CCNR ROADMAP
for reducing inland navigation emissions

41 meeting of the ADN Safety Committee
26 January 2023

KEMPMANN Kai, Administrator for Infrastructure, Environment and Dangerous Goods

CCNR
CENTRAL COMMISSION FOR THE NAVIGATION OF THE RHINE

The organisation
CCNR

- **Oldest international organisation** in operation (1815)
- **5 Member States**, 11 Observer States
- **Cooperation** with other international organisations, such as EU and UNECE
- Intensive participation by industry
- Governs navigation on the Rhine: **freedom, safety** and **promotion** of navigation
- **Binding regulations** from Basel to the sea
  - Police/operational rules
  - Vessel technical requirements
  - Crew (qualification and manning)
- Other competencies relating to **infrastructure, economics, legal issues and dangerous goods**

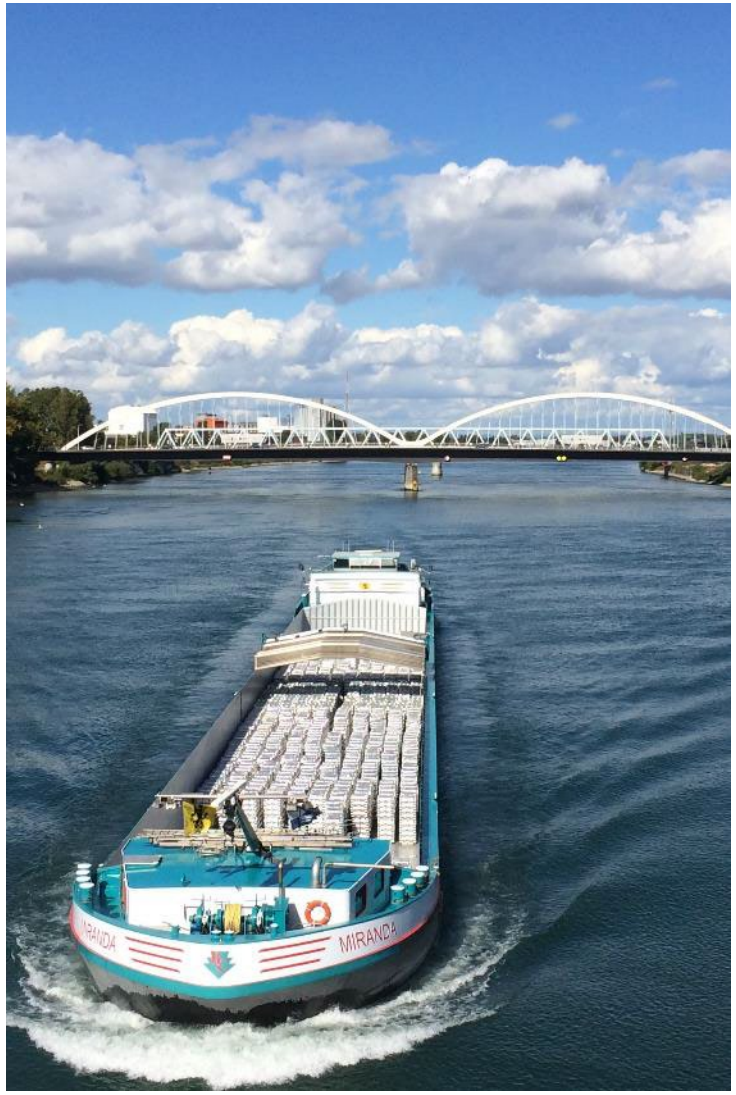
The Rhine waterway

- **Some two thirds of IWT in EU** (330 million tons/year, 2 million TEU/year, > 50% international freight in corridor)
- **300 vessels/day on the lower Rhine**
- Probably most **innovative inland navigation fleet** worldwide

TRANSPORT PERFORMANCE IN MAIN EUROPEAN RIVER BASINS (IN BILLION TKM)

60
40
20
4
3
1

Specificities
of inland navigation transport



- **Relatively small size of the European IWT market:**
  - 15,500 vessels overall in European fleet and new constructions = 100/year (cargo and passenger)
  - Rhine fleet: 63%, Danube fleet: 22%, other: 15%

- **Ageing fleet and long lifetime of vessels** (> 50 years is “standard”)

- **Navigation in confined surroundings** (transiting of locks, fluctuating water levels, bridge clearances, vessel manoeuvrability)
  - Very different from those of maritime navigation

- **Inland navigation not regulated by IMO and flag principle**
  - National, European and international framework
  - For instance, EU and CCNR refer to the same CESNI standards in their respective legal frameworks

Mannheim Declaration
Objectives

In the Mannheim Declaration (2018), Ministers in charge of transport of the CCNR Member States:

> *"tasked the CCNR to develop a roadmap in order to **largely eliminate greenhouse gases and other pollutants by 2050**"*

> *"underlined the **need for new financial instruments** to achieve these environmental objectives and entrusted the CCNR to lead this development"*

To carry out this work, a study on the financial and technological aspects was published in 2021:
Study on financing the energy transition towards a zero-emission European IWT

CCNR roadmap
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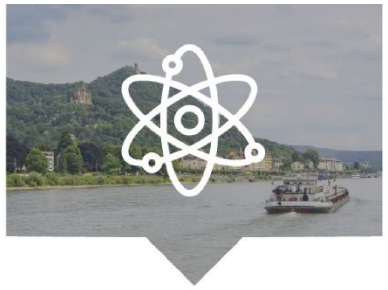
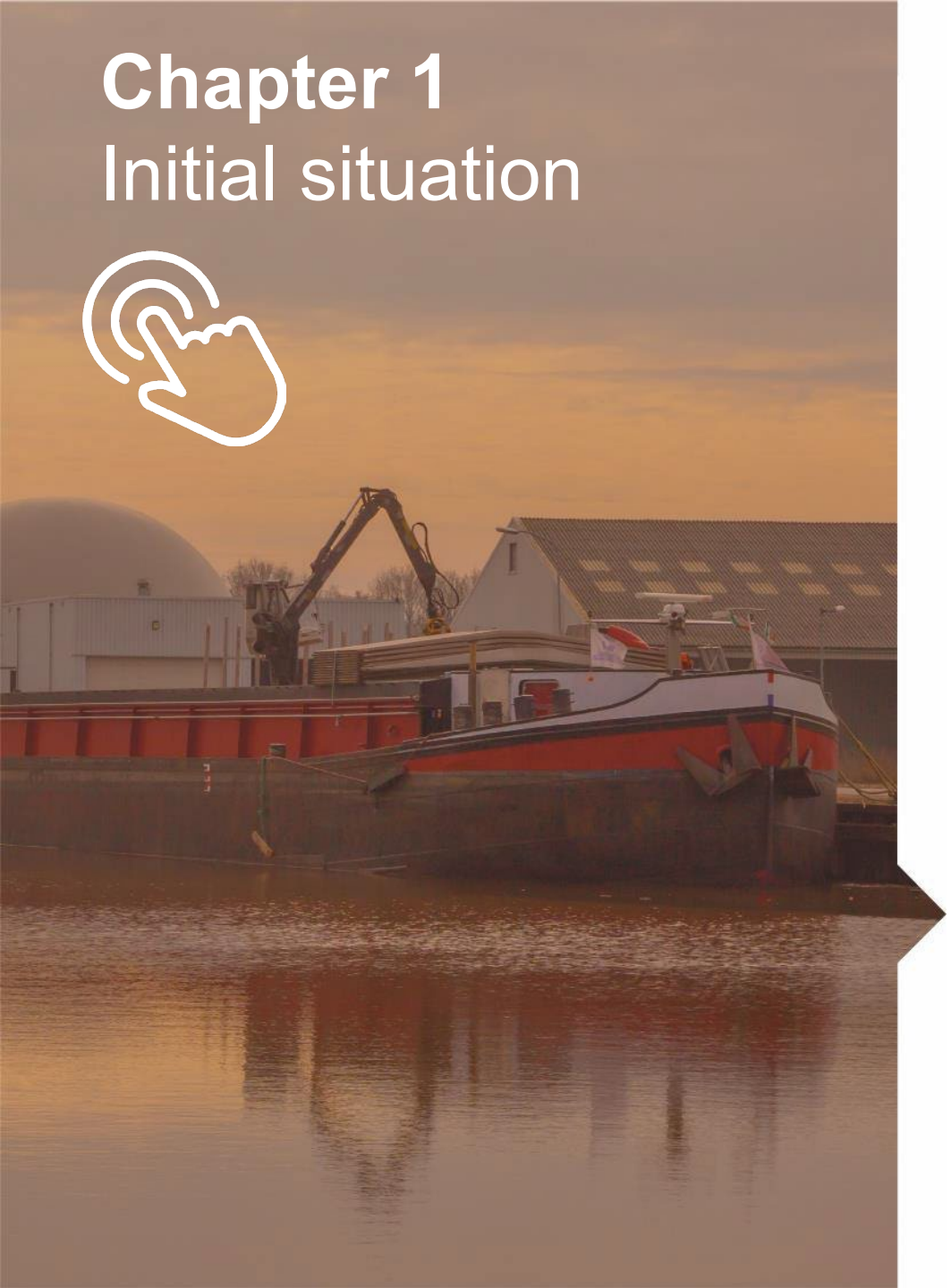


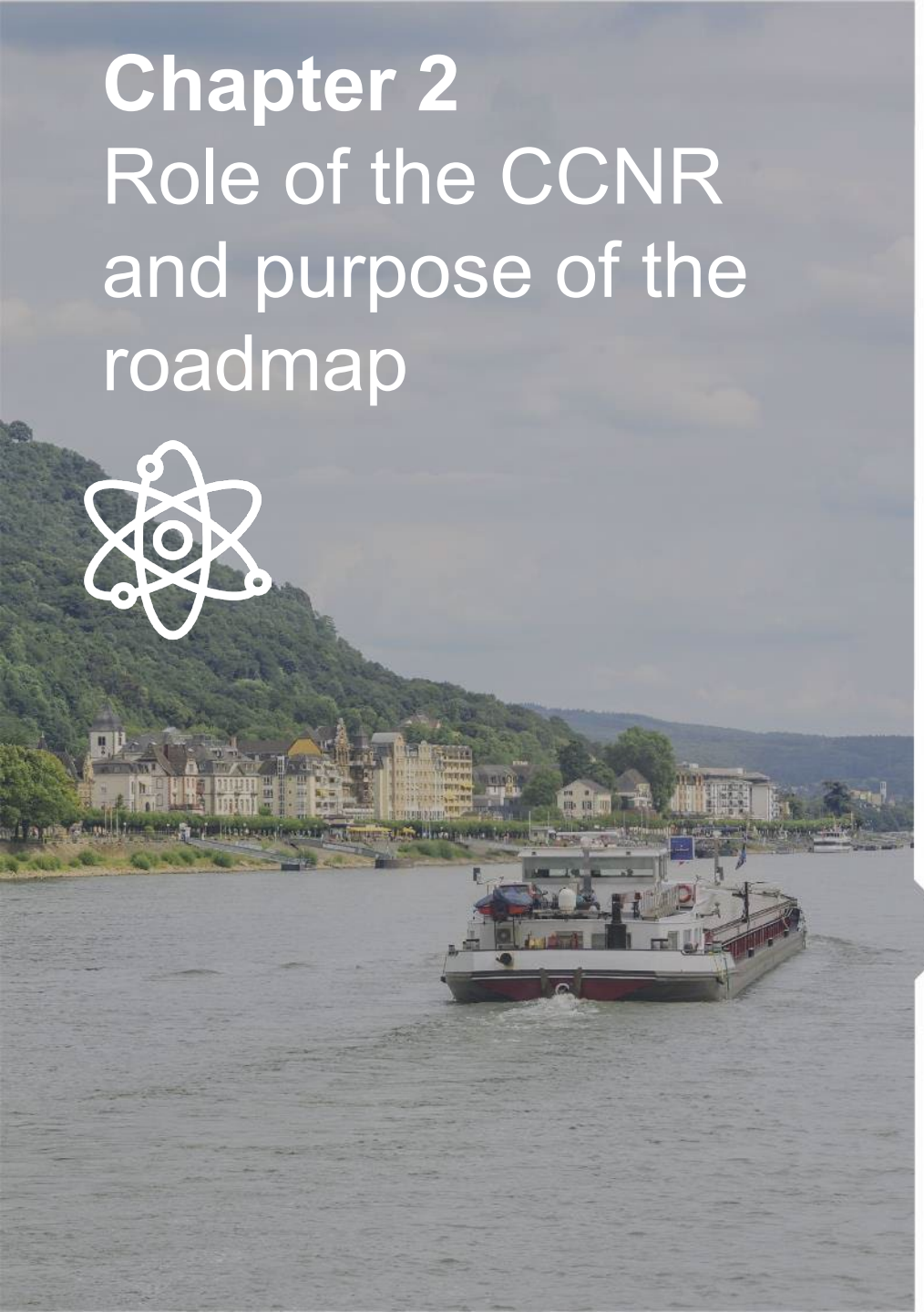


Chapter 1
Initial situation



- Mandate conferred by the Mannheim Declaration in 2018
- CCNR and EU share the same **long-term vision** with “a zero greenhouse gas emissions inland navigation sector by 2050”
- Energy transition seen as a **crucial challenge** for Rhine and European inland navigation
- Innovations to reduce emissions from **existing and new vessels** have increased but are limited to pilot projects

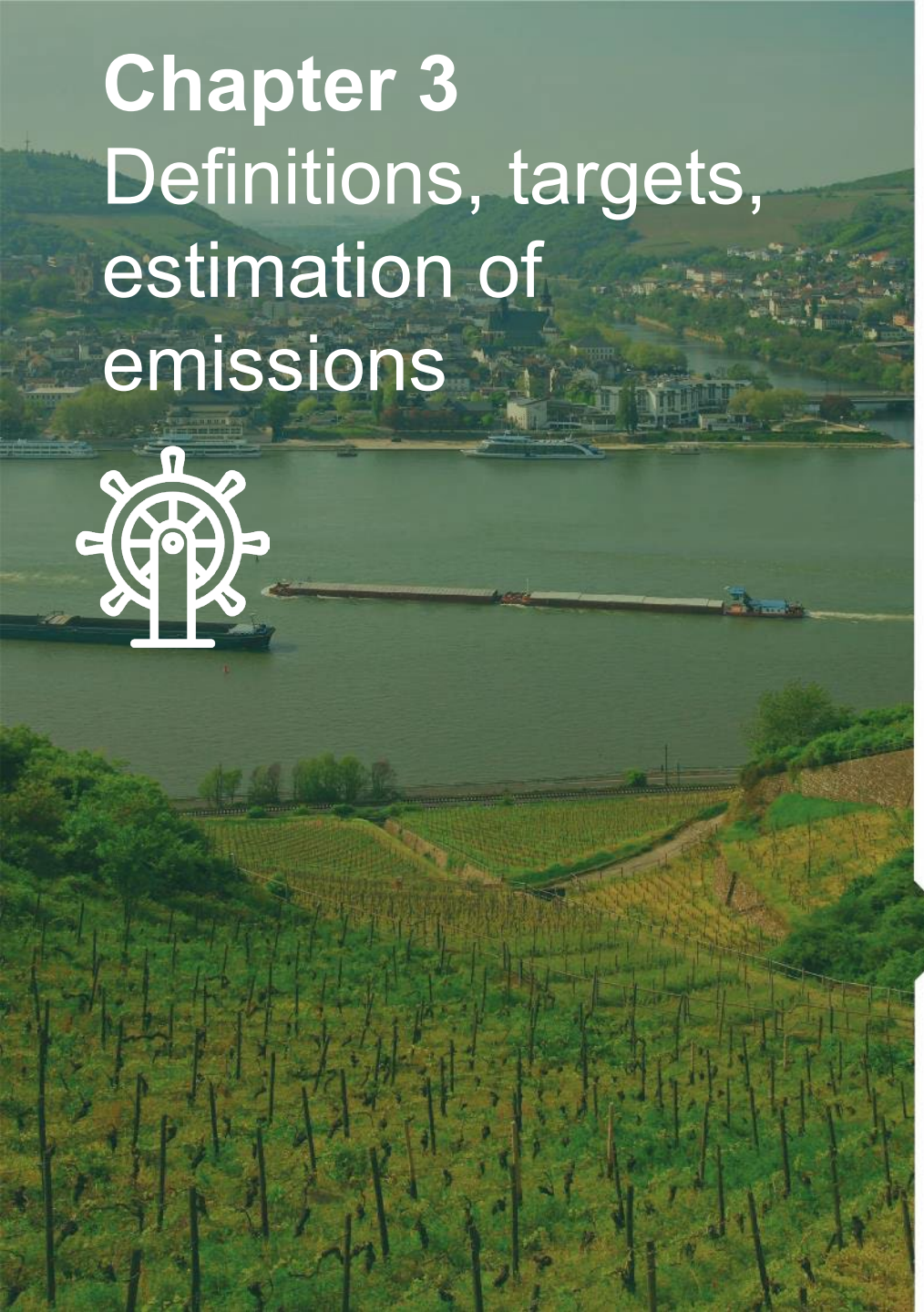
Chapter 2
Role of the CCNR and purpose of the roadmap



- Despite **current uncertainties** it is necessary to make an immediate start on designing an approach towards zero emission in 2050.

- Roadmap understood as the **primary CCNR instrument** to:

  - mitigate climate change and foster the energy transition;
  - contribute to European IWT policy.



Chapter 3
Definitions, targets, estimation of emissions

- Ensure **common understanding** between all the actors involved

- Basic definitions – examples:
  - **Inland navigation**: transport of goods and the carriage of passengers by inland waterway vessels. Recreational craft, service vessels and floating equipment not included.
  - **Emissions**: atmospheric pollutants and greenhouse gases (GHG) arising from the operation of an inland navigation vessel's propulsion and auxiliary systems.

- Estimation of emissions in 2015 as a baseline:

Emissions	Total (kt)
Carbon dioxide (CO_2)	4149.2
Carbon monoxide (CO)	38.2
Methane (CH_4)	0.2
Nitrogen oxides (NO_x)	60.9
PM_{10} (Particulate matters)	2.0

Chapter 4
Transition pathways for IWT by 2035 and 2050

Two transition pathways – why?

- **Many technological solutions available** but with different levels of maturity
- **No “one-size-fits-all” solution**
- Many **uncertainties** as to technology development, prices, availability of fuels
- Technology **neutral and open approach**
- Actual development of the fleet somewhere between these two pathways

Purpose of the transition pathways:

- Describe the expected **evolution of the fleet** (new and existing vessels) and the technologies and fuels used to achieve the 2035 and 2050 goals.
- Ease the **dimensioning of policy measures** (financing, regulatory, logistics, infrastructure…)

Chapter 4

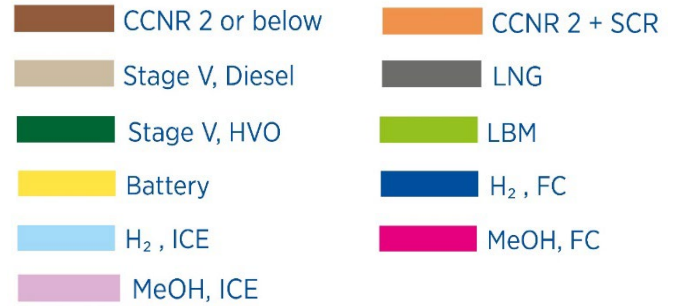
Transition pathways for IWT by 2035 and 2050

- Technologies considered in the roadmap, in addition to conventional diesel engines
  - Focus on a set of technologies with a **technology readiness level (TRL) of 5**

Fossil fuels	Stage V, Diesel	Fossil diesel in an internal combustion engine which complies with the emission limits EU Stage V.
Fossil fuels	LNG	Liquefied Natural Gas in an internal combustion engine which complies with the emission limits EU Stage V.
Biofuels	Stage V, HVO	HVO in an internal combustion engine which complies with the emission limits EU Stage V. HVO stands for hydrotreated vegetable oil itself (without blending with fossil fuels) and all comparable drop-in biofuels (including e-fuels) as well as synthetic diesel made with captured CO_2 and sustainable electric power.
Biofuels	LBM	Liquefied Bio Methane (or bio-LNG) in an internal combustion engine which complies with the emission limits EU Stage V.
Battery	Battery	Battery electric propulsion systems, with fixed or exchangeable battery systems.
Hydrogen	H_2, FC	Hydrogen stored in liquid or gaseous form and used in fuel cells.
Hydrogen	H_2, ICE	Hydrogen stored in liquid or gaseous form and used in internal combustion engines.
Methanol	MeOH, FC	Methanol used in fuel cells.
Methanol	MeOH, ICE	Methanol used in internal combustion engines.

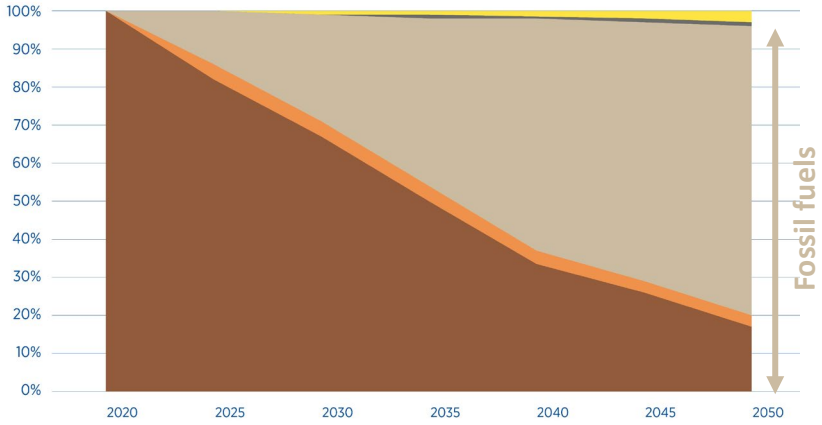
Chapter 4

Transition pathways for IWT by 2035 and 2050



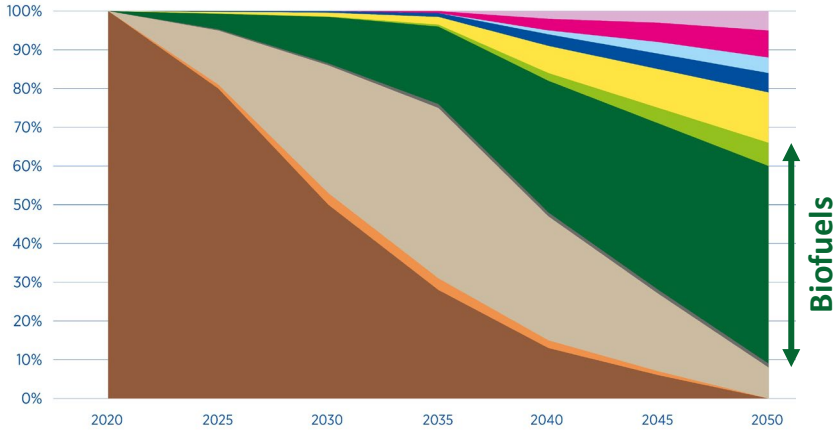
Development of fuel share (in %) within the fleet (new and existing vessels) towards 2050…

… in the “business-as-usual” scenario



GHG: -22% by 2050
NOx: -76% by 2050
PM: -83% by 2050

… on the “conservative” pathway



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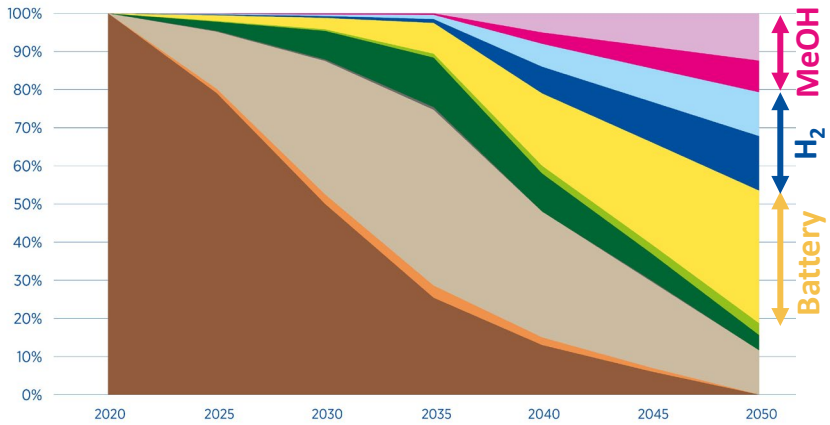
… on the “innovative” pathway



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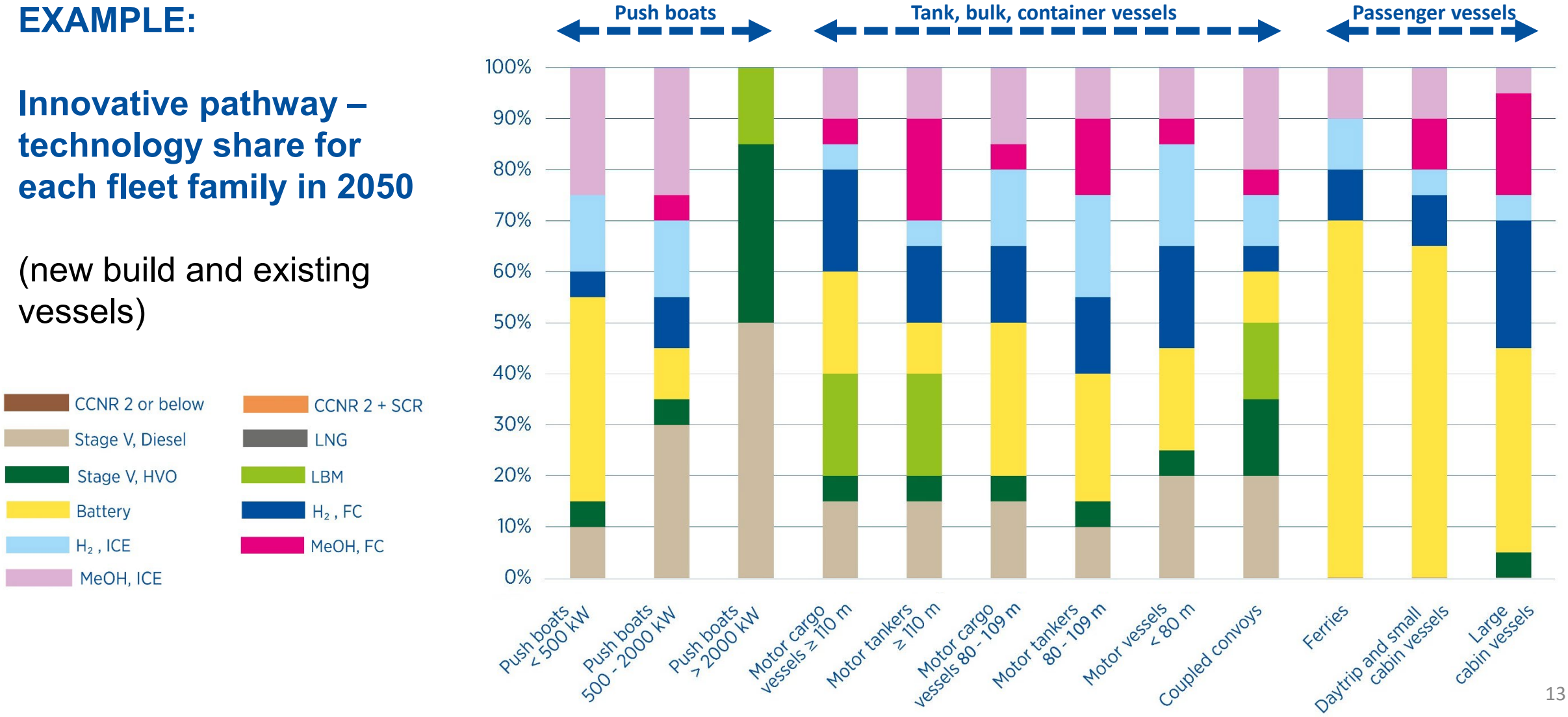
Chapter 4

Transition pathways for IWT by 2035 and 2050

EXAMPLE:

Innovative pathway – technology share for each fleet family in 2050

(new build and existing vessels)



Chapter 4

Transition pathways for IWT by 2035 and 2050

The financial challenge and related investments

An important financial gap to be bridged to realise this transition

- **Conservative pathway**
- Total accumulated TCO (30 years) gap: €2.65 bn in the average price scenario

- **Innovative pathway**
- Total accumulated TCO (30 years) gap: €7.80 bn in the average price scenario

- For both pathways, **higher financial gap from 2030-2035 onwards**: expected date for larger deployment of more expensive zero emission technologies.

- What does it mean? **Highest amount of money to be disbursed from 2030-2035 onwards**.

Chapter 5
Implementation plan

- Economic, technical, social and regulatory aspects to be tackled
- **A list of possible measures to enable the transition** (to be adopted directly or not by the CCNR)
- **Three types: legal requirements, voluntary measures and financial measures**

A FEW EXAMPLES:

Legal requirements
R1a: Appropriate regulatory framework for the use of alternative fuels and batteries (vessel construction)

Voluntary measures
V1: Label for environmental and climate protection

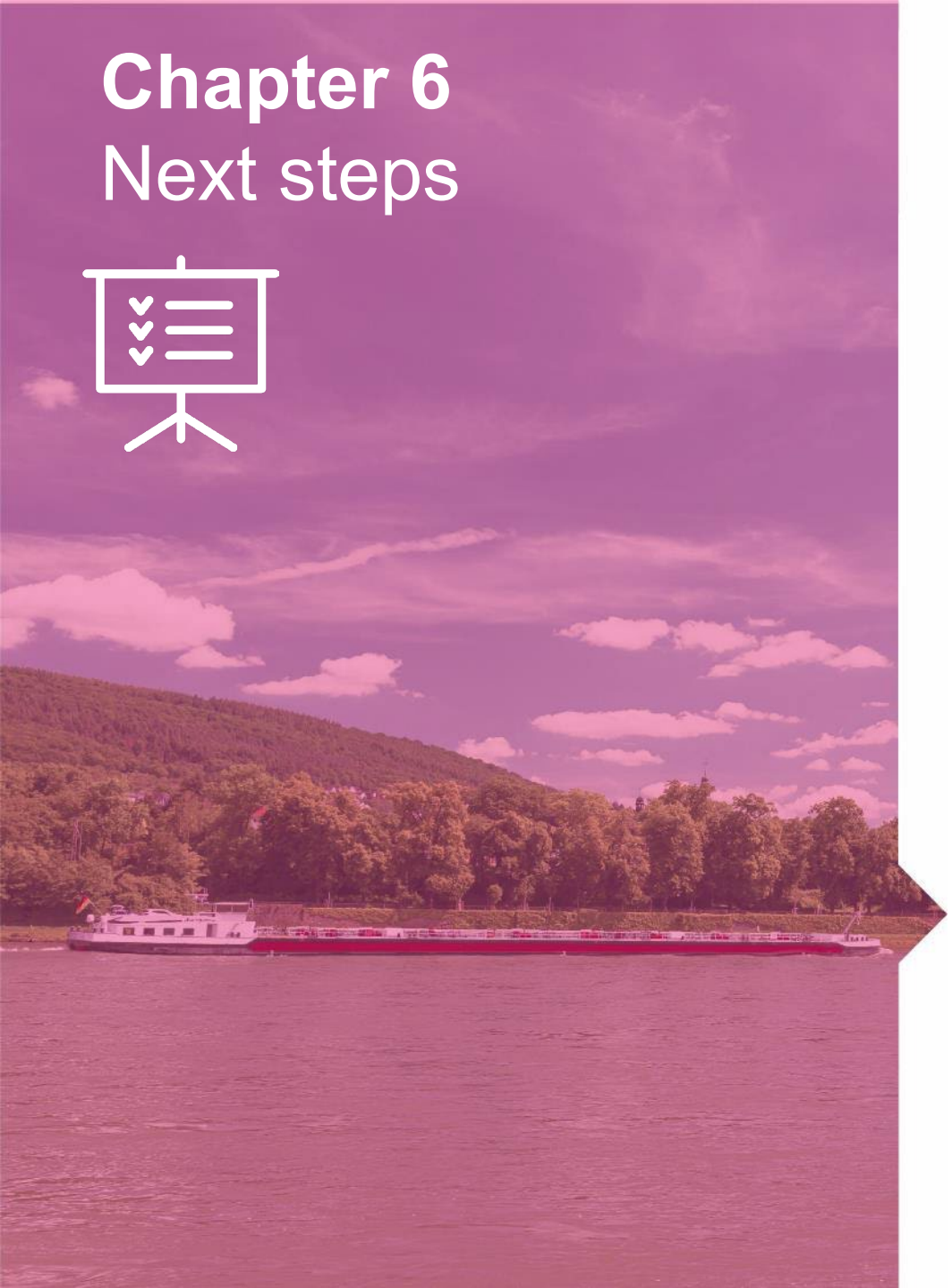
Financial measures
F1: Examination of European funding and financing instrument to support the inland navigation energy transition

Chapter 5
Why regulations?

- Legal certainty strongly influences the investment in new technologies (reduces the risks for shipowners who invest)
- Stimulate a structuration of the market
- Reduce the cost of ownership (initial investment and operational costs)
- Ease the acceptance of new technologies by limiting safety or environmental issues



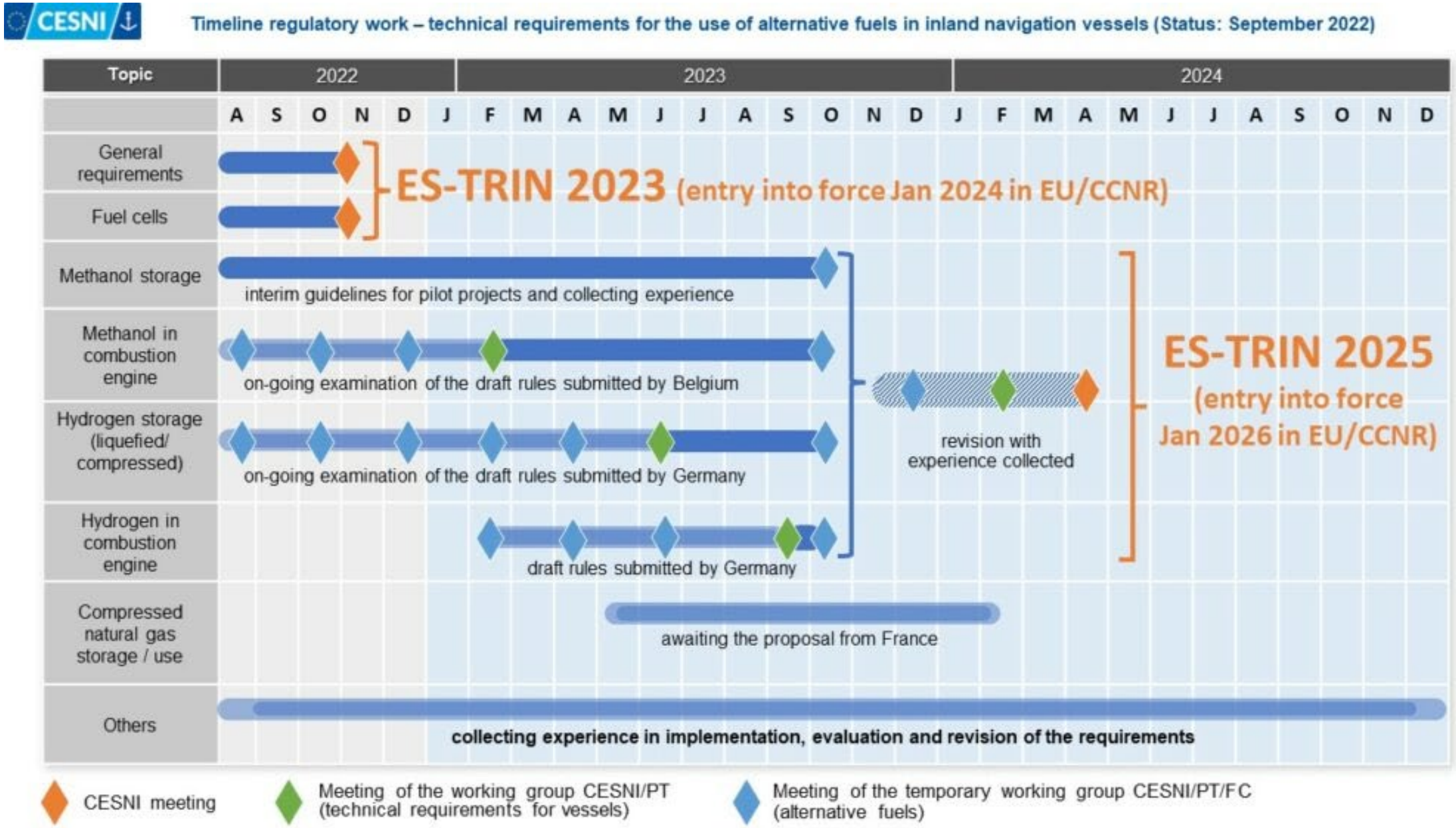
Chapter 6
Next steps

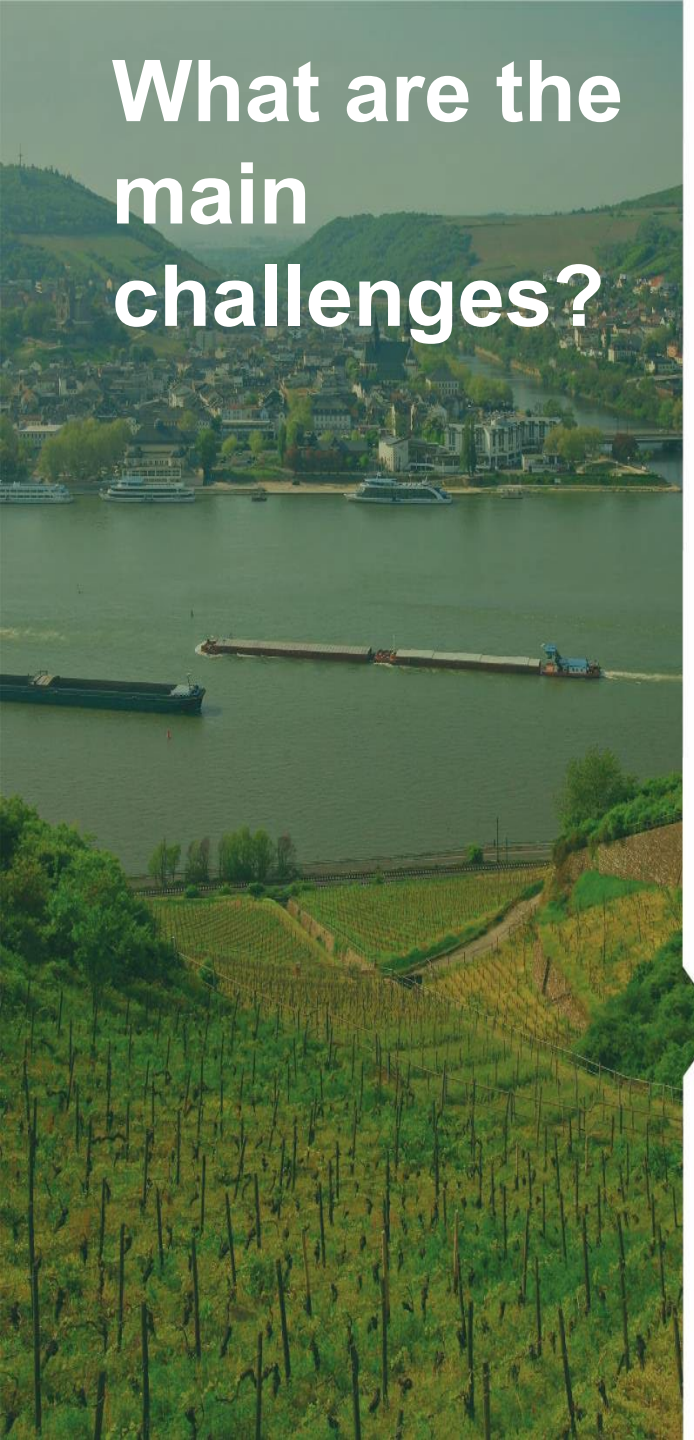


The CCNR undertakes to:

- report by **2025** on the progress in the implementation as well as the need to update the roadmap,
- at the latest in **2025,** evaluate whether it is opportune to revise the “CCNR’s study”, especially on the economic and technical evaluation of the technologies,
- evaluate by **2025** whether it is opportune to extend the scope of the roadmap, for example to other greenhouse gases such as N2O, or to emissions associated with other aspects of the vessel’s life-cycle, the manufacturing and disposal of propulsion systems, other types of vessel, or even the technologies’ safety,
- review the TTW approach in a forthcoming revision of its roadmap,
- revise, if necessary, by **2030** the roadmap and the corresponding action plan.

Timeline regulatory work ES-TRIN





What are the main challenges?

Many challenges lie ahead

FINANCIAL

1 - important financial gap

2 - lack of incentives to trigger investment decision on the side of individual vessel owner

3 - lack of certainty that the investment made will be future proof.

COMMERCIAL

4 - lack of certainty regarding the demand for low/zero emission vessels.

TECHNOLOGICAL

Lack of certainty regarding

5 - the technologies which are the most adapted to my vessel

6 - the availability of alternative fuel infrastructure

7 - the availability of fuels (quantity and sustainable origin)

THANK YOU
very much for your attention!

Any questions?
For more information, check out our website:
www.roadmap.ccr-zkr.org

KEMPMANN Kai, k.kempmann@ccr-zkr.org

CCNR
CENTRAL COMMISSION
FOR THE NAVIGATION OF THE RHINE

Advantages
of inland navigation

» Inland navigation is **sustainable.** Like rail, the share of GHG emissions in Europe due to inland navigation is the lowest (0,5%) compared to the total amount of GHG caused by transportation.

» Inland navigation is **energy efficient.**

Large Rhine vessel
Length 110 m
Width 11.40 m
Draught 3.00 m
Cargo capacity 2,750 t

Large container vessel
Length 135 m
Width 17 m
Draught 3.50 m
Cargo capacity 500 TEU

» Urban areas can be easily accessible by IWT, thereby contributing to **reducing congestion.**

» Potential for further **massification** of cargo flows.

» Inland navigation is a **safe** mode of transport.

» European and Rhine waterways dispose of **free capacity**, offering modal shift potential.

» An international, interconnected and **dense network** of navigable waterways in Europe.

» An essential link in the logistic chains to **transport large cargo volumes** such as grain, coal and oil.

Chapter 1
Initial situation

- Pilot projects are of **utmost importance** to:
  - gain knowledge of new technologies
  - addressing **economic, financial, technical and regulatory obstacles** to their deployment

Push boat with Hydrogen Fuel Cell and batteries (Elektra)

Passenger vessel with batteries (Ducasse sur Seine)

Retrofit of 1931 passenger vessel with batteries (MNE Ceresio)

Vessel with exchangeable battery containers for propulsion

Port of Antwerp – European Fastwater (tugboat conversion to diesel-methanol propulsion)

Chapter 2

Role of the CCNR and purpose of the roadmap

- The objective is to **reduce Rhine and inland navigation emissions** by:
  - setting transition pathways for the fleet (new and existing vessels),
  - suggesting, planning, and implementing measures,
  - monitoring goals set by the Mannheim Declaration.
- Develop a **shared vision of the energy transition** and associated challenges **within the inland navigation sector**.
- Could serve to **coordinate decisions at the political and European level**.

Chapter 3

Definitions, targets, estimation of emissions

A **tank-to-wake (TTW)** approach is used in the roadmap:

- In accordance with scientific methodologies and those used in regulatory frameworks
- Allows consideration of the potential of carbon neutrality of certain fuels
- Implies making assumptions concerning the upstream chains
  - Emissions produced simplified and fuel availability idealised for all technologies
  - Requires the origin of biofuels to be traceable and sustainable

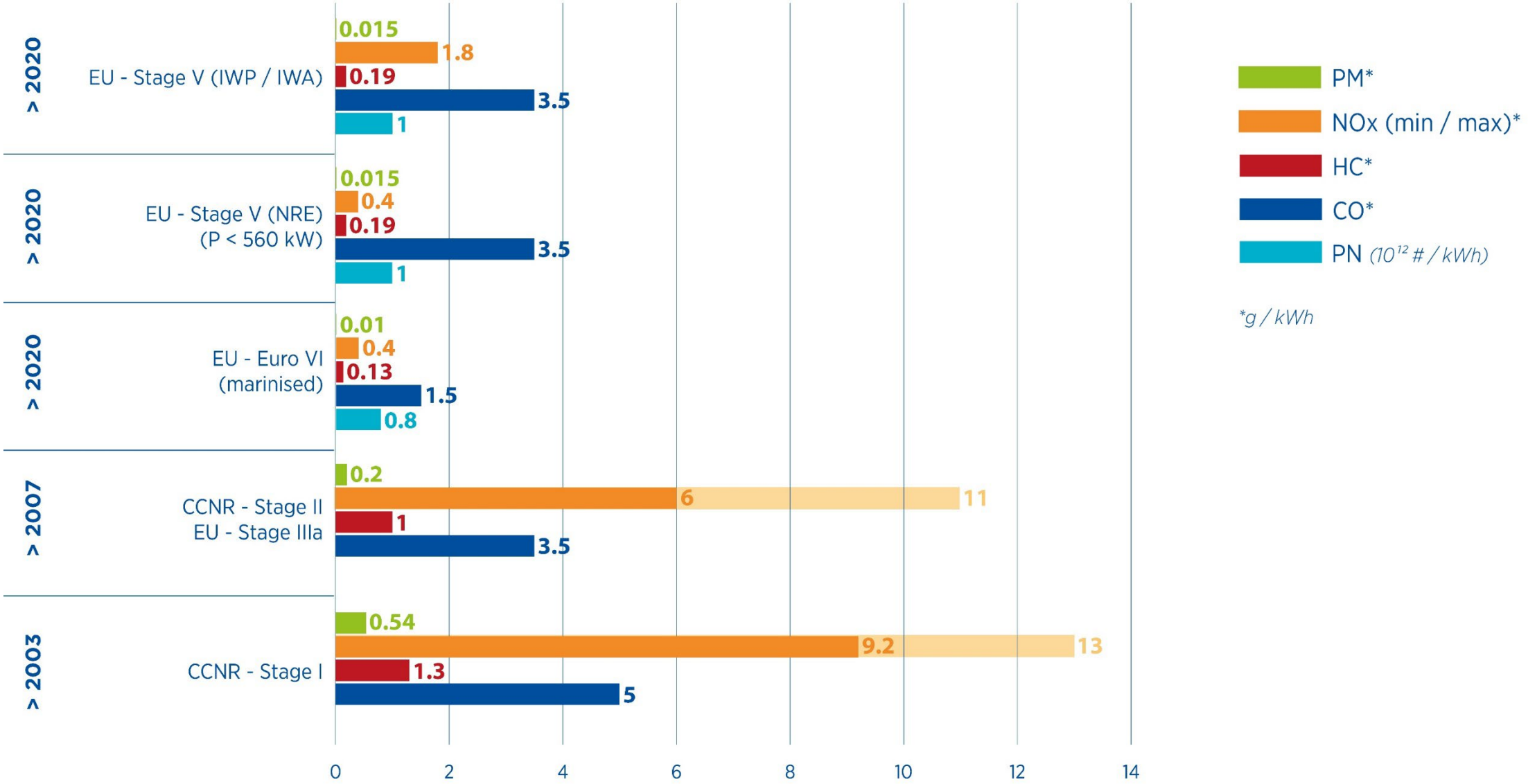
There are several reasons for choosing a simplified approach.

The CCNR acknowledges that this TTW approach may be deemed a simplification and that it implies limitations and possible inaccuracies.

However, the CCNR considers it as a first step and commits to reviewing this approach at a later stage.

Chapter 4

Emission limits for IWT engines (Power > 300 kW)



Chapter 4

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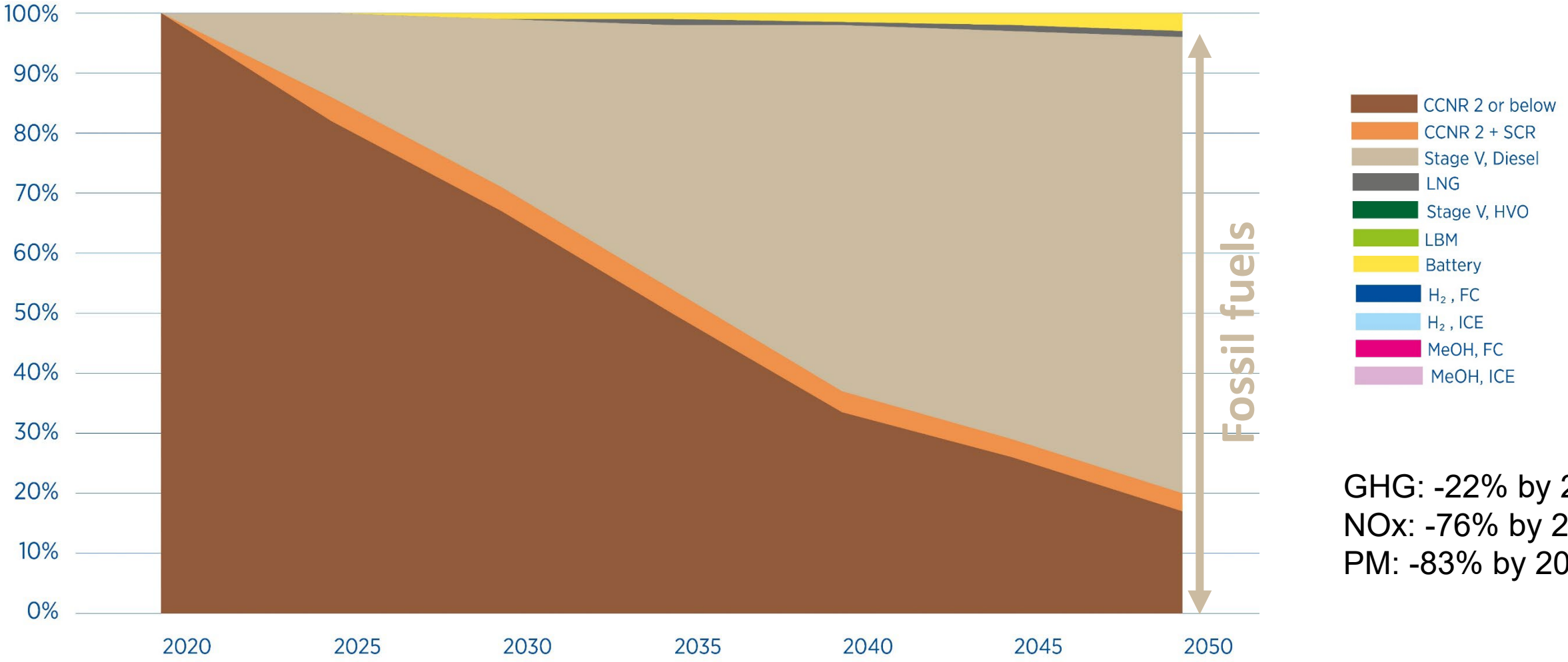

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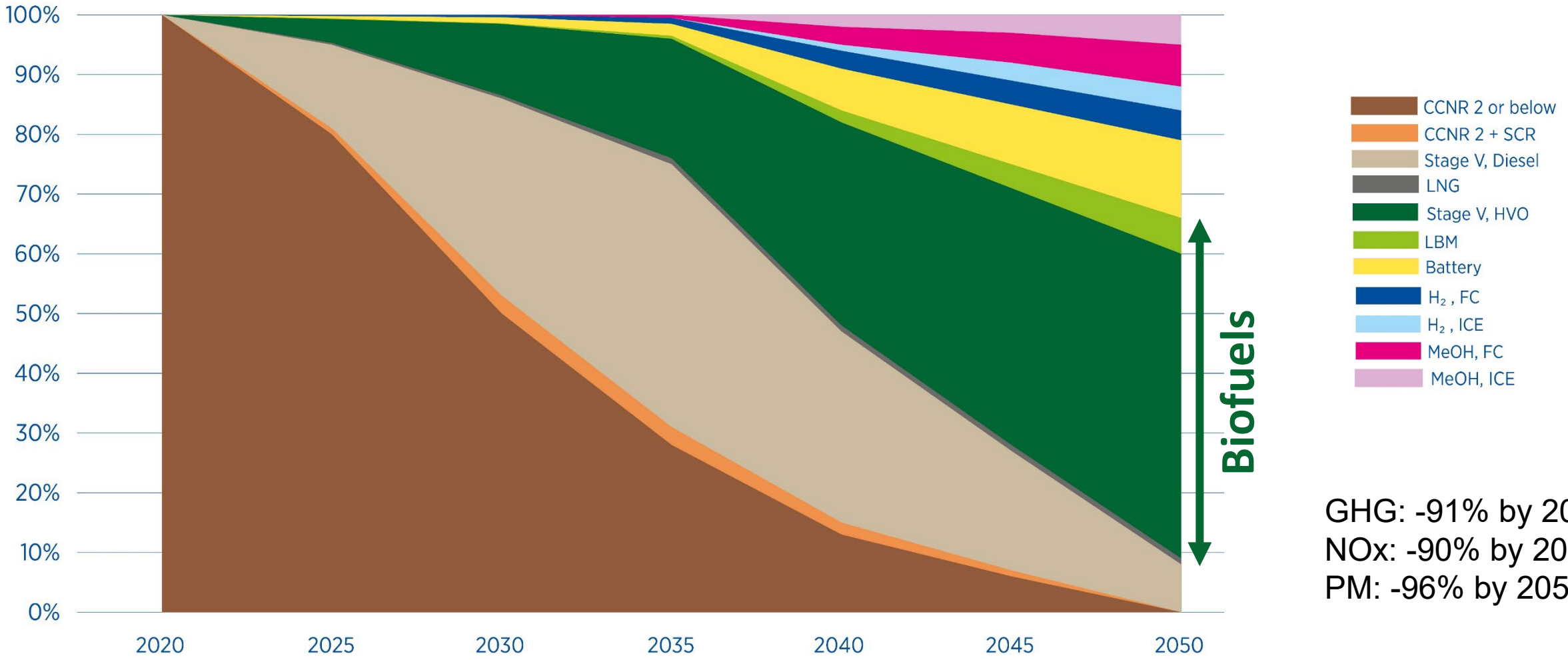
Development of fuel share (in %) within the fleet (new and existing vessels) towards 2050 on the “conservative” pathway



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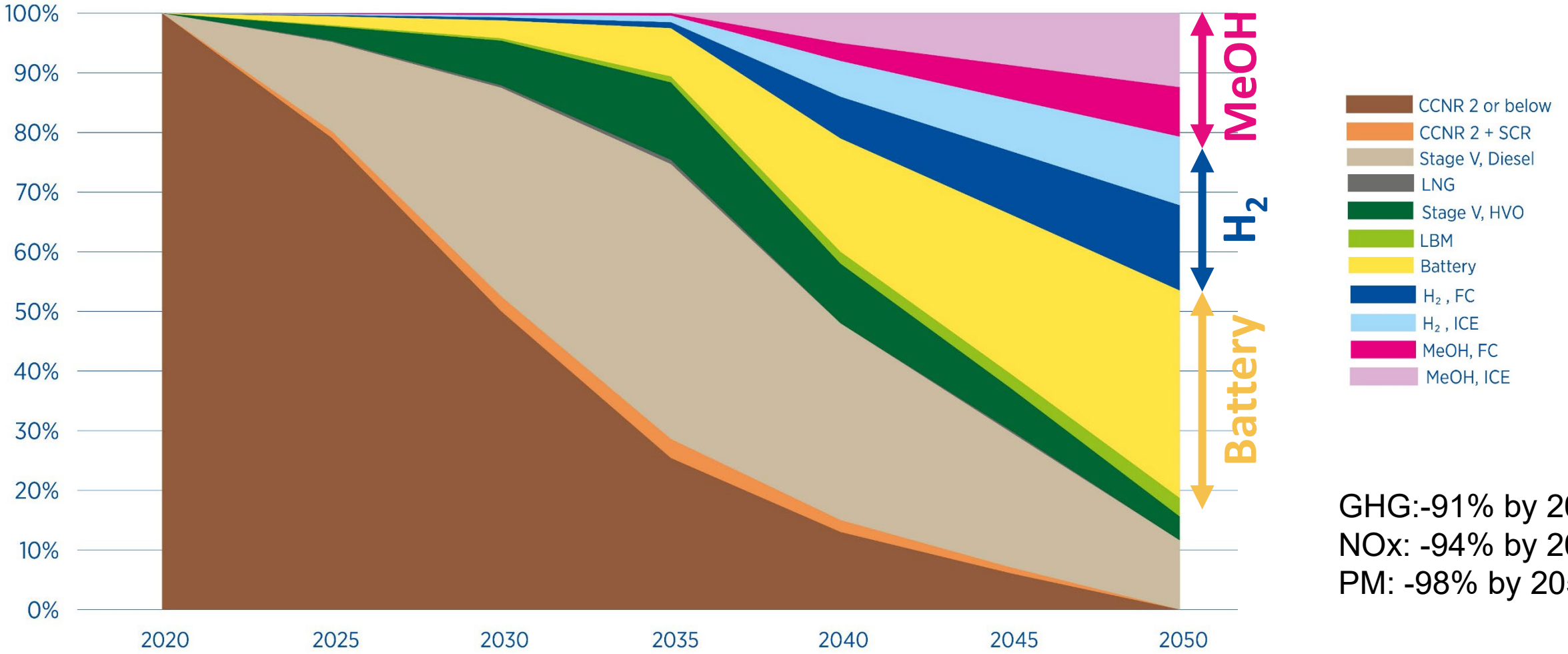

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Chapter 4

The financial challenges and related investments

How to financially support the energy transition?

A considerable financial gap to be bridged (several billions)!

- The profession is able to bear only a part of the costs
- Limited incentive for vessel owners to invest in greening
- Significant grants needed to close the gap and make the pathways economically viable
- No business case = no access to loans

A European instrument for the energy transition of IWT could play an important role!

- Open to all European countries (EU countries as well as Rhine and Danube riparian states not members of the EU)
- Easy access and administrative simplicity
- Economic, technical, legal and practical feasibility questions to be addressed by competent organisations

Chapter 4
Transition pathways for IWT by 2035 and 2050

Can “no-regret investments” be identified in the inland waterway transport sector’s energy transition?

Ferries and day-trip vessels
Vessels operating locally (especially, in densely populated areas) with a limited energy demand.

→ Investment in ELECTRIC DRIVETRAINS WITH BATTERIES

Large push boats will use internal combustion engines (ICE). Carbon footprint reduced by using drop-in fuels (HVO, LBM) and after-treatment systems.

→ Investment in CLEAN & EFFICIENT ICE (according to the latest emissions standards)
ENERGY EFFICIENCY MEASURES

New or retrofitted ships, only if the operational profile is suitable.

→ Investment in ELECTRIC DRIVETRAINS (modular approach)

NO-REGRET INVESTMENT