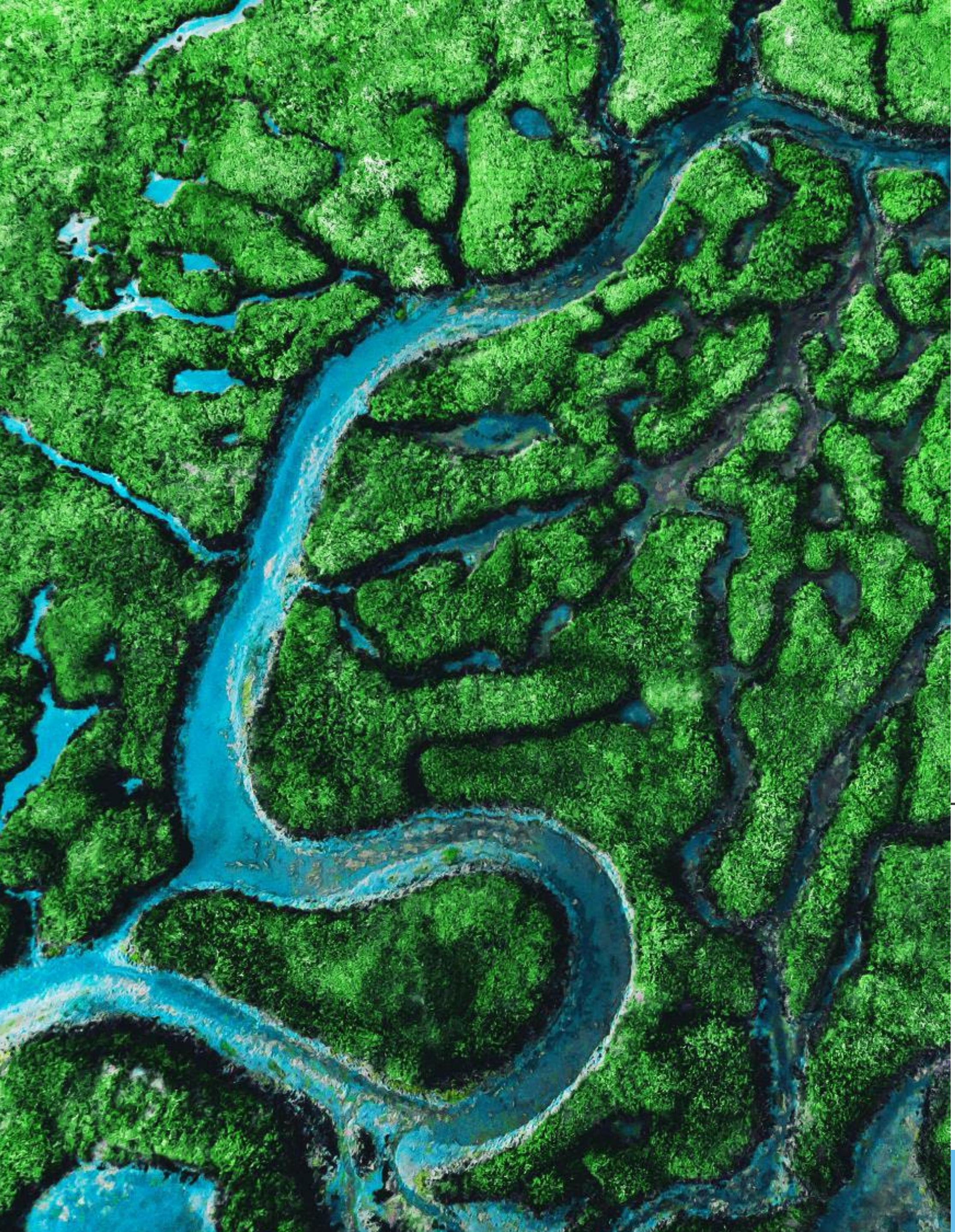


Association of the leading European River Cruise Companies

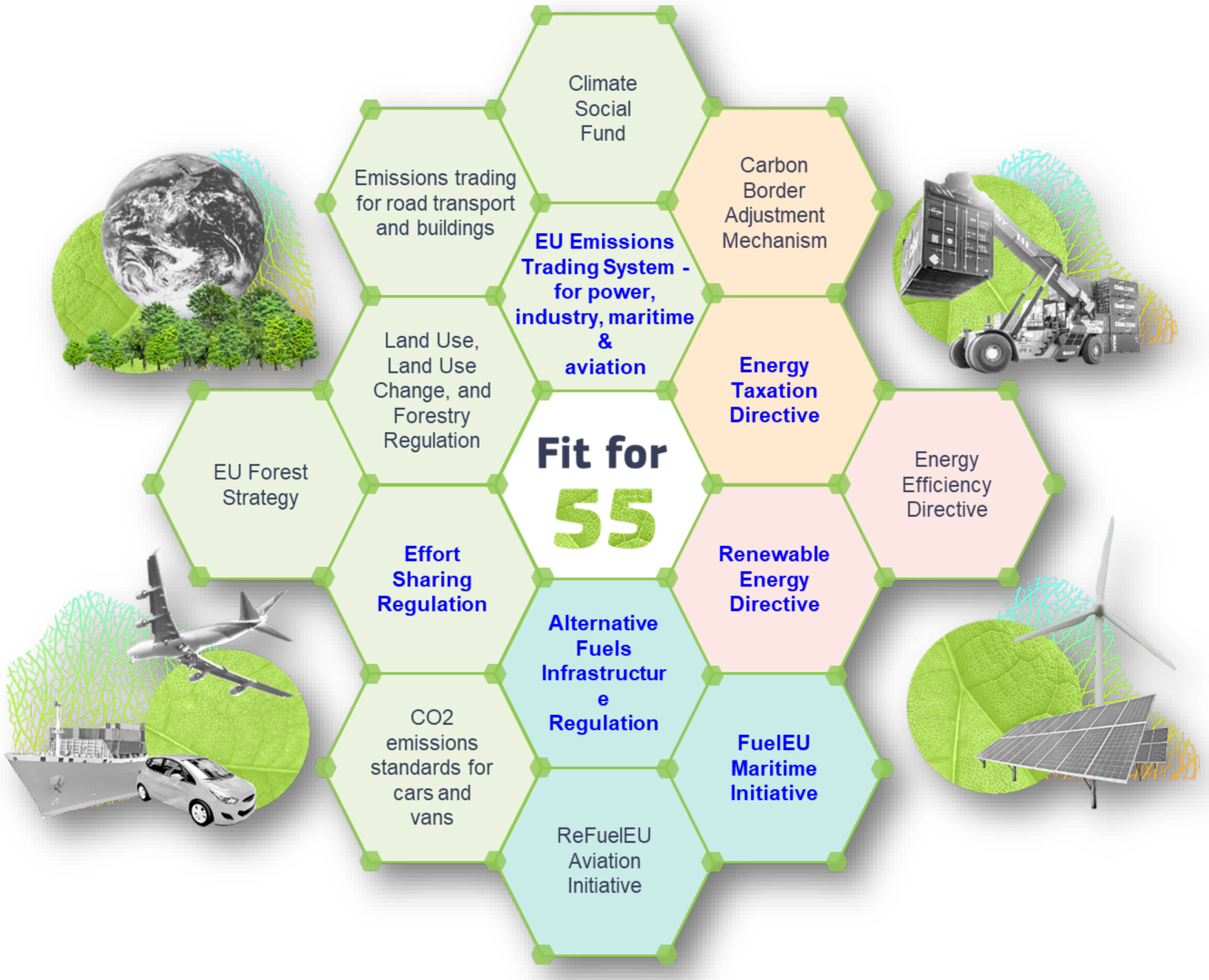
DANUBE CONFERENCE

The Challenge
We need a proof of concept

The Legislative Framework

The European Green Deal has an evolving legislation. Each sector has a ***basket of measures*** to drive it to reach its decarbonisation goals.

The basket of measures can be compared to a “stick and carrot” approach, where tax and GHG limits become the “stick”, and ETS and Funding become the “carrot”



IG RiverCruise The European River Cruise Association RICARDO DNV

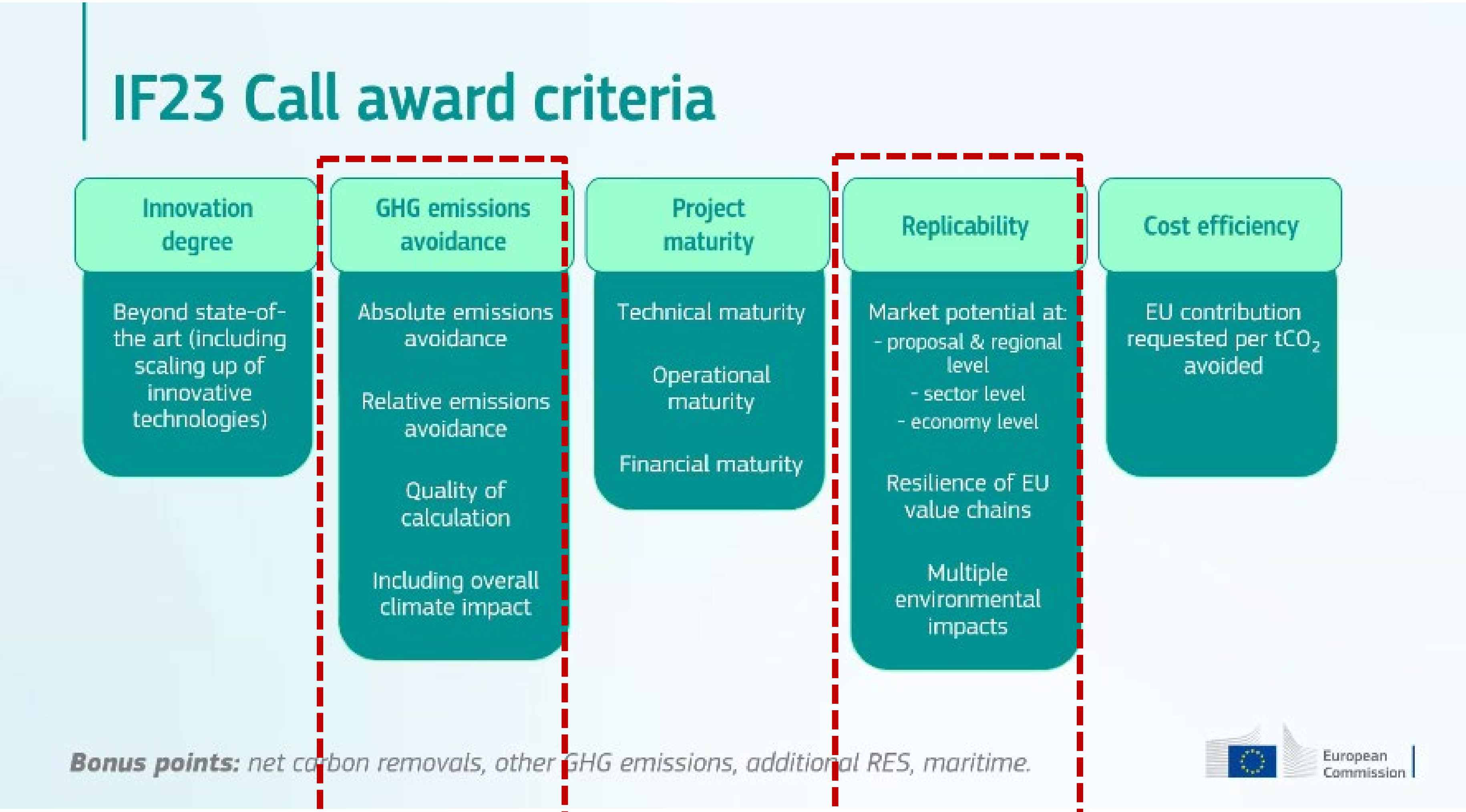
An introduction to one of the world's largest funding programs for the deployment of net-zero and innovative technologies.

Budget: beyond €40 Billion
Maritime: potential €9.9 Billion

The challenge with large funds are the decarbonization criteria

You will be competing with hard-to-abate sectors such as renewable energy production, energy storage, carbon capture, and low carbon technologies …translates into big industries…

…remember that shipping is a very efficient transport mode…



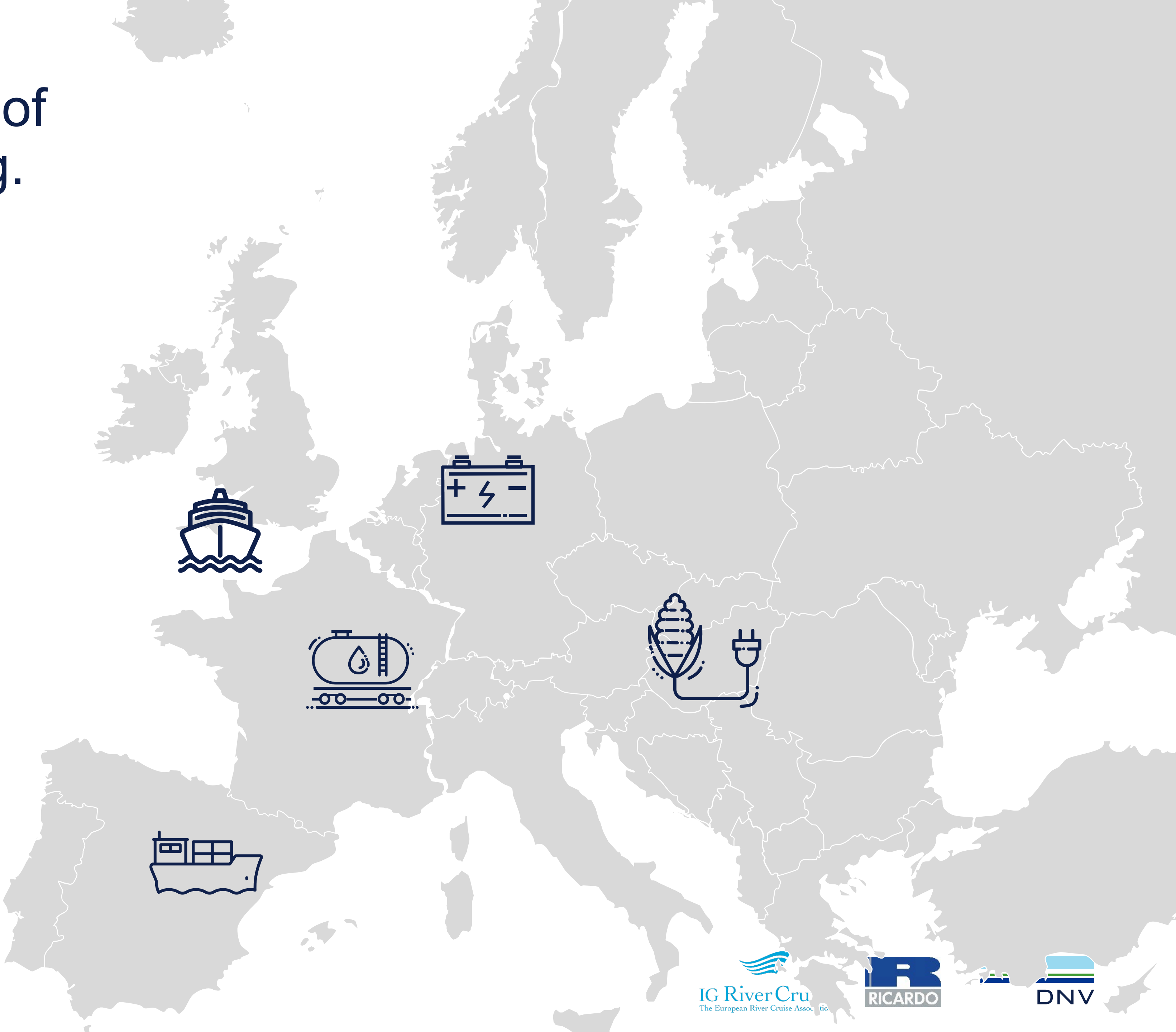
Challenge

Challenge

The sector needs a proof of concept to access funding.

- Type of Molecule or Electron
- River Stretch
- Number of Ships on Stretch
- Bunkering Infrastructure
- Port Infrastructure

= GHG Reduction and Scaling Potential for River



The Findings

There are timely solutions

Key findings

No. of vessels in fleet

380
vessels

Passenger day capacity

13.5 million
PAX-days

Fuel consumption

240 000
tonnes MGO

Total GHG emissions

790 000
tonnes CO_2-eq

Weighted average duration of cruise

9.3
days

Average no. of days in operation

232
days

Top 5 embarkation ports

1. Amsterdam
2. Budapest
3. Basel
4. Cologne
5. Passau

Top 5 docking ports

1. Budapest
2. Vienna
3. Amsterdam
4. Cologne
5. Passau

Note: all findings are based on operational and technical vessel data for the fleet in 2023

Technology for decarbonisation is generally at a high level of technology or commercial readiness

Current **deployment levels** will inform basis of decarbonisation potential in foresight scenarios

Battery electric
- **Current**: Several vessels equipped for peak shaving; one fully electric vessel
- **Forecast****: low uptake by 2030 and 2050

OPS
- **Current**: Almost all vessels equipped
- **Forecast**: improved landside infrastructure

Hydrogen
- **Current**: No known deployment
- **Forecast****: low uptake 2030, medium 2050

Methanol
- **Current**: No known deployment
- **Forecast**: industry expressed interest

Biofuels
- **Current**: ~90% can operate on biofuels
- **Forecast**: Availability hindering deployment

*** 2022 survey results*

Alternative fuel propulsion power technology is either commercially mature or expected to be **ready** by 2030

Power converter technology	TRL (1-9) / CRL (10-11)				Can it be retrofitted?
	2022	2025	2030	2035	
Methane (LNG) ICE	10	11	11	11	Yes, but limited*
HVO ICE	11	11	11	11	N/A – Fuel is drop-in
Methanol ICE	9	10	11	11	Yes
Hydrogen ICE	7	9	10	11	Yes*
Fuel cell PEM	8	9	10	11	Yes*
Fuel cell – High temperature	7	8	10	10	Yes*

**Retrofit potential dependent on fuel storage volume while maintaining vessel range*

RICARDO DNV

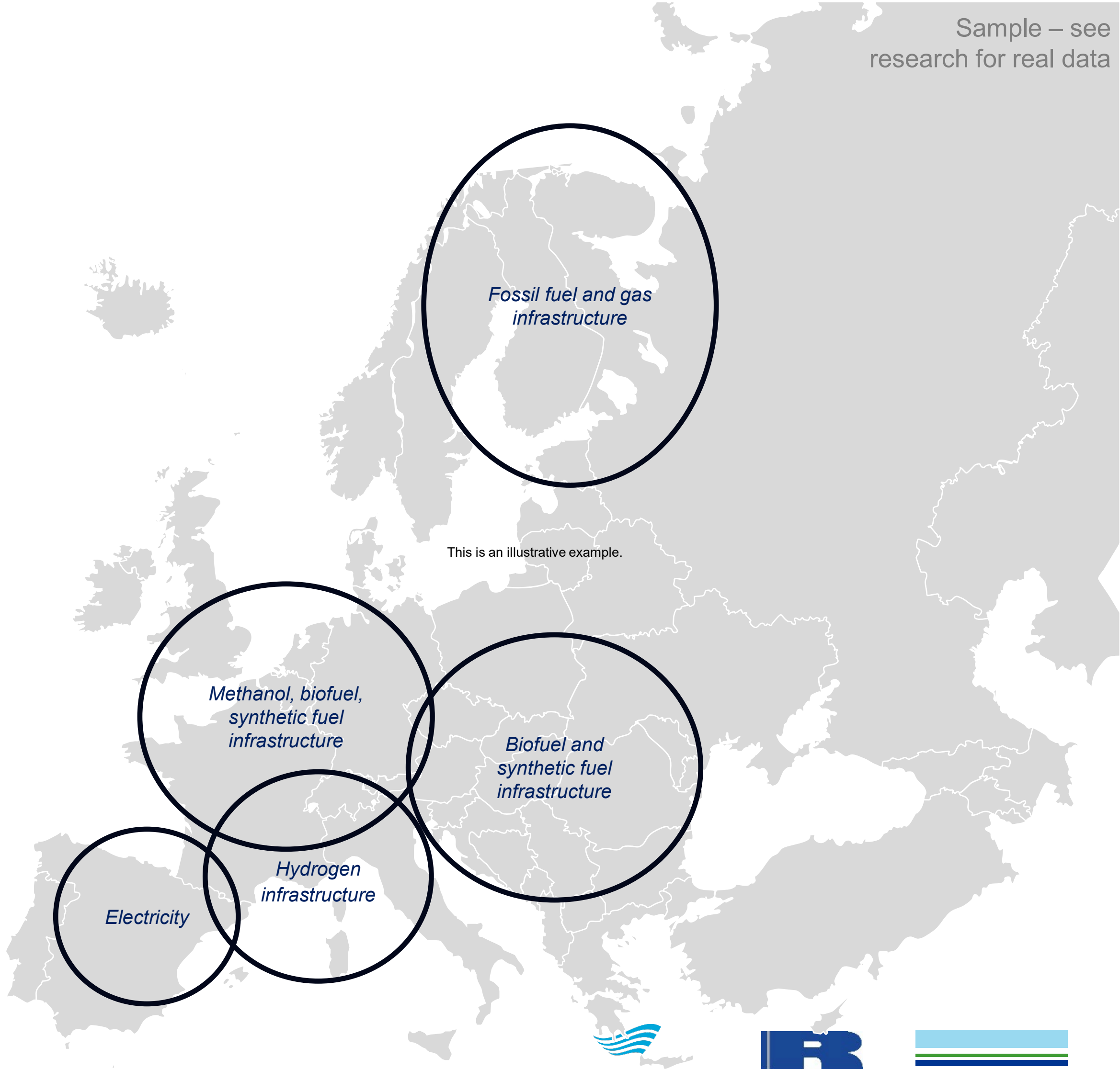
Geographical Difference to Decarbonization

Question to be determined: When mapping the current fleet, versus fuel availability, where would a new-build vessel with zero technology make sense and where we would we place net-zero technologies in retrofitting or new-build?

- "New" fuels are not distributed in the same logistical and geographical manner as traditional fuels are. Therefore, each area will have fuel diagnostic pockets that are unique to one energy carrier. For example, Paris has announced a hydrogen infrastructure on the river, whilst Rotterdam and Amsterdam maybe the key methanol hubs of the future.

- As a result, the fleet of vessels should not all be equipped with the same technology. Instead, zero emission new-build technologies can be deployed in some areas, whilst net-zero technologies may be more favourable in other areas for both new-build and retrofitted vessels.

- Such regional distinction will have a massive impact on operations cost based on fuel infrastructure cost and technology deployment.



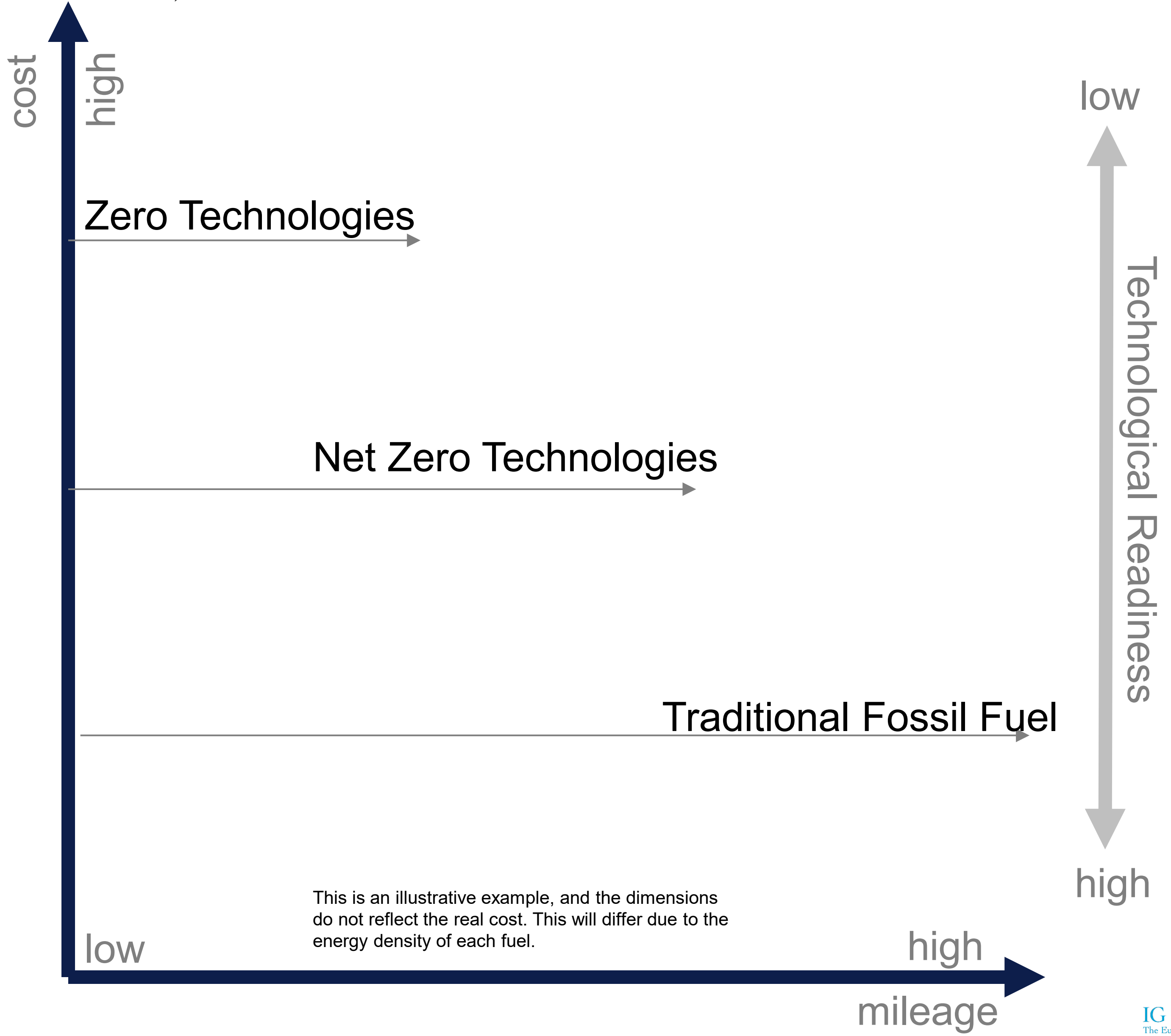
IG River Cruise The European River Cruise Association RICARDO DNV

Question 1:
What are you aiming for?

Question 2:
How does Nox, Sox,… impact your decision making?

Question3:
How does your decision making differ considering New Build vs Retrofit?

The energy density of different fuels differs significantly. This results in "new" fuels needing more storage space, providing less mileage per ton; the cost is impacted by the production complexity and the current lack of committed long-term demand;

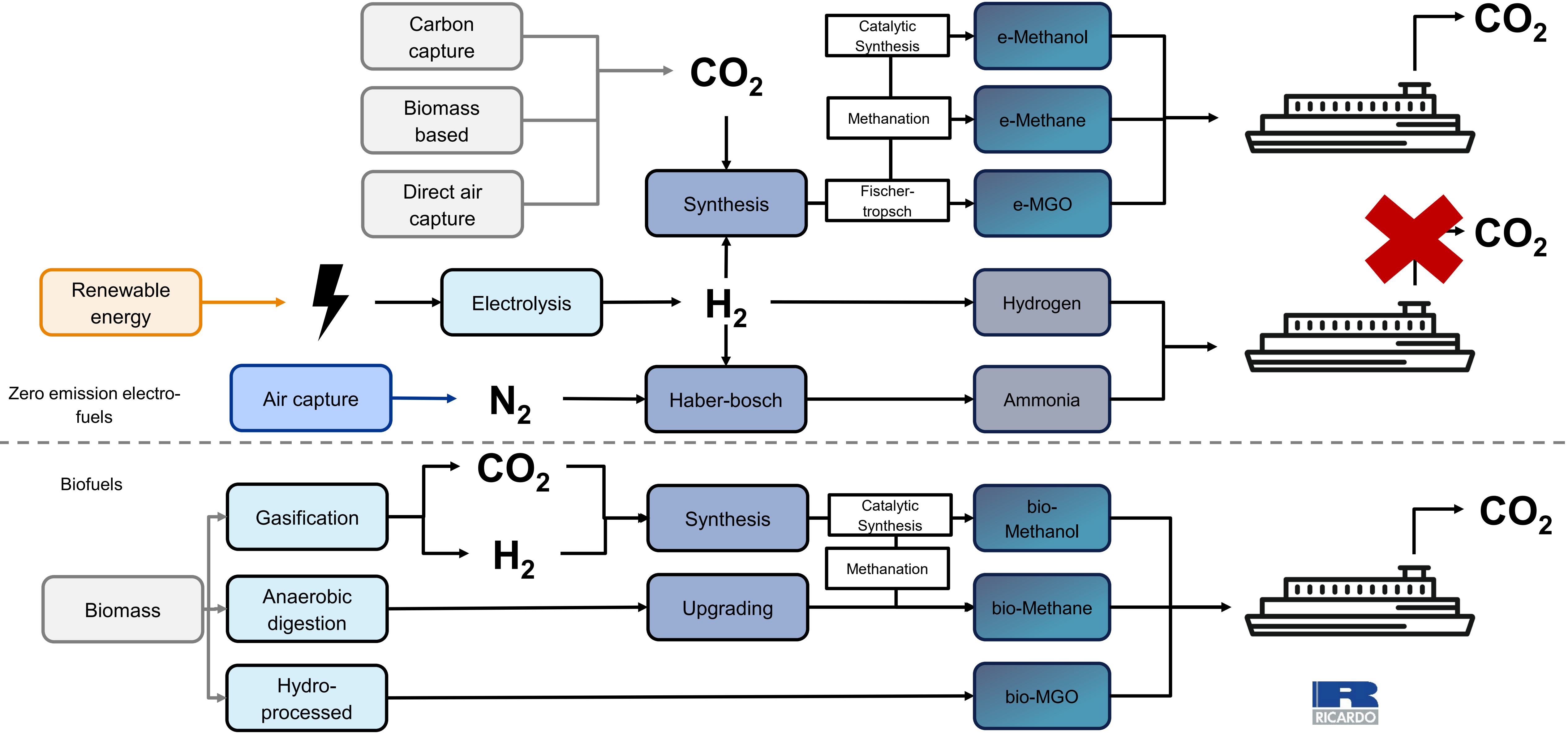


IG River Cruise
The European River Cruise Association
RICARDO
DNV

The Foresight

We need a consortium and agree

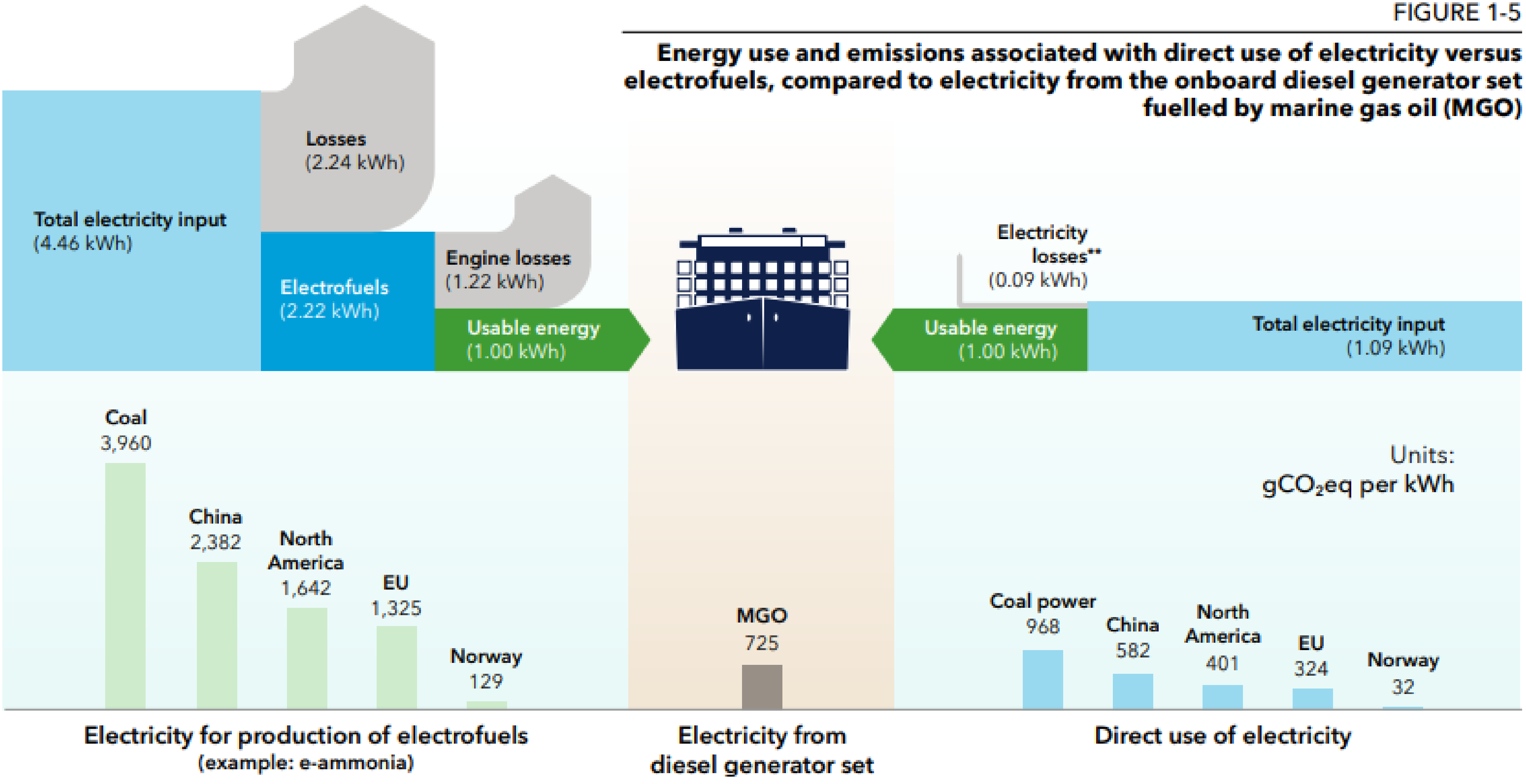
Production pathways and CO_2 emissions – Net Zero vs Zero



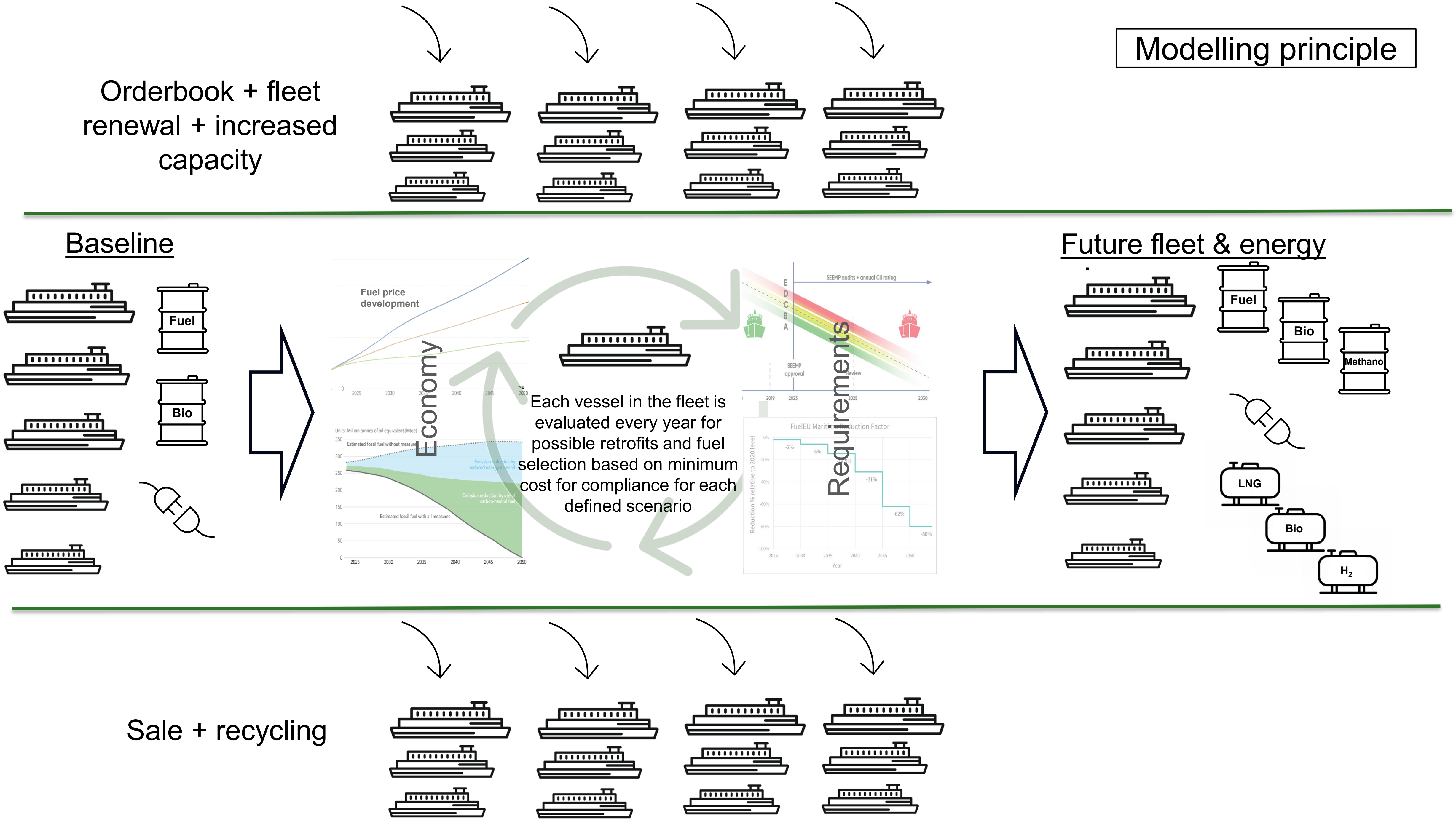
Electrons versus Molecules, with limitations on the renewable electricity, the most efficient is to use electricity directly onboard without converting to a fuel

FIGURE 1-5

Energy use and emissions associated with direct use of electricity versus electrofuels, compared to electricity from the onboard diesel generator set fuelled by marine gas oil (MGO)



Modelling principle



Scenario development – Foresight

Scenario 1: "Liquid drop-in fuels dominate" - MGO with transition into bio- and electro-based fuels

There is a high availability of sustainable biomass as feedstock for producing low-carbon bio-based fuels in the short and medium term. In long term there is a gradual increase of renewable electricity for producing low carbon electro-based fuels. The total volumes of low carbon fuels are sufficient for the cruise fleet to decarbonize, and the prices are affordable. Blend-in of low carbon liquid fuels is therefore the preferred decarbonization option, as new ships can be built with traditional fuel technologies having relatively low CAPEX, and existing ships will not need to undergo any retrofits to comply with the regulations. This preference will lead to a low interest in development of methanol infrastructure and carbon storage for shipping. As a result, these options become expensive and unavailable.

Scenario 2: "Electrons dominate" - Electrons in battery and hybrid solutions

There is a gradual improvement in energy density for batteries that result in an increased uptake of battery and hybrid solutions. At the same time the onshore electricity production and infrastructure promotes use of electricity as an energy efficient solution for de-carbonisation. When the ships need to extend the cruising range, MGO will be gradually replaced by bio-MGO and E-MGO when required to fulfil the emission requirements as most ships will also have options to operate with conventional combustion engines in this scenario.

Scenario 3: "High momentum for methanol" – MGO is replaced by methanol in the long term

A few fully equipped dual fuel methanol ships are already on order in other ship segments. In the first years, methanol is expensive, and in the first periods, we see a combination of alternative fuels for decarbonization. However, as the infrastructure and fuel production of methanol develops, this turns out to be a successful pathway for decarbonization in this scenario. Bio-methanol achieves lower production cost than other bio-based fuels, at the same time these products are highly sought after by other sectors, leading to higher prices.

As a result, the share of methanol ships in the order book increases gradually to become a marked standard towards 2050 in this scenario.

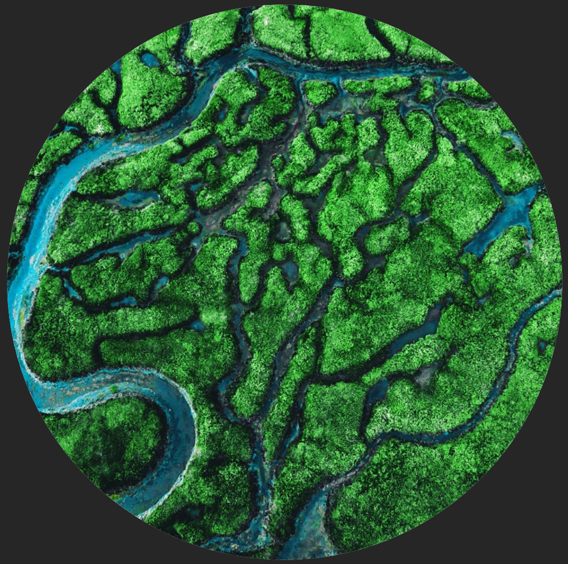
The aim of this consortium is to bundle the competencies and skills to decarbonize river vessels within 10 years based on 2024 EU regulations.

Retrofit

Increase the value of today's vessel by providing funded decarbonization solutions focused on engine replacement.

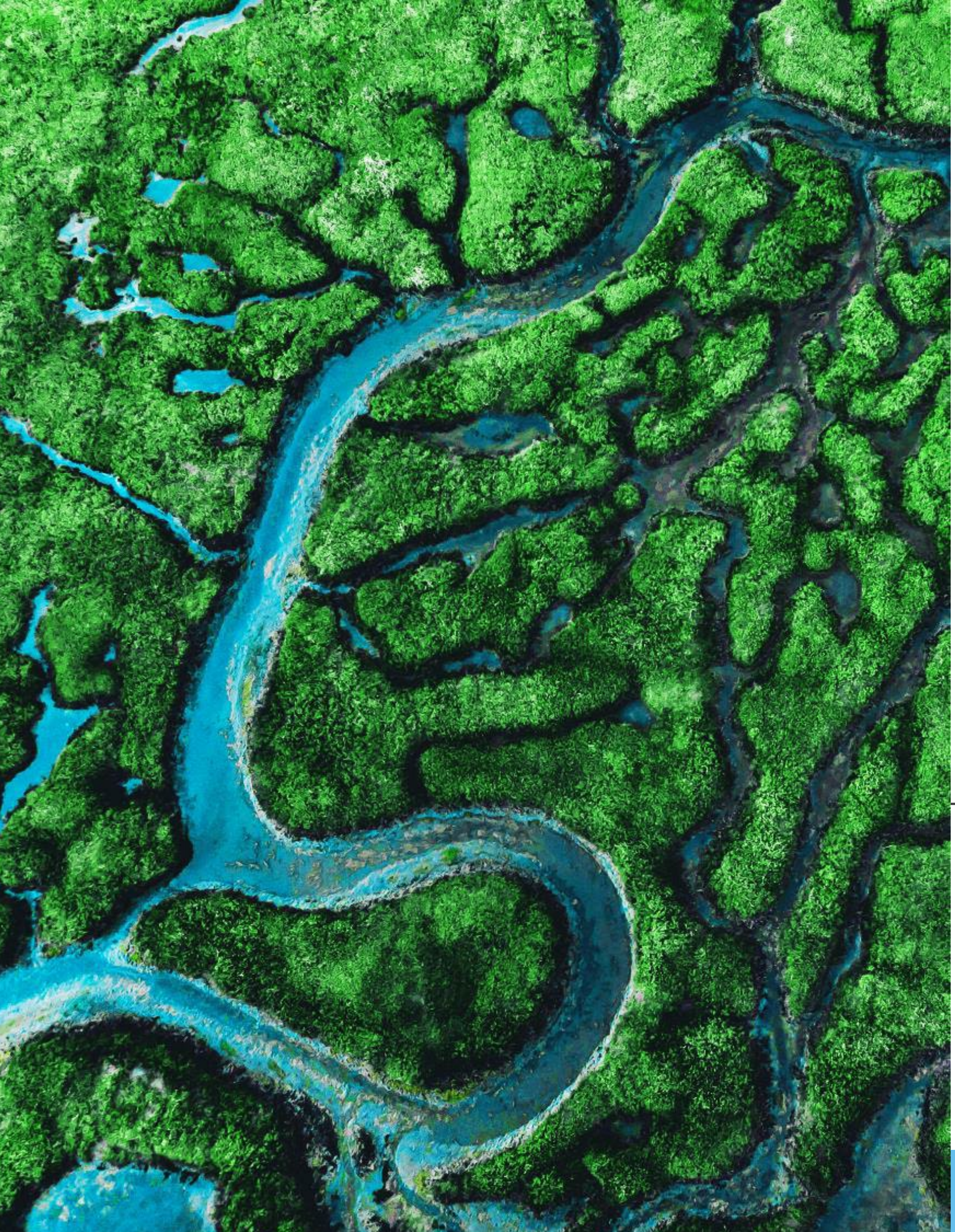
Replace

Design and Build new vessels for the Rivers of Europe.



Relocate

Relocate vessels based on NET-Zero and Zero GHG geographical criteria as well as mitigation and adaptation rules.



Credits

THE IG RIVER CRUISE WORKED WITH ITS MEMBERS AND THE RESEARCH TEAMS OF RICARDO AND DNV TO ESTABLISH THE DATA FOR THIS PRESENTATION.

Ship Financing Portal

What is the Ship Financing Portal?

The **Ship Financing Portal** is a valuable resource that aims to provide businesses and relevant organisations with the necessary financial tools to drive fleet renewal and retrofitting, enhance efficiency, and reduce environmental impact.

The **Ship Financing Portal** centralises access to a wide range of financing products, including grants, loans, and bonds, making it easier for stakeholders to find suitable opportunities to fund their needs, projects, and technology development.

The **Portal** will be updated periodically to reflect the latest opportunities within the sector.

Explore the Ship Financing Portal:

Consolidated resource

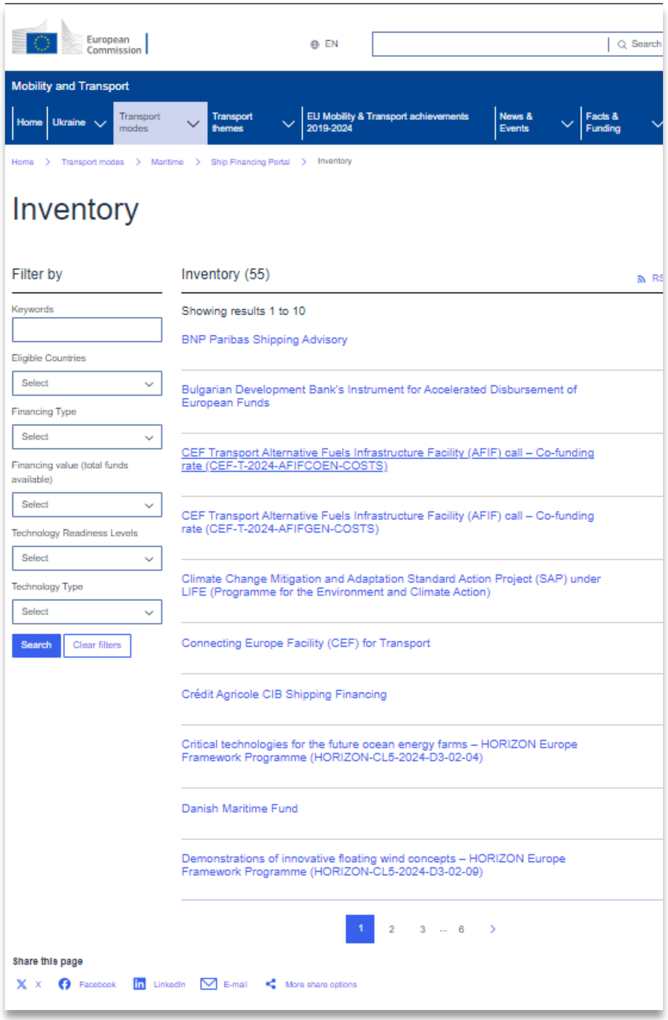
Access to a centralised variety of pan-Europe financing products, making it easier for stakeholders to find suitable financing opportunities.

Current information

Up-to-date information on available grants, loans, and other financing products administered by the EU, Member States and private financial institutions.

Sector-specific solutions

Financing products relevant for the shipping sector, facilitating the development and deployment of green maritime technologies.



https://transport.ec.europa.eu/transport-modes/maritime/ship-financing-portal_en