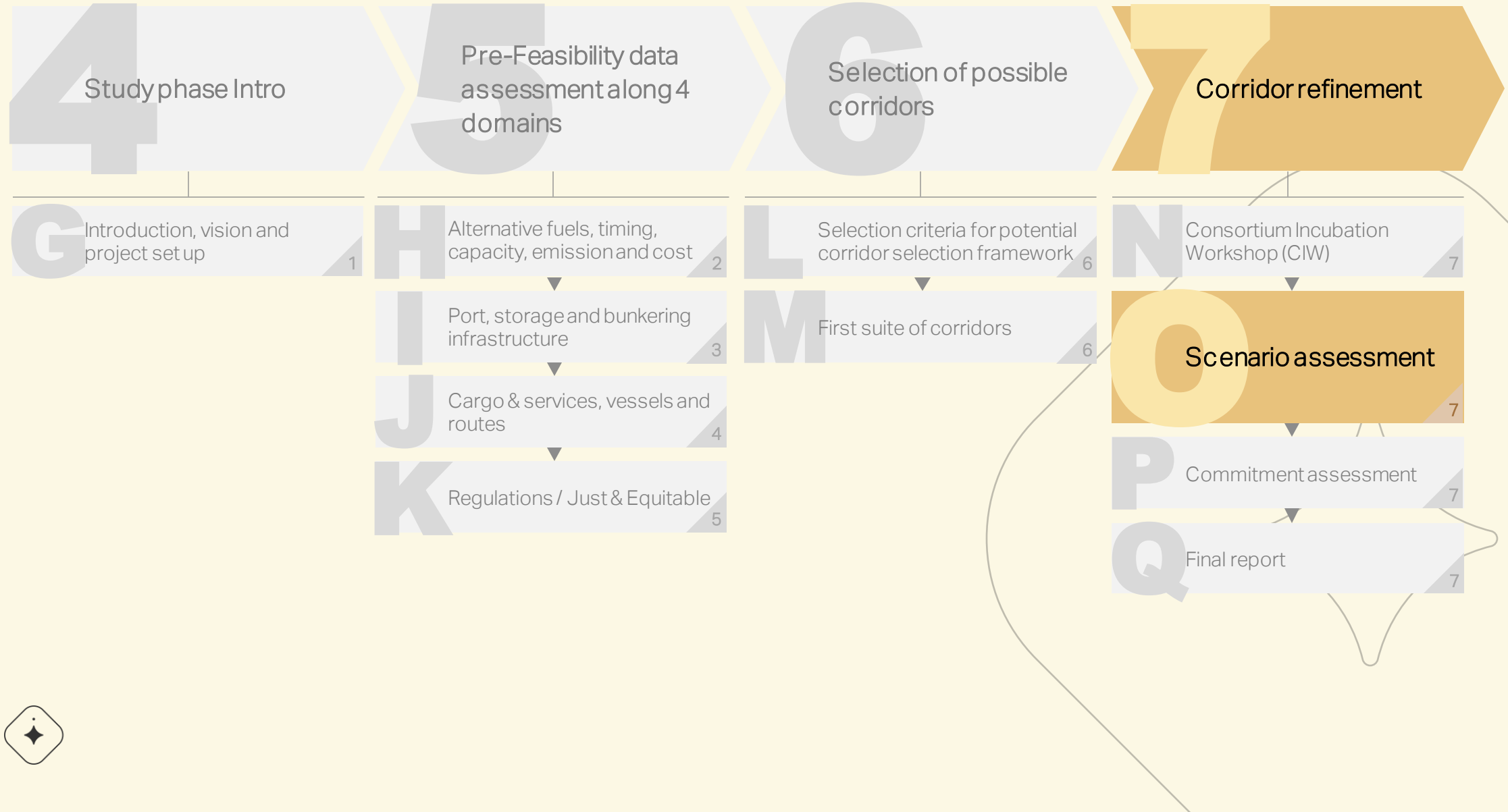
10-15min/corridor

Step 3

Plenary discussion on other corridors (if any)

15 mins

Workstream 7



7O. Scenario assessment: CO_2 and Cost / Just & Equitable

Purpose

- Reference point for initial view on incremental cost of green for consortium members.
- **CO_2eq emission and fuel consumption** (Table 6.3): After picking the most promising corridors, these calculations will add even more detail and strengthen the basis for further decisions.
- Input to Corridor Project Baselining, including the residual cost gap analysis, in Feasibility phase.
- The output of the scenario assessment provides project members with an initial understanding of
    - A : Amount of abated CO_2
    - B: Incremental cost
    - C: Just & Equitable assessment

Key questions

A : CO_2
- What are the CO_2eq emissions and how much fuel is needed in the relevant corridors?
- What is the expected level of abated CO_2?

B : Cost
- What is the first cost estimate of abated CO_2?
- What is the estimated incremental cost of green?

C : Just & Equitable
- What are the key socio-economic risks and opportunities and derived implications associated with the areas identified for 1st Wave green corridors?

Importance

A : CO_2
- Get an initial understanding of amount of abated CO2.
- These initial estimates give an important indication and allow stakeholders to understand if the corridor is likely to be impactful in terms of CO_2 abatement, cost effectiveness, technological enabling, etc.

B : Cost
- An initial understanding of the incremental cost, cost impact on cargo, and cost of abated CO_2 is important for the communication regarding the project in Pre-Feasibility.

C : Just & Equitable
- To ensure that a green corridor is created in a Just & Equitable way, it is crucial to extend considerations beyond the above and consider the socio-economic opportunities and risks.

CO_2 abatement potential of the green corridor provides preliminary insight

About the Green Corridor Scenario Modeling tool:

The tool, developed by the center, is a highly configurable, automated Excel-based tool designed to integrate a broad range of parameters, including fuel types, vessel types, operating profiles, and CO_2 emissions.
Its primary function is to provide detailed insights into the costs and CO_2 abatement potential of specific maritime corridors.
By allowing users to adjust inputs tailored to the specifics of a given corridor, the tool dynamically generates automated graphs and visuals.
These visual outputs offer a comprehensive analysis of several key metrics including the incremental cost of adopting green fuels over traditional fuels

Tool is available at XXX

A. CO_2 abatement potential of the green corridor provides preliminary insight

Adjust the input to the **Green Corridor Scenario Modeling tool** according to the corridor's specifics and initial assumptions from the project team

Review output in the tool (table and graphs): CO_2 abatement potential in the area

Re-adjust input to the model as the project team generates more knowledge and insights

B. The cost and scenario assessment provides further insights on the incremental cost of green for the green corridor

Adjust the input to the **Green Corridor Scenario Modeling tool** according to the corridor's specifics and initial assumptions from the project team

Review output in the tool (table and graphs): Incremental cost of green in the area

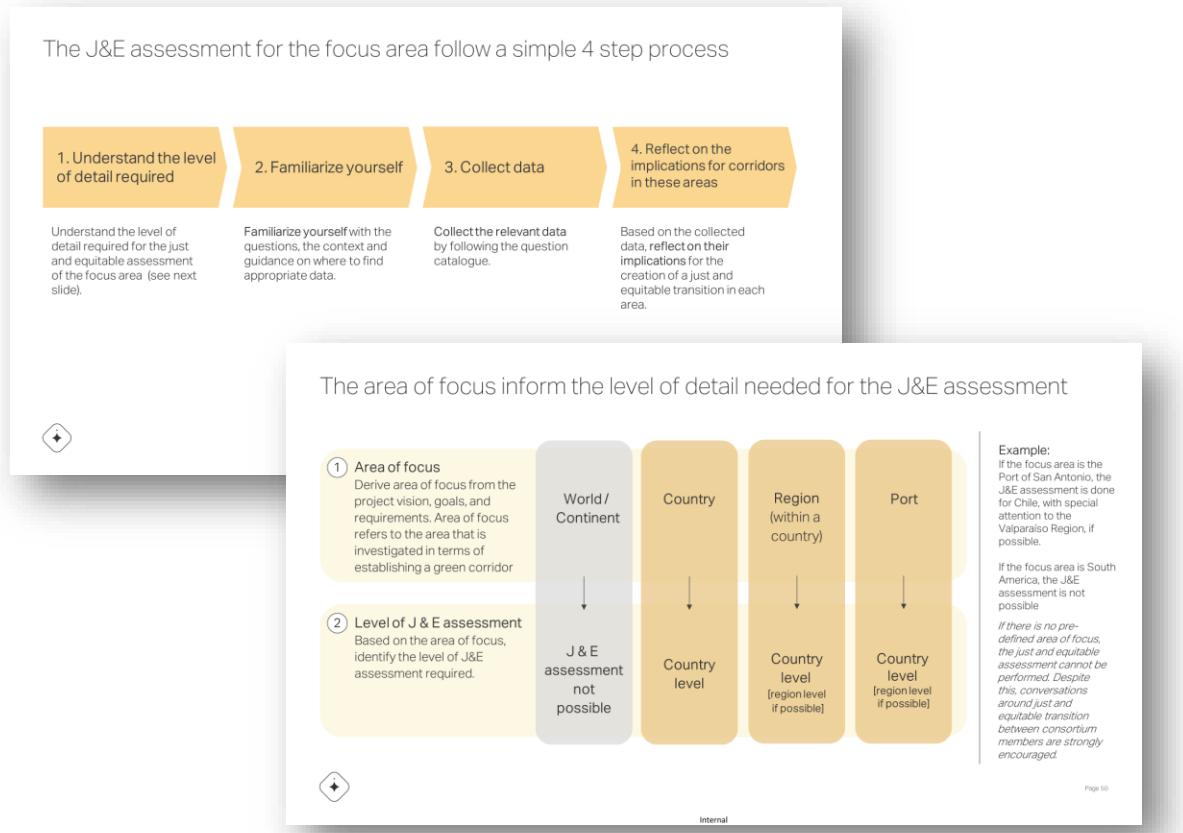
Re-adjust input to the model as the project team generates more knowledge and insights

C : J&E assessment within scenario assessment (7O)

This exercise is essentially a repetition of the work done on the focus area in Workstream 5. As explained in 5.2, the objective of the J&E assessment is to create awareness about the socio-economic risks and opportunities for the countries or regions included in each of the 1st Wave of green corridors. Additionally, the assessment can be used as input for the final prioritization of 1st Wave corridors.

The J&E assessment in this **section covers only those countries/regions/ports that are included in 1st Wave corridors beyond the focus area.**

If all 1st Wave corridors are domestic and hence covered by the analysis done in 5.2.1, then consider if additional analysis is needed at a regional or local level (Table 5.2.2).



Summary of steps necessary (consult the relevant slides in Section 5)

1. Assess the level of detail required, by confirming the list of countries/regions/ports.
2. Revisit the questions in Section 5 and data collection template.
3. Collect data in accordance with the questions.
4. Reflect on the implications for the identified 1st Wave corridor projects

4 Study phase Intro

- G Introduction, vision and project set up — 1

5 Pre-Feasibility data assessment along 4 domains

- H Alternative fuels, timing, capacity, emission and cost — 2
- I Port, storage and bunkering infrastructure — 3
- J Cargo & services, vessels and routes — 4
- K Regulations / Just & Equitable — 5

6 Selection of possible corridors

- L Selection criteria for potential corridor selection framework — 6
- M First suite of corridors — 6

7 Corridor refinement

- N Consortium Incubation Workshop (CIW) — 7
- O Scenario assessment — 7
- P Commitment assessment — 7
- Q Final report — 7

7P. Commitment assessment

Purpose

- Evaluate key **stakeholders'** extent of **commitment** for the proposed Green Corridors.
- Identify **viable corridors** with substantial **commitment** through the value chain, providing a foundation for progressing to the Feasibility phase.
- **Optimize resource** allocation by efficiently focusing on corridors where there is genuine stakeholder support.

Key questions

- How extensively have **stakeholders** been engaged, and what is their level of **commitment**, interest and enthusiasm for the 1st Wave corridors?
- What non-financial **resources** are stakeholders willing to **commit** to the further development of the 1st Suite corridors?
- To what extent do the proposed Green Corridors **align with the strategic objectives** and priorities of the involved parties?
- What potential **risks** may hinder commitment, and what **mitigation** strategies can be employed?

Importance

- Acts as a **strategic filter**, guiding decision-makers toward corridors with genuine stakeholder support.
- **Minimizes wasted efforts** by efficiently directing resources to corridors with the highest likelihood of success.
- Ensures that development efforts **align with stakeholder priorities** and fit within long-term plans.

The Commitment Level is assessed through a 4-step approach, starting at the CIW

Commitment Level

The 1st Wave Corridors are prone to be moved into feasibility maturation phase.

In order to ensure that this phase is as successful as possible, it is crucial that the stakeholders participating in the project are the right ones for the project.

Commercial parties, with insight into their part of the value chain, need to be committed to carry out the feasibility maturation.

At Consortium Incubation Workshop[20)]

After Consortium Incubation Workshop

Present corridor and high-level requirements for Feasibility Phase

1st Wave Corridors are presented at the CIW following the Prioritization Exercise.

The requirements for the Feasibility Phase are explained, including expected manhours.

Receive indicative commitment from participants at CIW

Perform Commitment Level Exercise at CIW.

Workstream Lead: 1,000 hrs
Workstream Support: 500 hrs
Sounding Board: 50 hours

Critical that participants understand the importance and impact of their input.

Assess if commitment level is sufficient for next phase: value chain coverage, hours, etc

Is value chain covered for the corridor after the Commitment Level Exercise?

Do the key areas:

- Alternative Fuel
- Ports
- Vessel
- Cargo

have deep commitment?

Have commercial companies indicated their interest in leading the workstreams in the next phase?

Report back on Commitment Level findings and impact on corridor progression

Based on the commitment level, it is decided which corridors can be further matured.

There is no single number or black/white decision.

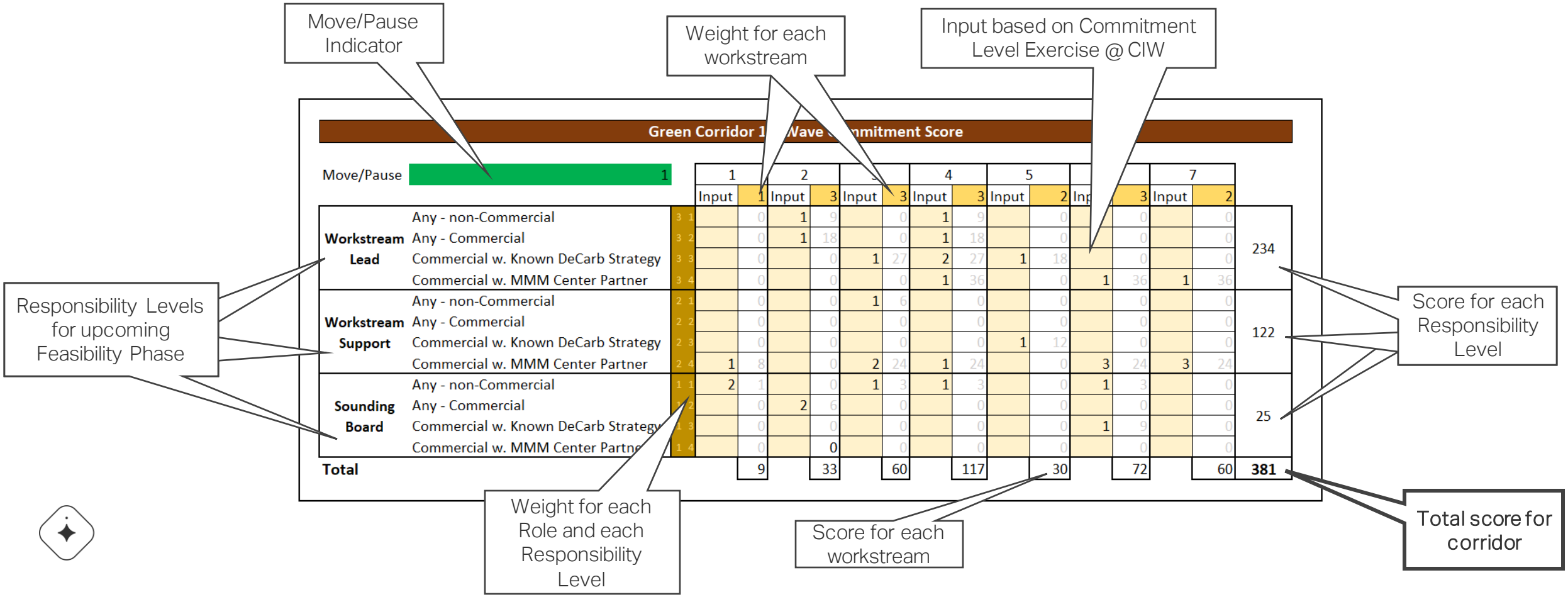
Future consortium has to decide if the commitment level is adequate to achieve the outcome of the Feasibility Phase.

20 : Covered in the section under Consortium Incubation Workshop

EXAMPLE

Project Commitment Level Assessment - Internal MMMCZCS process

Guiding principles for MMMCZCS to participate as Project Lead in Feasibility
Commercial companies are leading Workstream 2, 3 and 4. Each have committed to ~1,000 hrs of work in the Feasibility Phase. Each workstream can only have one commercial lead; Center partners and companies with decarbonization strategies will be preferred. Workstream lead can decide if support is needed, and from whom



Green Corridor 1 Wave Commitment Score

		Move/Pause	1															
			1		2		3		4		5				7			
			Input	1	Input	3	Input	3	Input	3	Input	2	Inp	3	Input	2		
Workstream Lead	Any - non-Commercial	3 1		0	1	9		0	1	9		0		0		0		
	Any - Commercial	3 2		0	1	18		0	1	18		0		0		0		
	Commercial w. Known DeCarb Strategy	3 3		0		0	1	27	2	27	1	18		0		0	234	
	Commercial w. MMM Center Partner	3 4		0		0		0	1	36		0	1	36	1	36		
Workstream Support	Any - non-Commercial	2 1		0		0	1	6		0		0		0		0		
	Any - Commercial	2 2		0		0		0		0		0		0		0	122	
	Commercial w. Known DeCarb Strategy	2 3		0		0		0		0	1	12		0		0		
	Commercial w. MMM Center Partner	2 4	1	8		0	2	24	1	24		0	3	24	3	24		
Sounding Board	Any - non-Commercial	1 1	2	1		0	1	3	1	3		0	1	3		0		
	Any - Commercial	1 2		0	2	6		0		0		0		0		0	25	
	Commercial w. Known DeCarb Strategy	1 3		0		0		0		0		0	1	9		0		
	Commercial w. MMM Center Partner	1 4		0		0		0		0		0		0		0		
Total				9		33		60		117		30		72		60	**381**	

Initial Corridor list, additions, prioritization and commitment throughout the last part of the Pre-Feasibility Study

Commitment Level impact on corridors

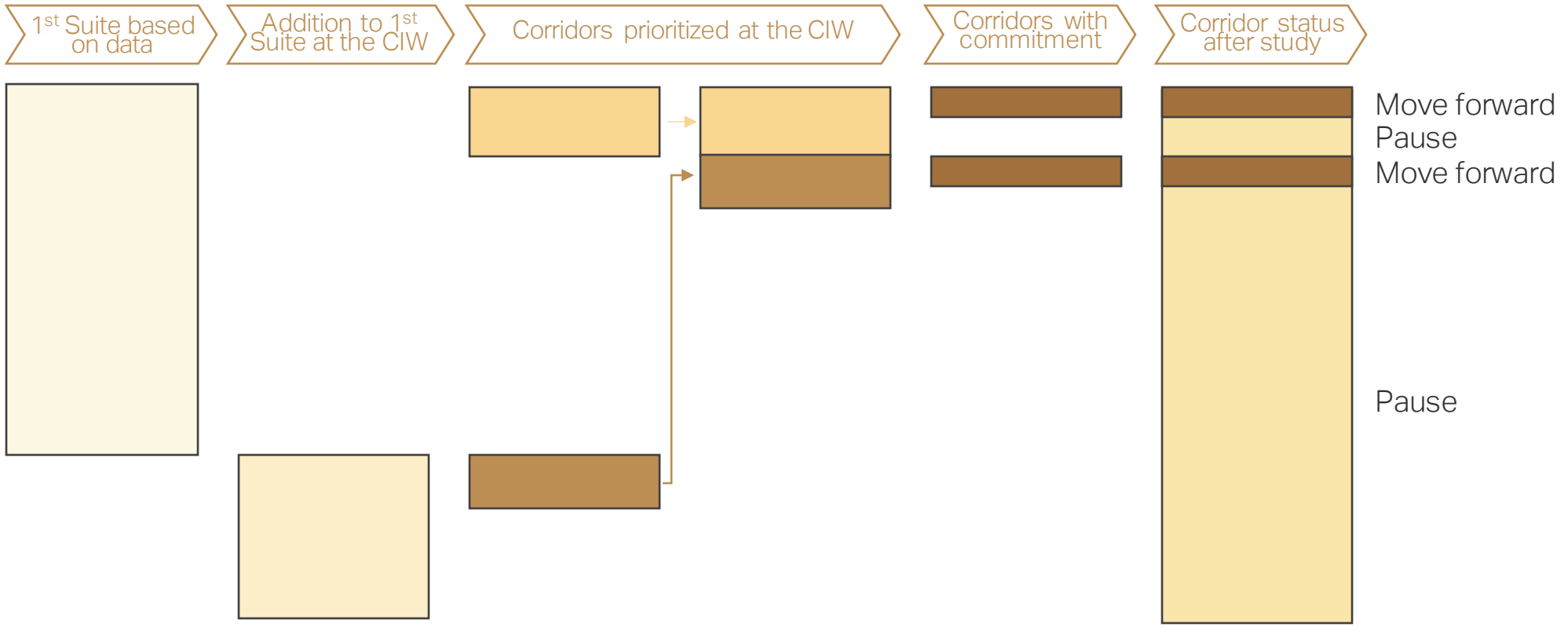
During the Pre-Feasibility Study phase, a number of corridors are identified based on the data and selection criteria = 1st Suite.

At the CIW, additional corridors can be added to the 1st Suite.

Corridors are prioritized at the CIW.

The corridors with largest interest are assessed for stakeholder commitment.

The final status of all corridors is reported.



4 Study phase Intro

5 Pre-Feasibility data assessment along 4 domains

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- O Scenario assessment — 7
- P Commitment assessment — 7
- Q Final report — 7

7Q. Final report

Purpose

- The final report serves to enhance accessibility and comprehension of the overall content for the intended audience.
- Distribution will especially encompass all chapter leads and other pertinent participants, ensuring widespread dissemination.
- Key components of the final report include:
  - An executive summary of the Pre-Feasibility Study (around X pages)
  - Findings from various assessment stages across dimensions such as Fuels, Trade, Cargo, Routes, Vessels, Regulation, and Just & Equitable
  - Furthermore, the final report enhances information regarding the 1st Wave of corridors, specifically in the assessment of CO2 abatement, Cost, and Just & Equitable considerations.
  - A concise summary of the Consortium Incubation Workshop (CIW), with the complete CIW report available in the Appendix.
  - Next steps, recommended course of action.

Importance

- This report furnishes a comprehensive overview of the accomplished work, thereby showcasing how the work aligns with the initial project goals.
- The final report is for internal project use only and the responsibilities for the content lies with the individual workstreams.
- The final report is not supposed to be 'proof-edited' by the overall project lead.
- Recommendations:
  - Use clear headings, subheadings, and numbering to improve readability.
  - Provide citations and references for any external sources, especially in technical discussions.
  - Ensure that the report adheres to any specific formatting or style guidelines required by your organization or industry.

Final Report Standards and Expected Deliverables

	1	2	3
Responsible	Workstream lead & support	Workstream lead & support	
What to do	Project work, detailed analysis, spreadsheets, data models, deep dives (including everything you would add to the Appendix)	Executive summary Limited content section per workstream (including Appendix)	Public report including executive summary
Format	Teams / Folder / SharePoint	Word	
Audience	Project Consortium	Consortium companies, C-suite & Project Leadership	
Timing	First half of Pre-Feasibility Study	Second half of Pre-Feasibility Study	

Congratulations!

You have successfully completed the Pre-Feasibility Study for your green corridors project.

Together with all project stakeholders, you navigated various steps and utilized our specialized tools to finalize a shortlist of potential green corridors.

This effort has provided initial estimates for CO_2 abatement potential and incremental costs of going green. It has ensured a Just & Equitable assessment for each shortlisted corridor.

What comes next?

Now, it is time to move to the Feasibility phase.

Click here to access the guidance and resources you need for the next steps in your green corridor project: Feasibility Scoping and Feasibility Study.

Disclaimer

This Methodology is provided "as is" without any warranty of any kind, express or implied, including but not limited to merchantability, accuracy, completeness, or fitness for a particular purpose. Any reliance you place on this Methodology is strictly at your own risk.

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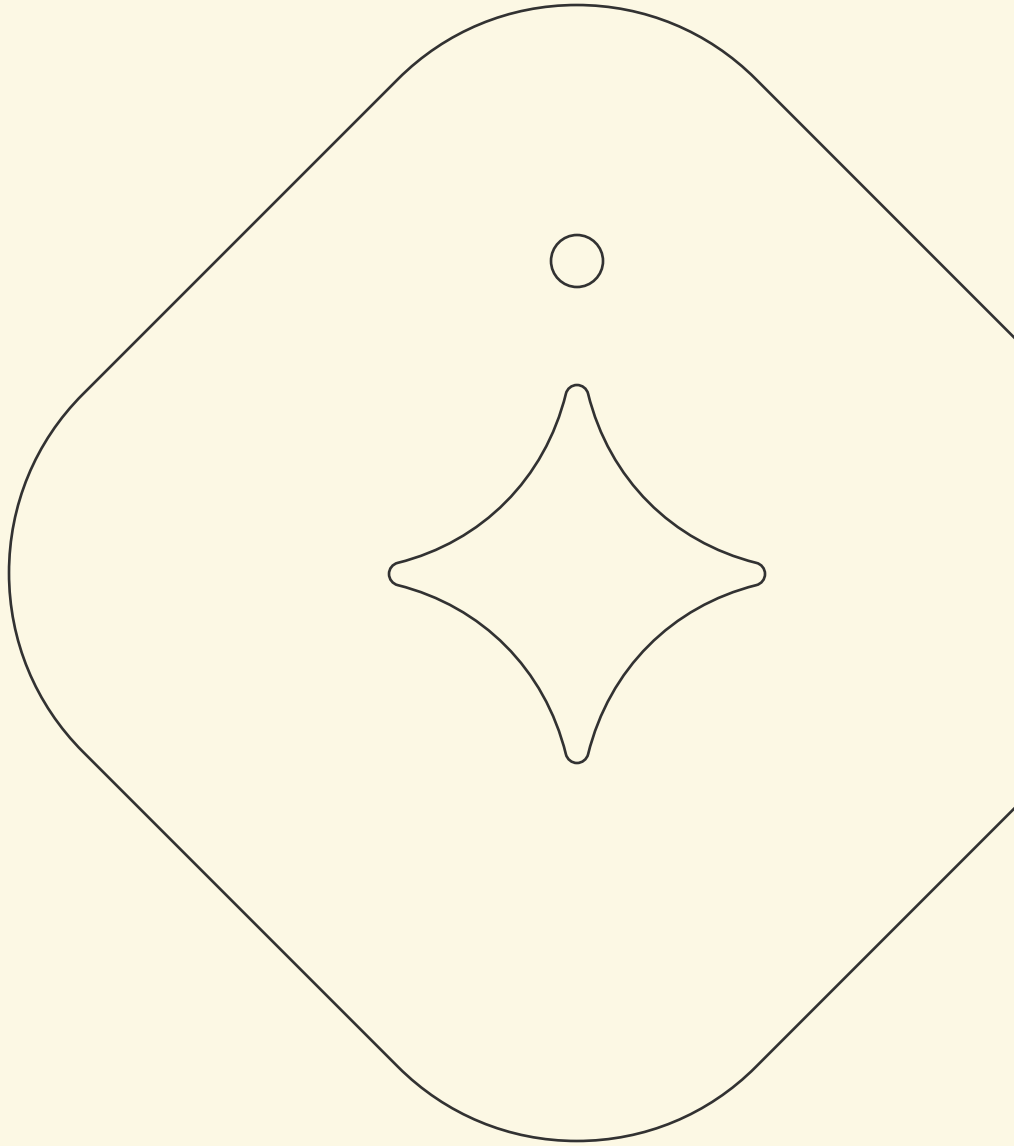
Appendix



Appendix

- 5H : Alternative fuels, timing, capacity, emission and cost / Additional recommendations
- 5I : Port, storage and bunkering infrastructure / Additional recommendations
- 5J : Cargo & Services, vessels & routes / Additional recommendations
- 5K : Regulation, Just & Equitable / Additional recommendations
- The Green Corridor Scenario Modeling tool
- Configurator, allowing users to configure the model to fit the selected green corridor's specifics
- Fuel configuration (1/2)– Different fuel type selection to be compared to the fossil-fuel baseline
- Fuel configuration (2/2) – Granular and robust data set including multiple bunker fuels
- The summary table provides a detailed overview of the methodology behind the three main output graphs
- Variety of other graphs providing a more nuanced overview
- Examination of simple ways to close the cost gap through a carbon price or willingness-to-pay
- Example of Green Corridors List

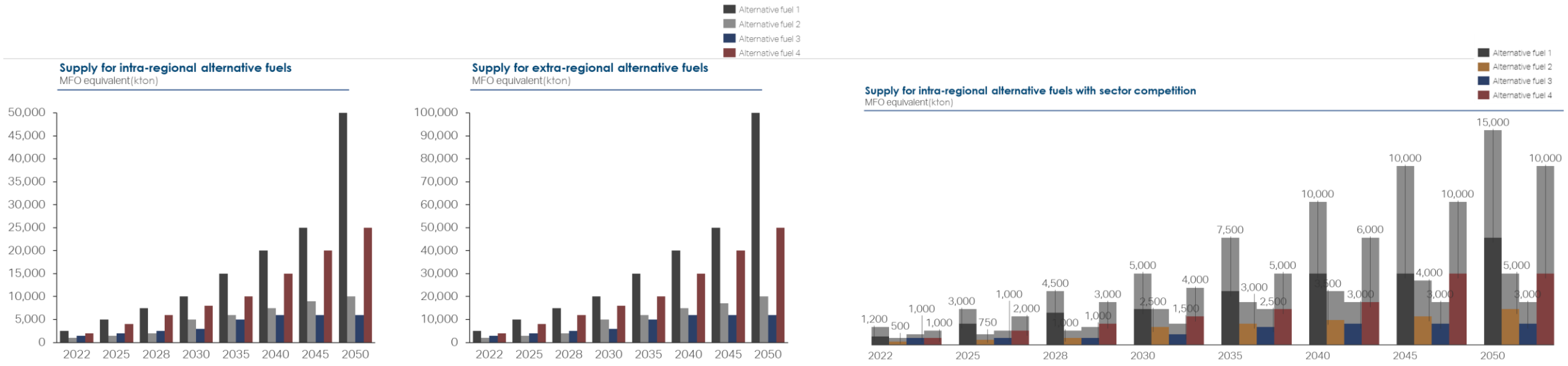
5H : Alternative fuels, timing, capacity, emission and cost

Additional recommendations

I. Communicate with stakeholders, including ports and shipping companies, to **identify alternative fuels**.

II. Clearly **communicate production outlook** and delivery of alternative fuels.

Illustrative examples



5I : Port, storage and bunkering infrastructure

Additional recommendations

I. Use **port readiness assessment** to enable green projects and corridors.

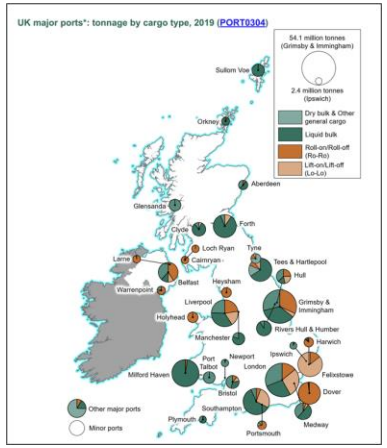
II. **Act as a catalyst** between fuel producers, shipping companies, and cargo owners to realize green corridors.

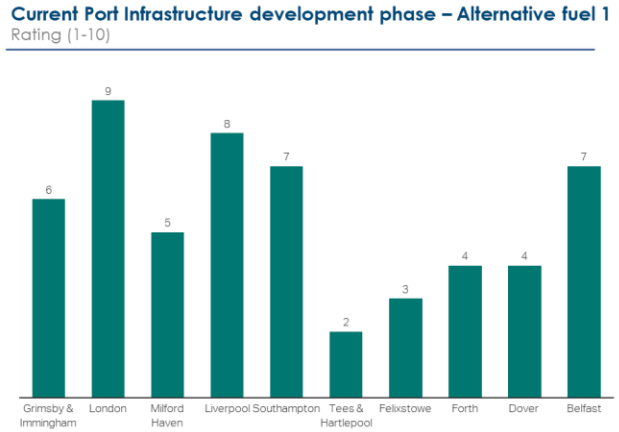
III. **Share knowledge with other ports** to solve challenges, identify opportunities, and develop common safety procedures.

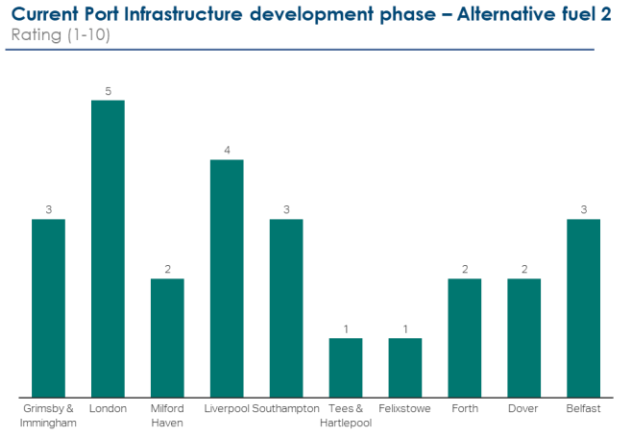
IV. Consider providing **discounts as incentives** to first movers for using green fuels.

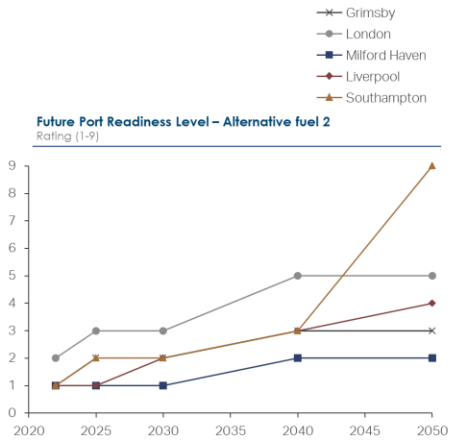
V. Recognize that getting **ready for new fuels** early can be a **competitive advantage** that provides **growth opportunities**.

Illustrative examples









5J : Cargo & Services, vessels & routes

Additional recommendations

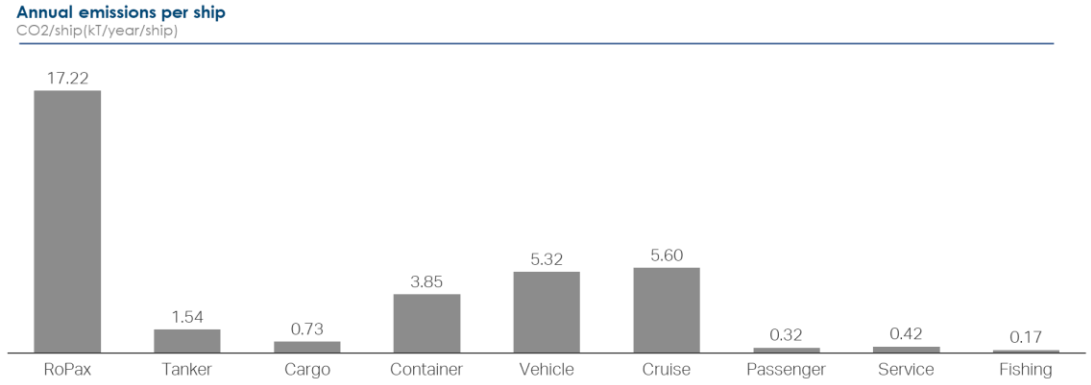
I. Aim to find **key customers** who have a pledge to decarbonize their transport and may be willing to pay for green transport.

II. Investigate **options with other stakeholders**, including ports and fuel producers.

III. If relying on **electricity to decarbonize**, then consider where you will get the **green energy** from.

Illustrative examples

	Trade route (Region to region)	Proxy corridor (port to port)	Product	Volume (M TUE)	Value of goods (€M)
Bulk - dry: Iron ore trade routes	Australia – China	Hedland – Tianjin	Iron ore	TBD	TBD
	Australia - Japan	Hedland - Tokyo	Iron ore	TBD	TBD
Bulk – dry: Grain trade routes	Australia - China	Hedland – Shanghai	Cereals	TBD	TBD
	Australia – Netherlands	Adelaide- Rotterdam	Oil seeds	TBD	TBD
Cargo: Container trade routes	Australia – Singapore	Brisbane - Singapore	Container	TBD	TBD
	Australia – China	Brisbane - Shanghai	Container	TBD	TBD



5K : Regulation, Just & equitable

Additional recommendations

I. Regulatory: provide **clear regulation for using alternative fuels**, to make implementation easier.

II. Regulatory: develop regulation that provides **financial incentive** to decarbonize and reward first movers.

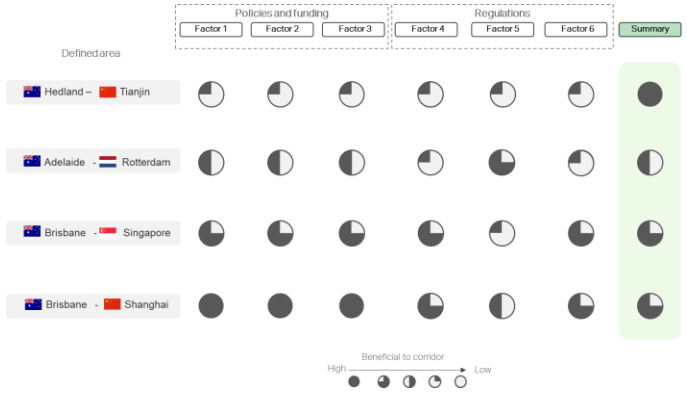
III. Politicians: develop **support schemes** and provide **funding** for first movers.

IV. Politicians: **support green corridor projects** to prove they are possible, then **push for regulation** to encourage alternative fuel adoption.

V. Defined areas: build your awareness of different kinds of fuels and how to handle them, to prepare the **social readiness and acceptance**.

V. Defined areas: recognize that **readiness for new fuels** early can be turned into a **competitive advantage** that could provide **growth opportunities in the area**.

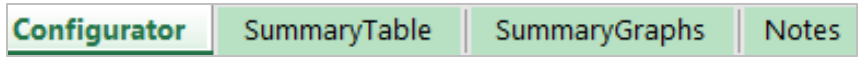
Illustrative examples



The Green Corridor Scenario Modeling tool is a configurable, automated Excel tool that provides insights on costs and CO_2 abatement potential of a corridor

How to use the tool

The tool has 4 main sheets ...



Adjust the input according to your corridor's specifics

View output in a table and graphs

Understand how to use the tool and what its **limitations** are

... and 6 hidden sheets with calculations, assumptions, and an index

If required, **review the corridor and vessel calculations** that the tool performs

If required, **review the assumptions** that the tool makes

Understand the various elements and sub-elements displayed in the tool

If required, **review the calculations** that the tool performs **to create the graphs**

For now, the tool has a range of limitations:

- In the output table (SummaryTable), electricity and fossil fuel costs are considered OPEX only
- Lost cargo space from larger fuel tanks. Currently, the model assumes same size fuel tanks
- Electrical and heat energy demand assumed constant no matter the operational profile to simplify vessel calculation
- Port costs are hardcoded for now. This can be changed in 'CorridorCalculation' in rows 64-65

Configurator: This sheet allows users to configure the model to fit the selected green corridor's specifics

(X) Deep dive follows (x) 3 main output graphs

A

Input values

Only red cells should be adjusted by the user – some of the cells have a drop-down menu that opens when clicking on the cell.

Override function (optional)

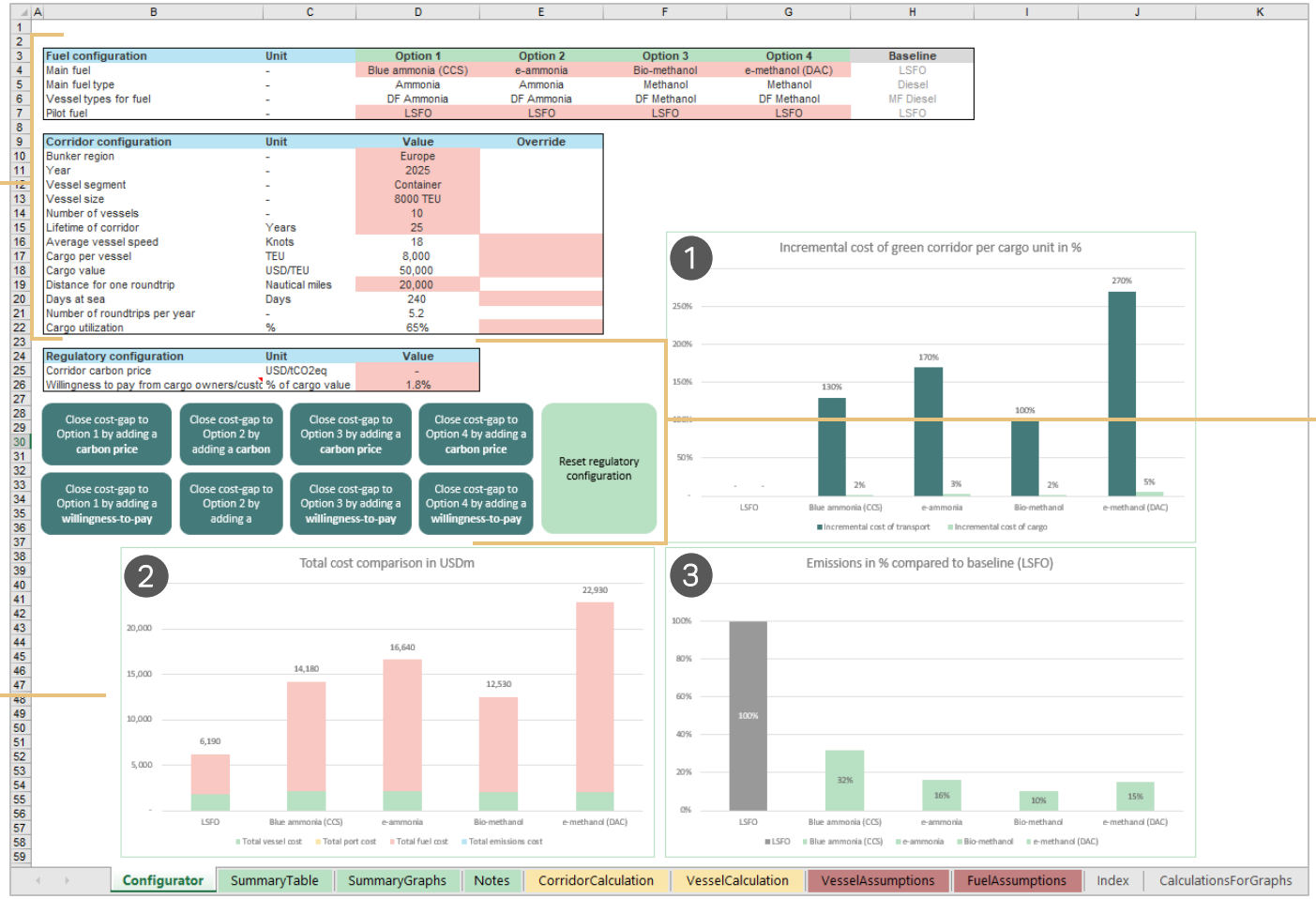
The red cells in this column can be used to override the values to their left if needed.

B

Output

The graphs provide the following output:

1. Incremental cost of green by alternative fuel type, split into transport and cargo.
2. Total cost by alternative fuel type, split into vessel, port, fuel, emissions.
3. Emissions compared to fossil-fuel baseline by alternative fuel type.



C

Goal seeking (optional)

The green buttons help the user understand the impact of adding a carbon price or adjusting the willingness to pay the incremental cost of green (i.e., the cost gap).

A. Input values: Fuel configuration – The user can select different fuel types and compare them to the fossil fuel baseline

Fuel configuration

Fuel configuration	Unit	Option 1	Option 2	Option 3	Option 4	Baseline
Main fuel	-	Blue ammonia (CCS)	e-ammonia	Bio-methanol	e-methanol (DAC)	LSFO
Main fuel type	-	Ammonia	Ammonia	Methanol	Methanol	Diesel
Vessel types for fuel	-	DF Ammonia	DF Ammonia	DF Methanol	DF Methanol	MF Diesel
Pilot fuel	-	LSFO	LSFO	LSFO	LSFO	LSFO

Corridor configuration	Unit	Value	Override
Bunker region	-	Europe	
Year	-	2025	
Vessel segment	-	Container	
Vessel size	-	8000 TEU	
Number of vessels	-	10	
Lifetime of corridor	Years	25	
Average vessel speed	Knots	18	
Cargo per vessel	TEU	8,000	
Cargo value	USD/TEU	50,000	
Distance for one roundtrip	Nautical miles	20,000	
Days at sea	Days	240	
Number of roundtrips per year	-	5.2	
Cargo utilization	%	65%	

Configurator | SummaryTable | SummaryGraphs | Notes | CorridorCalculation | VesselCalculation | VesselAssumptions | FuelAssumptions | Index | Calcul ...

Option 1-4 can be **customized** by the user by **adjusting the red cells**. The white cells in rows 5-6 are automatically filled based on input in row 4.

The **Baseline** in column H includes the **standard fossil fuels** as a comparison.

See the FuelAssumptions sheet for fuel data (see example on next page)

A. Input values: Fuel configuration – The model is backed up by a granular and robust data set which includes multiple bunker fuels

Granularity of data – selected elements (exemplary)

Bunker fuels

- e-hydrogen (liquefied)
- e-hydrogen (compressed)
- e-ammonia
- e-methanol (DAC)
- e-methanol (PS)
- e-methane liquefied (DAC)
- e-methane liquefied (PS)
- e-diesel (DAC)
- e-diesel (PS)
- Blue ammonia (CCS)
- Bio-methanol
- Bio-methane (liquefied)
- Bio-diesel (HTL)
- Bio-diesel (Pyrolysis)
- LNG
- LSFO

Yearly data points for e-hydrogen (liquefied) for the following parameters:

- CapEx (Global)
- OpEx (Africa)
- OpEx (Americas)
- OpEx (Asia)
- OpEx (Europe)
- OpEx (Middle East)
- Total emissions – WTT – GWP100 (Global)
- Total emissions – TTW – GWP100 (Global)
- Total emissions – WTW – GWP100 (Global)

A. Input values: Corridor configuration – Users can adjust multiple parameters to ensure the data model matches the specific corridor's characteristics

Corridor configuration

Fuel configuration	Unit	Option 1	Option 2	Option 3	Option 4	Baseline
Main fuel	-	Blue ammonia (CCS)	e-ammonia	Bio-methanol	e-methanol (DAC)	LSFO
Main fuel type	-	Ammonia	Ammonia	Methanol	Methanol	Diesel
Vessel types for fuel	-	DF Ammonia	DF Ammonia	DF Methanol		
Pilot fuel	-	LSFO	LSFO	LSFO		

Corridor configuration	Unit	Value	Override
Bunker region	-	Europe	
Year	-	2025	
Vessel segment	-	Container	
Vessel size	-	8000 TEU	
Number of vessels	-	10	
Lifetime of corridor	Years	25	
Average vessel speed	Knots	18	
Cargo per vessel	TEU	8,000	
Cargo value	USD/TEU	50,000	
Distance for one roundtrip	Nautical miles	20,000	
Days at sea	Days	240	
Number of roundtrips per year	-	5.2	
Cargo utilization	%	65%	

Configurator | SummaryTable | SummaryGraphs | Notes | CorridorCalculation | VesselCalculation | VesselAssumptions | FuelAssumptions | Index | Calcul ...

Customize the corridor configuration **by adjusting the red cells.**

The white cells are automatically filled based on input on the vessel segment and size. They are based on assumptions from the underlying data model, but **can be adjusted using the override function** in column E.

Using the override function is only recommended **when the user has very specific and detailed knowledge** of the vessel in the specific corridor.

See the VesselAssumptions sheet for fuel data (see example on next page)

A. Input values: Corridor configuration – The model is backed up by a granular and robust data set which includes multiple vessel types

Granularity of data – selected elements (exemplary)

Vessels

- Container (3500 TEU)
- Container (8000 TEU)
- Container (15000 TEU)
- Bulk carrier (Handy)
- Bulk carrier (Panamax)
- Bulk carrier (Capesize)
- Tanker (35k dwt)
- Tanker (100k dwt)
- Tanker (300k dwt)
- RoRo (4000 CEU)
- RoRo (7000 CEU)
- Gas Carrier
- Cruise (25k GT)
- Cruise (100k GT)
- Cruise (175k GT)
- Fast Ferry
- Ferry
- General Cargo
- Offshore
- Tug

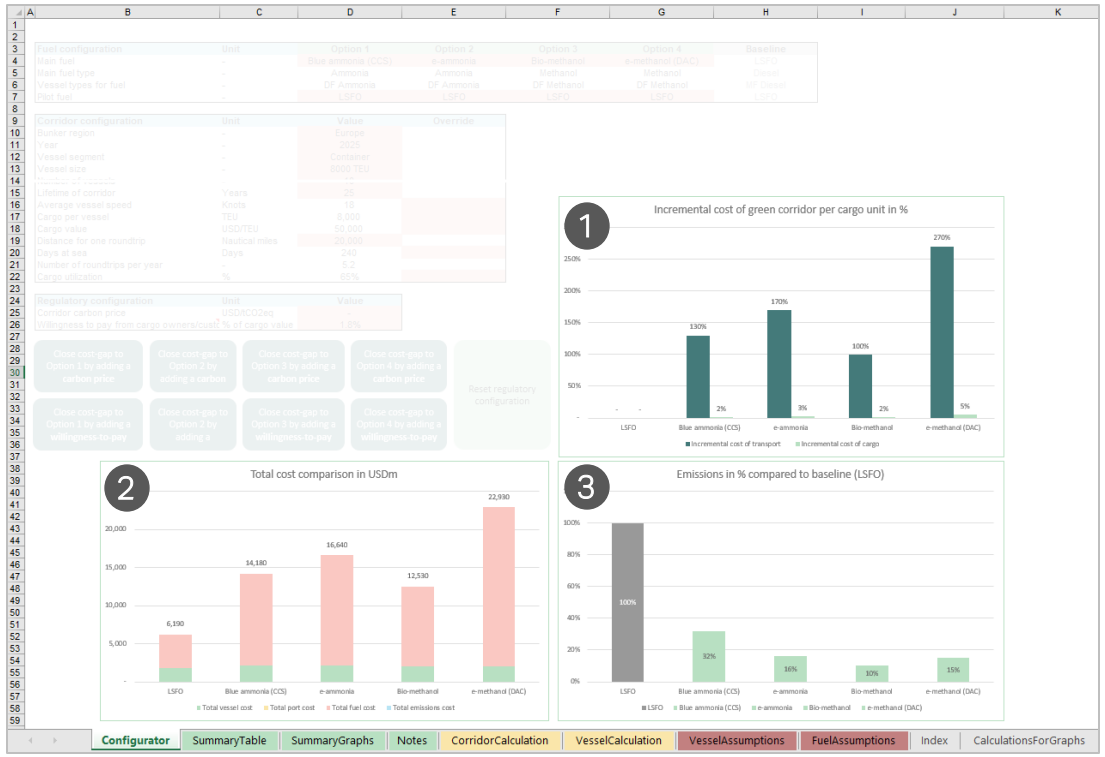
Yearly data points for Container vessels (3500 TEU) for the following parameters:

- Nominal capacity
- Days at sea
- Average speed
- Main engine thermal efficiency - MF Diesel
- Main engine thermal efficiency - DF Methane
- Main engine thermal efficiency - DF Methanol
- Main engine thermal efficiency - DF Ammonia
- Main engine pilot fuel share - MF Diesel
- Main engine pilot fuel share - DF Methane
- Main engine pilot fuel share - DF Methanol
- Main engine pilot fuel share - DF Ammonia

B. Output: The summary table provides a detailed overview of the methodology behind the three main output graphs

x 3 main output graphs

Key graphical output



Summary table sheet providing methodology behind output

	Main fuel		LSFO	Blue ammonia (CCS	e-ammonia	Bio-methanol	e-methanol (DAC)
	Cost summary	**Unit**	**Baseline**	**Option 1**	**Option 2**	**Option 3**	**Option 4**
	Total vessel CAPEX	USDm	1,000	1,300	1,300	1,200	1,200
	Total vessel OPEX	USDm	790	840	840	830	830
	Total port CAPEX	USDm	-	-	-	-	-
	Total port OPEX	USDm	-	-	-	-	-
	Total fuel CAPEX	USDm	-	840	1,900	1,900	2,900
	Total fuel OPEX	USDm	4,400	11,200	12,600	8,600	18,000
	Total emissions cost	USDm	-	-	-	-	-
	Total vessel cost	**USDm**	**1,790**	**2,140**	**2,140**	**2,030**	**2,030**
	Total port cost	**USDm**	**-**	**-**	**-**	**-**	**-**
	Total fuel cost	**USDm**	**4,400**	**12,040**	**14,500**	**10,500**	**20,900**
	Total emissions cost	**USDm**	**-**	**-**	**-**	**-**	**-**
2	**Total corridor cost**	**USDm**	**6,190**	**14,180**	**16,640**	**12,530**	**22,930**
	Incremental cost of green	**USDm**	**-**	**7,990**	**10,450**	**6,340**	**16,740**
	Main fuel		LSFO	Blue ammonia (CCS	e-ammonia	Bio-methanol	e-methanol (DAC)
	Emissions summary	**Unit**	**Baseline**	**Option 1**	**Option 2**	**Option 3**	**Option 4**
	Total emissions for the corridor	**tCO2eq**	**1,067,900**	**346,300**	**173,500**	**110,500**	**160,300**
	Emissions reductions	**tCO2eq**	**-**	**721,600**	**894,400**	**957,400**	**907,600**
	CO2eq abatement cost	**USDm/tCO2eq**	**-**	**440**	**470**	**260**	**740**
3	Emissions compared to baseline	% reduction	100%	32%	16%	10%	15%
	Main fuel		LSFO	Blue ammonia (CCS	e-ammonia	Bio-methanol	e-methanol (DAC)
	Cargo summary	**Unit**	**Baseline**	**Option 1**	**Option 2**	**Option 3**	**Option 4**
	Cargo value	USD/TEU	50000	50000	50000	50000	50000
	Transport cost	USD/TEU	930	2100	2500	1900	3400
	Baseline transport cost	USD/TEU	930	930	930	930	930
	Incremental cost of transport per c	USD/TEU	0	1200	1500	930	2500
	Total cost of cargo	USD/TEU	50900	52100	52500	51900	53400
1	**Incremental cost of transport**	**% premium**	**-**	**130%**	**170%**	**100%**	**270%**
	Incremental cost of cargo	**% premium**	**-**	**2%**	**3%**	**2%**	**5%**

B. Output: In addition to the 3 main output graphs, there are a variety of other graphs providing a more nuanced overview

Full graphical output

x 3 main output graphs

Emissions compared to baseline

Costs per cargo unit

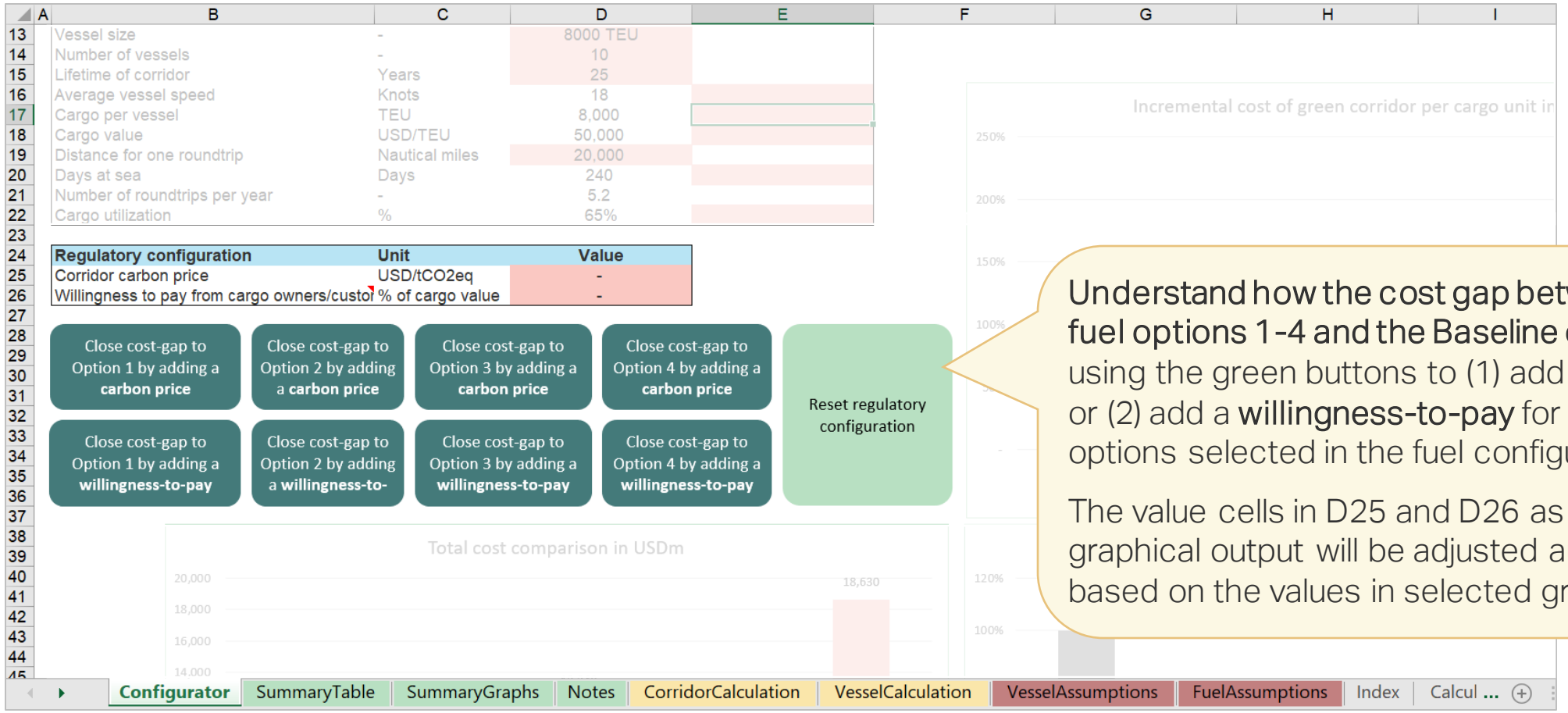
Total costs by vessel, port, fuel, and emissions

Incremental cost gap identified by fuel – serves as input for residual cost gap analysis[21]

21: Incremental cost for vessels are set to 100 in the model

C. Goal seeking: Examine simple ways to close the cost gap through a carbon price or willingness-to-pay

Goal seeking



Understand how the cost gap between Alternative fuel options 1-4 and the Baseline can be closed by using the green buttons to (1) add a **carbon price** or (2) add a **willingness-to-pay** for each of the 4 options selected in the fuel configuration.

The value cells in D25 and D26 as well as the graphical output will be adjusted automatically based on the values in selected green buttons.

Example of Green Corridors List

Domestic International

C/No.	Corridor Name	Map No.
A1	Ro-Pax Melbourne–Tasmania	3
A2	Auckland Ferry	4
A3	Picton–Wellington Ferry	4
B1	Weipa Ro-Ro	3
B2	Geelong/Devonport Ro-Ro	3
C1	Pure Car Truck Carrier(JPN–AU–NZ)	1
C2	Pure Car Truck Carrier (EU–AU–NZ–JPN)	1
D1	Gladstone Bauxite	3
D2	Gladstone–Bluff Alumina	2
D3	Adelaide–Melbourne Cement	3
D4	Gladstone–Newcastle Alumina/ Cement	3
D5	New Zealand Cement	4
E1	Gladstone Coal	1

C/No.	Corridor Name	Map No.
E2	New Zealand Timber	1
E3	Agriculture Corridor	1
F1	Sydney Cruise Line	3
F2	Eco-Tourism (Great Barrier Reef)	3
F3	New Zealand Cruise Line	4
G1	Gladstone–Newcastle NH3 Carrier	3
G2	NH3 Export to Asia	1
H1	Sydney Container	1
H2	Melbourne Container	1
I1	New Zealand Feeder Container	4
I2	Botany Bay–Melbourne Container	2
J1	Geelong–Melbourne small tanker	3
K1	Tug/service	3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The consortium formation

Core consortium identified

Create an initial core team for the project.

This typically includes a smaller subset of stakeholders from the Value Chain and/or public decision makers and stakeholders.

Agreement on roles

Agree on roles for consortium members (Workstream Lead, Workstream Support, Sounding Board) for the upcoming Pre-Feasibility Study phase based on their commitment level, interest and expertise.

Consortium Gap Analysis

Identify workstream gaps (if any) in the consortium using the role assignment template.

Select additional potential consortium members in a step-wise process based on commitment level, interest and expertise, and align with the core team on the selection of additional consortium members.

Final consortium

Finalize consortium committed to moving into Pre-Feasibility Study phase.

Letter of Intent (optional)

Continuously adjust consortium as more insights are generated and goals & narrative evolve (the core consortium can already start with activities in the Scoping Phase before the consortium has been finalized).

Adjustment ends when there are **no more gaps** identified.