CLINSH

SUSTAINABLE WATERWAY TRANSPORT, CLEAN AIR

Financing the CLINSH scenario

Deliverable D2.3

CLEAN INLAND SHIPPING

WWW.CLINSH.EU

Project:	CLINSH – Clean Inland Shipping
Goal:	The objective of LIFE CLINSH is to improve air quality in urban areas situated close to ports and inland waterways, by accelerating IWT emission reductions.
Project reference:	LIFE15 ENV/NL/000217
Duration:	2016 – 2021
Project website:	www.clinsh.eu

CLINSH is an EC LIFE+ project delivered with the contribution of the LIFE financial instrument of the European Community. Project number LIFE15 ENV/NL/000217

This deliverable is part of Task D2.3.

Contributors:
Salar Mahfoozi, Cindy Kosseda, Martijn de Vries (New Energy Coalition)

Version: Final Version

Date: 23/11/2021

Abbreviation	Meaning
BAU	Business as Usual
CBA	Cost Benefits Analyses
CCNR	Central Commission for the Navigation of the Rhine
CCR0/CCR1/CCR2 also known as CCNR0/CCNR1/CCNR2	Emission standards for inland waterway vessels
CLINSH	Clean Inland Shipping project under LIFE+ programme
DPF	Diesel particulate filter, to reduce particulate emissions
ETS	Emission Trading System
FWE	Fuel water emulsion
GTL	Gas-to-Liquids, a synthetic diesel oil made from natural gas
HVO	Hydrotreated Vegetable Oil
IWT	Inland waterway transport
LNG	Liquefied Natural Gas
NOx	Collective term for mono-nitrogen oxides (NO, NO_2 and NO_3), emissions of which lead to smog formation, environmental acidification and respiratory damage
NPV	Net Present Value
PM	Particulate matter
$PM_{2.5}$	Particulate Matter smaller than 2.5 micro-meter
ppm	Parts per million
SCR	Selective Catalytic Reduction, an exhaust gas treatment system to reduce NO_x emissions.
Stage V	Updated European emission standards for non-road mobile machinery (NRMM), such as construction equipment, railroad engines, inland waterway vessels, and off-road recreational vehicles. (Regulation: (EU) 2016/1628)
TCO	Total Cost of Ownership
ZE	Zero-emission

Table of content

1. Objectives of Action D2 / Task D2.3

Introduction

There is about 37,000 km of inland waterways in Europe and these waterways maintain 6.0% of total inland freight transport in the EU (European Commission, 2020). Among the EU-27, the Netherlands has the highest share of inland waterway transport which consisted of 43.2% of inland freight transport in 2018 (Eurostat, 2020) which translates to 5010 self-propelled vessels maintaining this share for the aforementioned year (European Commission, 2020).

Research into emissions from shipping and the likely wider impact on air quality and climate change has been mainly directed at sea-going ships (Bond, et al., 2013) (Eyring, et al., 2010). This impact relates to gaseous emissions of CO_2, SO_2 and NO_X, and particulate matter (PM) consisting of elemental and organic carbon, sulphates and ash (Petzold, et al., 2008) (Moldanová, et al., 2009). Less research has been conducted into emissions from inland waterways, probably because their contribution to total shipping emissions is limited. However, inland shipping emissions may be significant for air quality and the related health impacts for people living nearby. This is particularly relevant in the Netherlands where more than 40% of goods are transported over inland waterways.

Inland waterway transport (IWT) is efficient because it's CO_2 emissions per ton-kilometers over water is lower than those for land transport by a factor of six (European Commission, 2012). However, PM emission factors per kWh from inland ships are considerably higher than diesel truck engines due to less stringent emission standards for inland ships. For the Netherlands, it has been estimated that PM emissions per ton-kilometer from water transport are typically five times higher than from road transport (Hulskotte & Denier van der Gon, 2010).

The environmental problem targeted in the CLINSH project is air pollution by NO_2 and PM_{10}/$PM_{2.5}$ caused by the emissions of the IWT sector. Awareness grows that inland shipping disproportionately contributes to the concentrations of NO_X, and particulate matter. It does not only contribute to the large-scale background concentrations, but also strongly affects the air quality of the areas along inland waterways and nearby inland ports. Especially in the bigger ports, the emission of NO_X by inland navigation reaches up to 25% of the total NO_X emission. Many inland ports are situated in, or close to cities, thereby directly affecting the air quality of populated areas. Because emissions at low height are concerned, the effect on the direct surroundings is relatively high. Emission legislation has only been implemented since 2002, and emission levels for new engines are significantly less strict than those for road transport. The IWT sector has thus been underexposed in EU legislation. This, combined with long-term lifetime of ship engines, results in a lower environmental performance of the inland navigation sector.

In order to address this issue at a fundamental level and take palpable measures to immediately reduce the effect of these emissions in urban and rural areas the CLINSH project has been contracted. The main objective of CLINSH is to improve air quality in urban areas by accelerating emission reduction from Inland Waterway Transport (IWT). CLINSH will demonstrate the environmental impact of emission reduction technologies, in order to facilitate the implementation and enforcement of EU policy and legislation on air quality.

Air pollution abatement requires measures paid by the entities responsible for causing the pollution whilst the benefits (air quality and health) are gained by the community. Thus, ship-owners are not willing to invest if there is no return on investment. A level playing field is needed for ship-owners, port authorities and skippers in which payback of investments for emission reduction is viable.

Description and methods employed under Task D2.3
The main goal of this report is to provide recommendations for effective and easily accessible financing mechanisms for greening the IWT fleet. Via this action, CLINSH will highlight these financing mechanisms in order to provide stakeholders and in particular policy makers with a guidance for decision making. This translates to adopting the recommendations provided by this report and making sure that the industry can make use of available resources and funding schemes that will allow the stakeholders to take advantages of new emission reductions schemes.

This report will make use of several resources in order to make sense of financial inland waterway transition challenges in North-western Europe, in particular the Netherlands, Belgium, Germany, France and Switzerland. These include results from reports D2.4 (Fleet Scenarios) and C.1 (Socio-Economic study) of studies undertaken by CE Delft which provide the actual costs and TCO's (total cost of ownership) for a greener fleet and several reports by the Central Commission for the Navigation of the Rhine (Reports A, C, D, E, F, I and final report) focusing on the financial aspects of greening the IWT fleet toward a zero-emission pathway by 2050.

2. The Baseline and CLINSH Scenario

In order to be able to make recommendations regarding financing instruments with which emission reduction in inland shipping can be accelerated and achieved, it is important to have insight into the size of the investments in emission-reducing techniques towards 2035. To do this, two scenarios have been constructed in Task D2.4: a business-as-usual or **Baseline scenario** describing the development of the fleet without any policy measures, and the so-called **CLINSH scenario** where emission reduction measures are taken which result in the most optimal societal outcome.

Social costs and end user costs (Task C1)

Two types of perspectives come into play when considering the costs and benefits of emission reduction techniques: social costs perspectives and end-user costs perspectives. Social costs can be defined as the external costs from emissions associated with the various engine investment options or lack thereof. To be more specific: air pollution evaluations consider the following four types of impacts (leading to external costs) caused by the transport emissions: Health effects (e.g., bronchitis, asthma, lung cancer), crop losses, material building damage as well as biodiversity loss. The end user perspective considers which techniques lead to the lowest cost for ship-owners. This perspective shows the option most vessel owners will opt for in the absence of policies to promote cleaner technologies.

These fleet scenarios have been used in other actions/tasks to quantify the effect on emission and air quality. Below, these scenarios are further explained and elaborated in relation to the financing requirements for implementing emission-reducing measures in the inland shipping sector.

2.1 Description of the Baseline and CLINSH scenarios

Baseline scenario

The Baseline fleet scenario is a scenario without new policies to increase adoption of emission reducing technologies in the IWT sector. In other words: the scenario in which the current way of reducing emissions from the IWT sector would continue without additional measures. However, the Baseline scenario needs to be determined and clarified in order to understand the current status quo and future projections for the development of the sector. This was done by identifying:

1. The number of vessels, the type of vessels, and the number and type of engines used by these vessels.
2. The lifetimes of engines; this allows for predicting engine replacement dates.
3. Introduction of market forces: increases or decreases in certain product types (e.g., dry cargo such as coal, sand, stone and liquid cargo such as petroleum products,

fertilizer etc.) will change the demand for certain types of vessels and the development of transport volumes

Results from deliverable D2.4 indicate that by 2035 a total number of 6,694 vessels will be roaming the waterways. 4,994 vessels will still be using unregulated CCR0/CCR1/CCR2 engines[1] under the Baseline scenario (

Number of vessels	CCR0	CCR1	CCR2	Stage V	LNG mono fuel	SCR	SCR+DPF	Diesel electric	GTL	Sum
Baseline 2020	2838	1608	2211	0	19	0	100	0	0	6776
Baseline 2035	1429	1263	2302	1579	19	0	103	0	0	6694
CLINSH 2035	0	0	0	5815	19	110	103	0	646	6694

Table 1). Only 1,579 vessels will “autonomously” have switched to the environmentally beneficial and efficient Stage V type engines, because the old engines were at the end of their lifetime. Based on these totals, a considerable number of the IWT fleet will still be running on engines that are detrimental to air quality and the environment.

For the CLINSH scenario the same number of vessels are part of the fleet, however Stage V engines constitute a strong share of the fleet (more on this later in the report).

Number of vessels	CCR0	CCR1	CCR2	Stage V	LNG mono fuel	SCR	SCR+DPF	Diesel electric	GTL	Sum
Baseline 2020	2838	1608	2211	0	19	0	100	0	0	6776
Baseline 2035	1429	1263	2302	1579	19	0	103	0	0	6694
CLINSH 2035	0	0	0	5815	19	110	103	0	646	6694

Table 1: Number of vessels per technique for all vessel types in 2020 and 2035 for the Baseline and CLINSH scenario (Source: CLINSH Deliverable D2.4 (Scholten & Otten, Fleet Scenarios CLINSH - Deliverable D2.4, 2021))

CLINSH scenario

The CLINSH scenario focuses on applying NO_x and PM_{10} reducing measures up to 2035 to the part of the inland waterway fleet that will not voluntarily renew their engines between 2020 and 2035. Different types of emission reduction techniques and fuels were assessed for determining the CLINSH scenario. Highlights of each technology are listed below:

[1] For more detailed information refer to Deliverable D2.4.

- LNG (mono and dual fuel)
    - Mono: LNG used for engine ignition and running the engine.
    - Dual: Diesel used for engine ignition; LNG used for running the engine.
    - Lower fuel costs, lower port duties compared to diesel-powered engines.
    - Installation costs: €1,000/kW.
- After-treatment components (SCR/DPF)
    - Selective Catalytic Reduction mainly used for NO_x reduction (by conversion of NO_x to water and nitrogen).
    - Diesel Particulate Filter used to trap PM from the exhaust.
    - SCR is possible on all engines but SCR+DPF is only viable on CCR2 engines.
    - Urea/AdBlue is needed for SCR.
    - Results in an additional fuel use of 2%.
    - Costs of installation are between 125 – 185€/kW.
- Fuel water emulsion (FWE)
    - Emulsification of water and fuel before engine injection.
    - PM and NO_X are reduced.
    - Investment costs range between 70 – 135 €/kW depending on the engine size.
    - Reduction of fuel consumption (2 – 5%).
- Gas to Liquids (GTL)
    - Sulphur free.
    - Lower emissions of CO, NO_X, PM etc. compared to conventional petroleum products.
    - Higher fuel costs of €70/ton.
    - Does not require additional investments before use.
- Diesel electric/Battery electric (in combination with right sizing of engine)
    - Utilizes electric motor driven propellor(s) with the electric motor used for low-speed sailing.
    - €900/kW installation costs – additional costs for revision (€70/kW after 6 years).
    - In pilot phase – only used for the sake of comparison with other emission reduction techniques.
- Stage V/marinized Euro VI diesel engines (See Figure 1)
    - Integrated with SCR and DPF.
    - Lower emissions of NO_X and PM compared to regular engines.
    - Full fixed costs for installation €350/kW.
    - Euro VI engines have been certified as meeting Stage V emission limits.

Air pollutants can be avoided to a large extent with combustion engines and modern aftertreatment systems. Referring back to

Number of vessels	**CCR0**	**CCR1**	**CCR2**	**Stage V**	**LNG mono fuel**	**SCR**	**SCR+DPF**	**Diesel electric**	**GTL**	**Sum**

Baseline 2020	2838	1608	2211	0	19	0	100	0	0	6776
Baseline 2035	1429	1263	2302	1579	19	0	103	0	0	6694
CLINSH 2035	0	0	0	5815	19	110	103	0	646	6694

Table 1 we saw that in the CLINSH scenario the most adopted technology is Stage V engines followed by GTL, SCR, SCR+DPF and LNG technologies. Stage V engines are suitable for a large group of the various fleet categories because these engines emit 79% less NO_X and 97% less PM compared to estimated emissions of the European IWT fleet in 2015[2] (DST, 2020). Given the uncertainties of future emission regulations an engine lifetime of 15 years is assumed for these newly updated engines, although actual lifetimes of engines and reduction techniques can be longer. The situation after 2035 is much more uncertain, and options for emission reduction might include new technologies, such as battery-electric and hydrogen fuelled engines.

Figure 1: Upside view of a Paccar Stage V/Euro VI engine with 390 kW/530ps power output

In the CLINSH scenario, vessels autonomously switching to Stage V technologies in the Baseline scenario are also switching to Stage V in the CLINSH scenario. For the remaining 4,236[3] vessels that are still sailing on traditional engines identified in the Baseline scenario (CCR2 and older) it was assumed that these ships will switch to options that results in the lowest social costs based on the fleet type.

[2] Refer to
Annex Table 5 for estimated emission values.

[3] 5,815 (All Stage V engines) – 1,579 (Autonomous switch to Stage V) = 4,236.

It is important to add that the technologies monitored in CLINSH focus on the reduction of NO_X and PM_{10} emissions and not (so much) on the reduction of CO_2 emissions. However, since the Paris agreement, the EU Green Deal, the Mannheim declaration and the Fit for 55 package, CO_2 reduction in IWT has become an even more important goal. Technologies such as battery electric engines, hydrogen-fuelled engines (either fuel cells or combustion engines) and biofuels are getting more and more attention. Biofuels however do not have a significant impact on emission reduction of air pollutants. Battery electric and hydrogen-fuelled vessels on the other hand have no combustion emissions at all, or much lower emissions in the case of H_2 used in a combustion engine. ZE technologies are currently at the phase where initial pilots are being designed and policy ambitions are formulated. Up to 2035, therefore, zero-emission technologies are expected to play a limited role and will only be used for specific short-distance trips (Scholten & Otten, Socio-economic study of the CLINSH project - Deliverable C1 , 2021).

Classification by vessel types and power ratings

Since variations exist between the vessel types and their operational profiles, different technologies can be beneficial for different fleet types. The ship categories consist of various vessel types with classifications based on power-ratings or ship lengths:

1. Passenger vessels
    a. <250 kW
    b. 250 – 500 kW
    c. 500 – 1000 kW
    d. >1000 kW
2. Push boats
    a. <500 kW
    b. 500 – 2000 kW
    c. Push boats > 2000 kW
3. Motor vessels
    a. <80 m. length
    b. dry cargo typical 80 and 86 m ship
    c. dry cargo 110 m ship
    d. dry cargo > 130 (135m ship)
    e. liquid cargo 80 – 109m length
    f. liquid cargo 110m length
    g. liquid cargo >130 (135m ship)
4. Coupled convoys
5. Ferry
6. Tugboat and workboat

2.2 The financial consequences of the Baseline and CLINSH scenarios (required investments and TCO)

Figure 2 below shows the results of NPV (Net Present Value) calculations for a dry cargo 110m vessel with a 15-year timeframe. The most expensive option from a social perspective cost is revision of CCR0 engines, while a Stage V engine is the least expensive option. However, from a vessel owner point of view, revision of the current engine is the least expensive option, while the social costs of revision are among the highest.

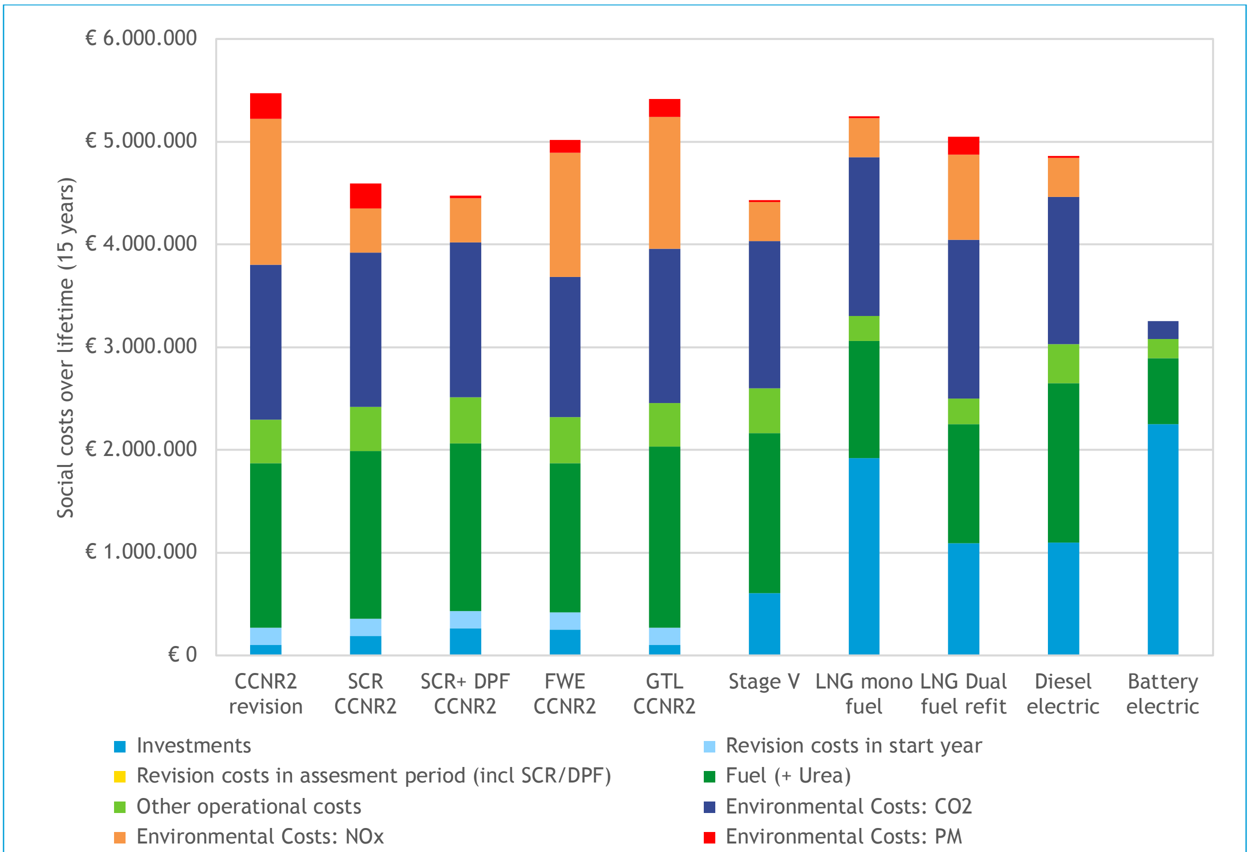


Figure 2: NPV calculation for a 110-meter dry cargo vessel based on societal costs for the various cost elements – 15-year timeframe – normal fuel use (Source: (Scholten & Otten, Fleet Scenarios CLINSH - Deliverable D2.4, 2021)).

The costs can be broken down to investment costs (CAPEX) and the operational costs (OPEX) which consists of fuel consumption and maintenance costs. Various environmental costs for NO_X, PM and CO_2 are shown for each technology, the discernable portion of these costs is clearly significant for a vessel utilizing lower optimal measures as opposed to a Stage V technology.

From an end user perspective, we can see differences in costs between the various technologies. All technologies have an operational expenditure in the range of 2 — 4 million euros depending on the emission reduction technology. LNG, Stage V and Diesel-electric are technologies with a high level of initial investment.

What can be seen is that the options with the lowest end-user cost (e.g., revision, FWE, GTL and SCR) do not result in optimal social cost benefits. Stage V engines are the most prominent and have the lowest social costs but require significantly higher investments compared to revision. Based on this cost fact, ship owners would naturally opt for engine revision due to its low investment costs. This reality amplifies the need for policy intervention in order to encourage ship owners to opt for better solutions. Implementation of battery electric propulsion systems are not within the scope of CLINSH but are added as an ideal point of comparison.

Stage V engines are expected to result in lower fuel expenses than CCR2 engines; however, urea/Adblue is needed as a supplement. Therefore, the OPEX of a revised CCR2 engine and a Stage V engine is expected to be at the same level (CCNR, 2021) and the differences are slight. This claim is also established in Figure 2 with a minor cost advantage for Stage V engines. In essence it's the fluctuation of prices in fuel and urea that will impact the operational costs for a Stage V engine however generally they result in slightly lower operational costs compared to revised CCR2 engines.

Table 2 depicts various environmental/financial categories costs for the baseline and CLINSH scenarios. These are divided into social costs, initial investment costs, total costs of ownership (TCO), and CO_2/NO_X/PM costs representing the environmental costs involved with emitting these pollutants within a 15-year lifetime.

Table 2: Comparison of Baseline Vs. CLINSH scenario net costs per various categories in M€ (Source: (Scholten & Otten, Fleet Scenarios CLINSH - Deliverable D2.4, 2021) (Scholten & Otten, Fleet Scenarios CLINSH - Deliverable D2.4, 2021))

Values for 2035	**Baseline scenario 2020 - 2035**	**CLINSH scenario in 2035**	**Difference**
Number of vessels	6,776 (2020) → 6,572[4] (2035)	6,776 (2020) → 6,572	-

Number of vessels	**CCR0**	**CCR1**	**CCR2**	**Stage V**	**LNG mono fuel**	**SCR**	**SCR+DPF**	**Diesel electric**	**GTL**	**Sum**
Baseline 2020	2838	1608	2211	0	19	0	100	0	0	6776
Baseline 2035	1429	1263	2302	1579	19	0	103	0	0	6694
CLINSH 2035	0	0	0	5815	19	110	103	0	646	6694

[4] 6,572 is the number of vessels which will adopt emission reduction options (autonomous engine renewal as well as expedited adoption of options including engine renewal). The difference between 6,694 vessels mentioned in Table 1 and 6,572 in Table 2 is the LNG & SCR/DPF vessels (total of 122) that are currently sailing and will not switch to Stage V diesel, GTL and SCR (6,694 - 122 = 6,572).

Social costs with 15-years lifetime (M€)	**26,139**	**21,280**	**-4,859**
Initial investment costs (M€)	1,123	2,393	**1,270**
Total costs ownership with 15-years lifetime (M€)	10,751	11,512	**761**
CO_2 costs with 15-years lifetime (M€)	8,074	7,867	-207
NO_X costs with 15-years lifetime (M€)	6,051	1,788	-4,263
PM costs with 15-years lifetime (M€)	1,264	112	-1,151
Diesel consumed over 15 years (ML)	14,662	14,286	-376
TCO increase per litre of diesel (€/L)	0.733	0.806	**0.053**[5]

The total cost of ownership, or TCO, includes the purchase price of a particular asset plus operating costs over the asset's lifespan (Twin, 2020).

TCO is an important criterion in assessing the adaptation of a propulsion technology because it reflects the capital and operational costs that a vessel owner needs to bear in order to adopt an environmentally friendlier form of propulsion. A larger differential in the TCO gap (the gap between what the ship owner can finance himself for the TCO and what he needs in total resources to cover the TCO) can lead to greater financial challenges for ship owners. In order to make real progress in the area of emission reduction in inland navigation, these gaps need to be covered as much as possible in the new funding mechanism (CCNR - EICB, 2021).

We can see that the imposed social costs under the Baseline scenario is a substantial ≈26.1B€ (billion euros) while under the CLINSH scenario this value is curbed to ≈21.3B€. The implementation of emission reduction technologies under the CLINSH scenario leads to an increased initial investment of ≈1.3B€ however this cost yields significant social benefits of ≈4.9 B€ mainly due to the effect of NO_X reduction. Looking at the **NO_X costs** we can see a solid **70% reduction** in this category under the CLINSH scenario and a **92% reduction** for **PM costs**. These reductions underscore the monumental effect that financial support can have for the IWT sector and for public health and safety.

The TCO for the CLINSH scenario is ≈11.5B€ while the baseline scenario entails ≈10.7B€ of costs. Closing this **761 M€ TCO difference** would need investment subsidies of usually 40-60% of the price difference between a cleaner product and the established product. However, even 60% may be too low for many capital-starved vessel owners to make such investments. The minimum tax on IWT diesel proposed in the Energy Tax Directive is € 0.9/GJ or 3.24 €cts/liter, whereas on average the TCO gap per liter is about 5.3 €cts. This means that if the revenue from IWT fuel could be earmarked for the greening of IWT, the

[5] Based on average of fuel use in Baseline and CLINSH scenarios.

TCO gap could be almost closed. It should be noted that the size of the TCO gap differs for various vessel categories.

Additional tables detailing total investment costs per vessel type (Annex Table 2) and total social costs (Annex Table 3) can be found in the annex.

Annex Table 4 provides a detailed overview of the TCO for all vessel groups under both the baseline and CLINSH scenarios.

2.3 The financing requirement from the sector in the Baseline and CLINSH scenarios

Based on the costs and financial information from Table 2 it is clear that a substantial amount of funding is needed for both the Baseline and CLINSH scenarios from the IWT sector. Initial investment costs for fulfilling the CLINSH scenario is 2.4 B€ for the period of 2020 – 2035 which is a very significant amount for the industry and vessel operators.

The financial gaps are mainly a result of the higher capital costs (i.e., CAPEX) for the implementation of pollutant reducing technologies. Many vessel operators see these costs as burdensome and are not willing to handle the financial burdens nor have the sufficient monetary means to do so and decide to opt for revision initiatives that lead to the highest social costs or leave their engines as is.

For comparison: TCO from CCNR studies
In 2020 and 2021, the Central Commission for the Navigation on the Rhine (CCNR) carried out an extensive study regarding the energy transition towards a zero-emission inland navigation sector. An assessment of financing and funding instruments for the fulfillment of zero-emission fleets by 2050 was carried in several studies (Research questions A, D, E and F). It is important to be mindful of the fact that the CCNR study aims to realize a fully zero-emission fleet by 2050 while the CLINSH project aims for a quick implementation of emission reduction techniques with a high TRL level for the 2022 – 2035 duration. However, this does not create a conflict of interest with CLINSH since the difficulty of implementing zero-emission propulsion techniques also apply to other technologies for the transition towards zero-emission, such as investing in a clean combustion engine in combination with using renewable fuels (CCNR, 2021).

Table 3: TCO for the two transition pathways of the development of zero-emission drivetrains compared to the BAU scenario in the CCNR studies (total of 30 years, 2020 – 2050).

BAU	Conservative Pathway	Innovative Pathway
€1.2 bln – minimum price scenario	€2.43 bln – minimum price scenario	€5.26 bln – minimum price scenario
	€2.67 bln – average price scenario	€7.8 bln – average price scenario
€1.5 bln – maximum price scenario	€6.38 bln – maximum price scenario	€10.19 bln – maximum price scenario

The findings in Table 3 show that there is a TCO gap related to the two transition pathways which are defined as conservative and innovative development scenarios in the CCNR studies. The TCO for the business-as-usual scenario is also included for comparison. The conservative pathway refers to a pathway in which mainly alternative fuels and technologies is considered which are relatively easy to implement and cost efficient at the short term. The innovative pathway takes a more innovative approach with less internal combustion engines and more fuels and technologies which are currently still in a nascent stage (TRL 5-7) (CCNR, 2021).

Facilitating the accelerated renewal of the IWT fleet in the CLINSH scenario

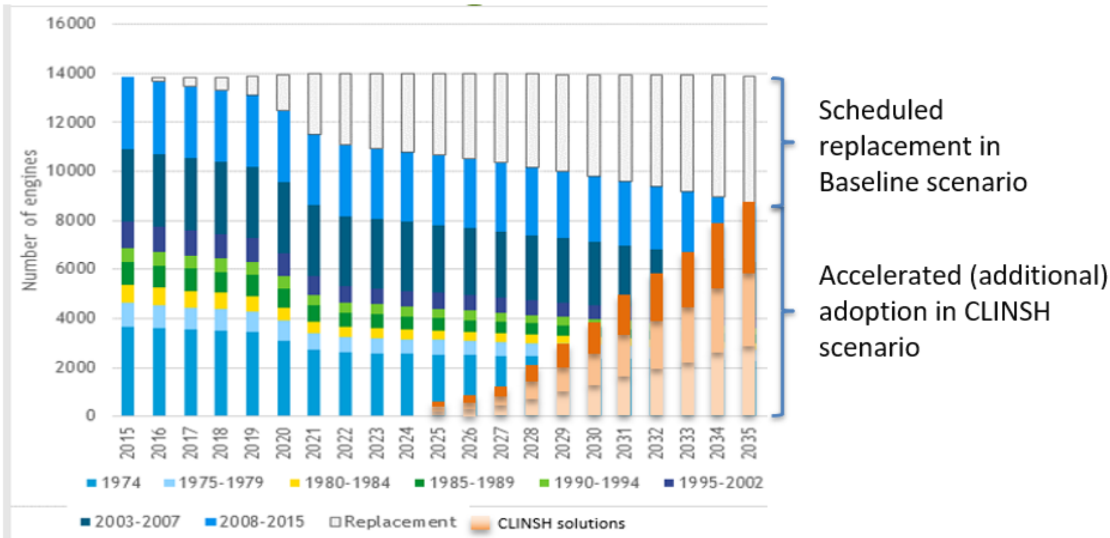


Figure 3: Accelerated contribution of CLINSH in terms of fleet renewal

From Figure 3 it is clear that the CLINSH scenario significantly increases the rate of engine modernization and bridging the gap towards ZE technologies. Thus, the 2022-2035 period can be used for accelerated adoption of available emission reduction options. It’s also important to add that CLINSH supports developing policy for the accelerated uptake of bio-fuels and e-fuels.

Given the relevance of the IWT sector for sustainable transportation in Europe, it is recommended that policy makers focus on developing the proper financial instruments to meet the energy transition challenge rather than only imposing strict limits or bans for existing inland waterway vessels not meeting the emission limits (CCNR - EICB, 2021). A possible fund shall aim at providing grants to vessel owners to support them in making the right investments which fit in the technology pathway towards a reduction in pollutant emissions. The weak financial capacity of vessel owners/operators and the lack of the business case for greening technologies is the main bottleneck to be solved by the fund. It is essential to address the issue from the viewpoint of the total TCO for the vessel owner, including the risks when investing in new technologies and committing to new types of fuels/energy.

3. Available funding instruments

Before giving recommendations about new possible financing instruments, it is useful to look into the existing landscape of available funding instruments that are currently available. After all, new instruments are only necessary and useful if the existing funding mechanisms are insufficient in filling the gaps for the IWT sector especially with regards to the quick roll-out of pollutant reducing technologies defined in CLINSH.

There are incentive schemes available within the EU aimed at making shipping and inland shipping more sustainable on a European, national and even regional scale. This chapter provides further insight into this, noting that the overview of incentive schemes has a volatile character: programs and schemes (as well as the conditions) come and go. The overview therefore provides insight into the program and regulation landscape as it appears at the time of preparing this report (September 2021). Insight is provided at 3 levels: EU, national (i.e., Belgium, Germany and the Netherlands) and regional.

3.1 Available funding instruments on EU level

At EU level, funding instruments are available that focus on developing or actually taking sustainability measures for transport and logistics. These schemes are not exclusively aimed at the inland shipping sector, but this sector can make use of them to a lesser or greater extent. Table 4 provides an overview of the various grant schemes and funding opportunities on an EU level that have significance and applicability for different aspects of the IWT sector. The overview helps to identify which schemes are more practicable for the goals and purposes identified for the CLINSH project in terms of large-scale uptake of pollution abatement for the current IWT fleet. An assessment was made to what extent the relevant scheme/program actually offers subsidy possibilities for a major roll-out (TRL8/9) of emission-reducing techniques in inland shipping (last column). A more detailed version of this table is also available in Annex Table 6 which provides a more detailed look.

Table 5 includes regional funds that exist within the Netherlands, Germany and Belgium.

Table 4: Applicable funding instruments for (greening) the IWT sector on the EU level

Fund Name	Fund Target	Suitability for large-scale rollout for IWT
Connecting Europe Facility (CEF)	• Sustainable freight transport service • Resource and carbon efficiency • Grant amount of €42.3 billion – Total	• Emphasis on shore infrastructure actions such as ports. • CEF has potential to fulfil some of the challenges that the IWT sector faces. • Large-scale Implementation of readily applicable pollution control mechanisms for CLINSH is unclear.
Horizon Europe	• Focused on R&I • €15 billion budget related to Climate, Energy and Mobility cluster	• Does not support large-scale roll-out and is limited to research and testing.
Innovation Fund	• Demonstration of low-carbon technologies • €10 billion – Total	• Open for projects from the waterborne transport sector. • Focused on demonstration of best practices. • Not for large-scale deployment.
LIFE	• Focused on improving quality of the environment, air, water soil. • €5.4 billion	• Limited to testing and showcasing. • Not for deployment on a broader scale
Invest EU	• Targeted to sub-optimal investment situations. • €38 billion over four policy windows.	• Renewal/retrofitting of transport mobile assets and development of sustainable inland waterway infrastructure such as ports is explicitly mentioned.
ERDF	• Enable investments in a smarter, greener, more connected and more social Europe	• Limited to testing and showcasing • Not there to support large-scale deployment.

3.2 Available national and regional funding instruments

Table 5: National and regional schemes for greening IWT

Country	Fund Name	Available budget	Description
Netherlands	Energy Investment Allowance (EIA)	• €114 million	Allows for investments in specific energy-saving technologies
	Milieu Investeringsaftrek/Versnelde afschrijving milieuinvesteringen (MIA/VAMIL)	• €25 million	Provides subsidies for specific emission-reducing technologies.
	Green Deal Zeevaart, Binnenvaart en Havens (Green Deal on Maritime and Inland Shipping and Ports)	• €15 million	Aimed at significantly reducing CO_2 emissions and other harmful substances with the final goal of becoming climate neutral by 2050
	Stikstofreductie Binnenvaart (Nitrogen reduction inland waterway transport)	• €79 million	Focuses on the installation of SCR catalytic converters on existing inland vessels to reduce nitrogen emissions
	Subsidieregeling Duurzame Scheepsbouw (Sustainable Shipbuilding Subsidy Scheme)	• Unknown	Intended for shipyards that want to implement a shipbuilding innovation project that contributes to sustainable development.
	Stimuleringsregeling Schone binnenvaart en duurzame logistiek in Rotterdam (Clean inland shipping and sustainable logistics in Rotterdam)	• €500,000	Port of Rotterdam provides financial contributions to new projects that lead to a reduction in fuel consumption, greenhouse gases and air emissions (NOx, PM) by inland shipping. Currently defunct
	Demonstratie klimaattechnologie en -innovatie (Climate Technology and Innovation transport scheme)	• Subsidy: €500,000 – €2,000,000	Focuses on transport solutions with low or no CO_2 emissions and themes such as electric driving and sailing, efficient ships, driving etc.

 Belgium (Flanders)	Hermotorisatie kleine schepen (Repowering small ships)	• Max €50,000 per ship	For smaller ships requiring retrofitting of new engines Currently defunct
	Nabehandelingstechnieken (After treatment technologies)	• Max €50,000 per ship	Purchase and placement of after-treatment systems for larger ships Currently defunct
	Ecologie+	• €1 million	Suitable for greening of inland shipping
 Belgium (Wallonia)	Prime à l’acquisition d’un bateau de navigation intérieure d’occasion (Bonus for the acquisition of a used inland navigation vessel)	• Min. investment of €12,500 and max investment of €200,000	Promotes the purchase of a second-hand ship that will be retrofitted with a new engine.
	Prime pour l’adaptation technique de la flotte de navigation intérieure Wallonne (Premium for the technical adaptation of the Walloon inland waterway fleet)	• 30% re-imbursed for SME’s. 20% re-imbursed for bigger companies • Min investment of €12,500 • Max amount funded is €200,000	Promotes the uptake of new equipment that will modernize the ship and improve its ecological footprint.
 Germany	Förderprogramm nachhaltige Modernisierung von Binnenschiffen (Funding program for the sustainable modernization of inland waterway vessels)	• 30 – 65% of eligible expenses	Reduction of contaminant, noise and GHG emissions of IWT vessels etc.
	Versorgung des Verkehrs mit alternativen Treibstoffen (Providing traffic with alternative fuels)	• €50,000 to €3 million	Aimed at reduction of CO_2 emissions. Establishment and expansion of shore power for IWT and LNG refueling facilities
	Innovativer Schiffbau sichert wettbewerbsfähige (Innovative Shipbuilding Ensures Competitive Jobs)	• Up to €7.5 million • Up to €15 million	Aimed at shipbuilding innovation

3.3 Conclusions

While the aforementioned funding programs seem to offer the possibility to receive funding and/or financing for inland waterway transport and the available amount of the potential support sounds significant, the resources however are mostly granted to infrastructure projects under the IWT priorities (fairways, locks, river information services, under-bridge clearance etc.) and it is difficult to retrieve those resources on vehicle/inland vessels (CCNR, 2020). Even before opting for the limited level of resources, the administrative hurdles for an IWT fleet/vessel owner/operator are very high (CCNR, 2020).

Consequently, EU funding (grants) does not support large-scale uptake of greening technologies and the roll-out of technology for mobile equipment such as vessels is not in the scope of existing funding schemes (CCNR - Panteia, 2020). On the national level, the available grant schemes have limitations in duration and funding rate. These limitations also fully apply to the fulfillment of the CLINSH objectives: immediate large-scale roll-out mechanisms that can help the IWT sector in the uptake of emission reducing technologies.

Figure 4 provides a visual overview of where each funding scheme lies on the implementation scale. Of special importance are funds within the large-scale deployment area. Thus, both the CEF and “ESIF: Cohesion Fund & ERFD” could provide large scale deployment opportunities for the IWT sector but a substantial impact remains to be seen.

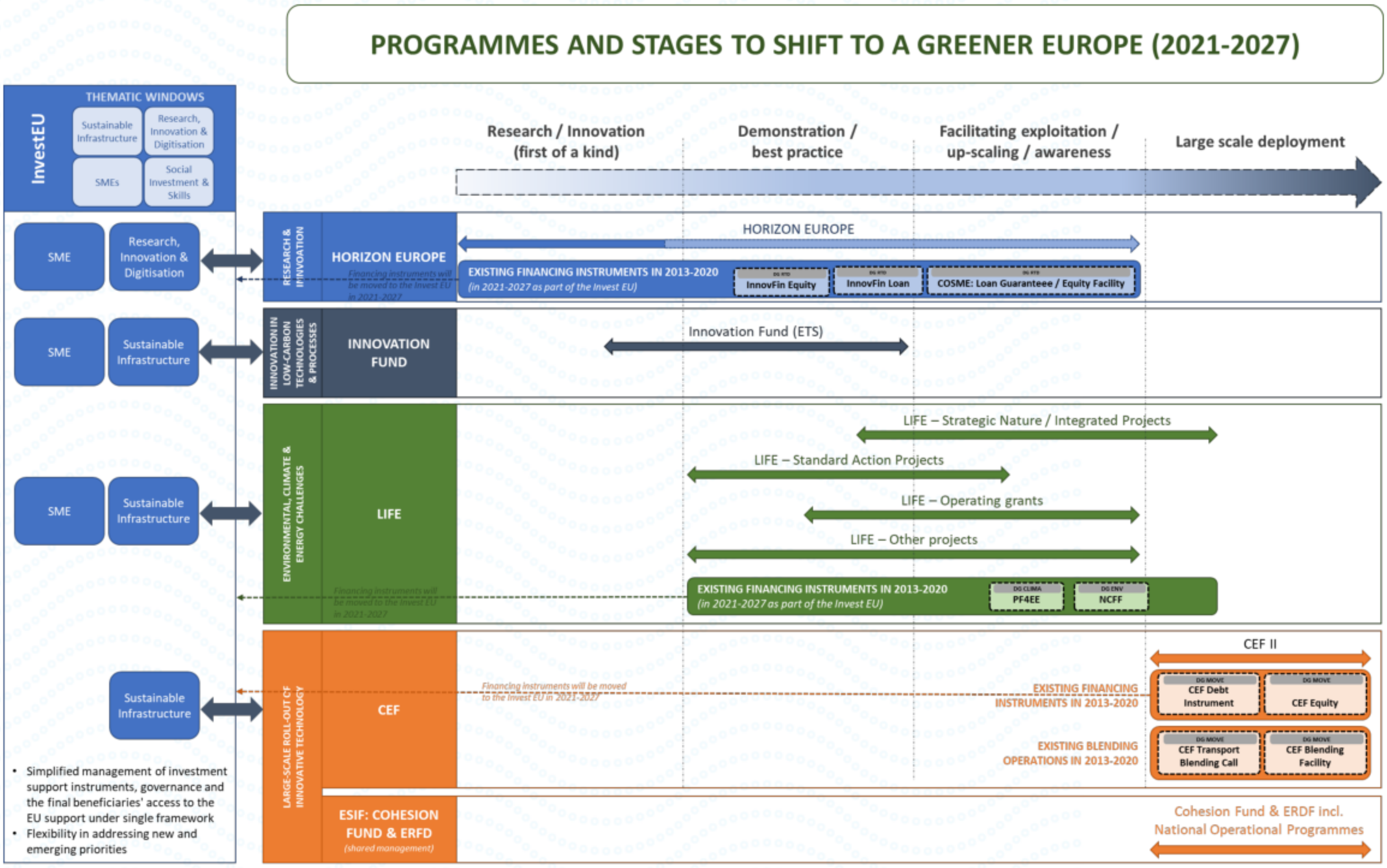


Figure 4: Overview of funding options with relation to the stage of innovation and deployment linked to the new single financing framework (Source: (CCNR - EICB, 2021))

4. Policy developments relevant to emission reduction in inland shipping

Various policy developments are underway at European level that can/will influence the available financing instruments for sustainable inland waterway shipping. This chapter lists the most important occurring policy developments, and also indicates how they can influence the implementation of CLINSH objectives.

4.1. European Parliament, resolution towards future-proof Inland Waterway Transport (IWT) in Europe

4.1.1 Broader Context and Background

In September 2021 the European Parliament adopted a resolution that was brought forward by the Committee on Transport and Tourism for a European Parliament Resolution on the topic of making the IWT future-proof. This resolution proposes a package of measures to facilitate modal shift from road to a.o. waterborne transport, help inland navigation in the transition to greening and zero-emission, digital and automated waterborne transport. One important ambition the resolution elaborates on is the greening of the inland waterway transport and the technologies which make vessels more suitable for the future with regard to the climate-related emission targets. Alternative fuels and propulsion measures play a major role in that regard highlighting low-emission and zero-emission alternatives. To cover the significant investments in zero-emission and digital inland waterway transport, the report also proposes the creation of a dedicated inland waterway fund.

4.1.2 Relevance for CLINSH goals

While appreciating the existing EU funding instruments, such as Connection Europe Facility (CEF) and Horizon Europe and the Structural Cohesion Funds there is also a need to mobilize them in order to make the financing of infrastructure, alternative fuels and adequate vessels. Due to the fact that the IWT sector is mostly run by SMEs, family businesses and smaller ports who have only limited financial means, it is difficult to stimulate the expensive investments needed for the goals of the Green Deal. The explicit demand of the European Parliament is thus setting up a dedicated European inland waterway fund that encompasses a one-stop-shop system that is easily accessible for help and assistance and has the possibility to combine projects into a single application. In that way the chances for funding can be maximized. Next to that, this dedicated fund should leverage further investments from the industry and focus on ship retrofitting and renewal in order to improve the energy efficiency of ships and support investments in innovative and energy-saving technologies as well as port infrastructure, notably the deployment of alternative fuels.

Furthermore, the fund should be financed through the reserve funds created under Regulation (EU) 546/20149 and where possible should be complemented with national funds and contributions. The possibility of blending with the CEF and the Structural and Cohesion Funds also should be realized (Nagtegaal, 2021).

4.2. NAIADES III: Boosting future-proof European inland waterway transport

4.2.1 Broader Context and Background

NAIADES III lays out an action plan on how to transform the IWT sector and to move it towards climate neutrality. It is clearly pointing out that renewing barge fleets and improving access to alternative low-carbon fuels will require substantial investments that will only happen if the right supportive EU frameworks are in place. The “Inland Waterway Transport Action Plan 2021-2027" in line with the new multiannual financial framework follows two main objectives. On the one hand, it aims at shifting more freight transport to inland waterways and on the other hand it targets to set the sector on an irreversible path to zero-emissions. The latter encompasses a paradigm shift towards digitalization while ensuring support for the current and future workforce. To enforce these objectives an array of policy measures in the following pillars are required: transportation, environment, digitalization, energy and finance. In this regard eight flagships have been developed which form the action plan (European Commission, 2021).

1. Flagship ‘Helping waterway managers to ensure a high level of service (Good Navigation Status) along EU inland waterway corridors by 31 December 2030’
2. Flagship ‘Updating the EU’s legal framework for intermodal transport to stimulate IWT
3. Flagship ‘Speeding up certification procedures for innovative and low-emission vessels’
4. Flagship ‘Guaranteeing IWT investments take into account climate and environmental objectives’
5. Flagship ‘Developing inland ports as multimodal alternative fuels infrastructure hubs’
6. Flagship ‘A roadmap for digitalization and automation of IWT’
7. Flagship ‘Smart and flexible EU crewing rules’
8. Flagship ‘Supporting the sector and Member States in the transition to zero-emission vessels’

4.2.2. Relevance for CLINSH goals

Since financing options are needed for the CLINSH project and the development of a sustainable IWT sector, the NAIADES III action plan shall be considered in the light of available funds. Therefore, non-financial aid by the Commission that is provided to support many flagships that will improve the climate impact of inland shipping in Europe are not relevant in this context although they are of general importance. The flagships that include relevant information for financing will be discussed in the following.

To begin with, flagship number four pleads for some non-financial aid related to infrastructure and is of special interest when it comes to financing instruments. The Commission points out that under this flagship on 'guaranteeing IWT investments' to take into account climate and environmental objectives. The facilitation of financial opportunities should take place on two levels: on the one hand, at regional and national levels, by public authorities and by the river commissions, on the other hand at EU level through funding instruments such as InvestEU or CEF (European Commission, 2021). Further supportive measures to stimulate the growth of low-carbon fuels are tax incentives which were implemented in the revision of the Energy Taxation Directive and the introduction of a harmonized minimum rate for fuels used in inland waterway transport depending on their environmental performance which also support energy efficiency. In order to increase the efficiency of investments, joint purchasing, joint innovation actions and other strategies should be followed so synergies between the small operators who dominate the IWT sector can be enabled. For more detailed pathways, the studies by the CCNR will be taken into consideration (European Commission, 2021).

Recognizing the key challenge of the sector's modernization the Commission follows the estimate of € 27 billion in order to comply with the targets set by the EU. Support for the initial deployment of zero-emission vessels and the related recharging/refueling infrastructure will be proposed through the Alternative Fuel Blending Facility and under the 2021-2023 work program of the Connecting Europe Facility (European Commission, 2021). In addition, the Commission will facilitate the efforts by stakeholders and Member States to create a fund to complement EU and national financial instruments for the deployment of zero-emissions vessels. The main idea is to ensure, to the greatest extent possible, that smaller vessel operators can combine their projects to receive attractive financing conditions. The creation of such a fund is also included in the Action Plan as the only step that is exclusively concerned with financing. With regard to the planning and timeframe of the action plan the financing step ought to be taken in 2024.

Next to this fund existing programs such as InvestEU, LIFE programme, Connecting Europe Facility (CEF) and Horizon Europe, mentioned in the seven flagships also play a role. However, it has been discussed previously that existing EU funding (grants) do not support large-scale uptake of greening techniques and the roll-out of technology for mobile equipment is not in their scope (CCNR - EICB, 2021).

Finally, the EU Taxonomy Climate Delegated Act recognizes the potential of low-carbon modes such as inland waterways to contribute to modal shift. The Commission will therefore establish relevant technical screening criteria for determining the conditions under which overall inland waterway infrastructure contributes to climate change mitigation, with a view to guiding market participants in their investment decisions.

4.3 The Fit for 55 Package

4.3.1 Broader context and background

In the Commission work program for 2021, the revisions and initiatives linked to the European Green Deal climate actions and in particular the climate plan's 55% net reduction target are presented under the 'Fit for 55' Package. The European Green Deal, presented in the communication sets out a detailed vision to make Europe the first climate-neutral continent by 2050, safeguard biodiversity, establish a circular economy and eliminate pollution, while boosting the competitiveness of European industry and ensuring a just transition for the regions and workers affected. With the announcement of the European Green Deal, the Commission President Ursula von der Leyen pledged to put forward a comprehensive, responsible plan to increase the European Union's emissions reduction target for 2030.

To implement the increased ambition, in July 2021 the Commission presented the first series of adopted files under the 'Fit for 55' Package. The package contains legislative proposals to revise the entire EU 2030 climate and energy framework, including the legislation on effort sharing, land use and forestry, renewable energy, energy efficiency, emission standards for new cars and vans, and the Energy Taxation Directive. The following announced initiatives were adopted by the Commission and communicated:

1) Revision of the EU Emissions Trading System (ETS), including maritime, aviation and CORSIA as well as a proposal for ETS as own resource
2) Carbon Border Adjustment Mechanism (CBAM) and a proposal for CBAM as own resource
3) Effort Sharing Regulation (ESR)
4) Revision of the Energy Tax Directive
5) Amendment to the Renewable Energy Directive to implement the ambition of the new 2030 climate target (RED)
6) Amendment of the Energy Efficiency Directive to implement the ambition of the new 2030 climate target (EED)
7) Revision of the Regulation on the inclusion of greenhouse gas emissions and removals from land use, land use change and forestry (LULUCF)
8) Revision of the Directive on deployment of alternative fuels infrastructure
9) Revision of the Regulation setting CO_2 emission performance standards for new passenger cars and for new light commercial vehicle

4.3.2 Relevance for CLINSH goals

Of the announced initiatives, two are relevant in relation to the discussion about the costs and financing of large-scale application of emission-reducing techniques in inland shipping:

- Revision of the Directive on deployment of alternative fuels infrastructure
- Revision of the Energy Tax Directive

These are explained in more detail below in light of the relevance of the CLINSH objectives.

4.4 Revision of the Directive on deployment of alternative fuels infrastructure

In relation to CLINSH, the Revision of the Directive on deployment of alternative fuels infrastructure is especially relevant for the roll-out of Onshore Power supply (OPS) in inland ports. The proposed amendment to the directive indicates that the number of sea and inland ports within the EU that offer OPS is still low: at the beginning of 2021, around 50 inland and maritime ports in the EU had at least one OPS connection point. Under the multiannual financial framework period 2014-2020, the Connecting Europe Facility (CEF) has been instrumental in supporting the rollout of OPS in 7 inland and 27 maritime ports.

For inland ports, the total infrastructure costs regarding OPS installations are estimated to range between €65 million and €412 million above the baseline cost (European Commission, 2021). The EU's multiannual budget for 2021-2027 provides a substantial increase in support for the rollout of alternative fuels infrastructure. Member States and other stakeholders can draw on a wide range of complementary funds and financial instruments e.g., through Member States' recovery plans under the Recovery and Resilience Facility (RRF). That support can be complemented by extended financing under the Connecting Europe Facility but also the InvestEU instrument and the European Structural and Investment Funds. The Horizon Europe program also offers financing options for making the fuel infrastructure in the EU more sustainable (e.g., through the 2Zero and Batteries Partnerships), however, the emphasis here is on research and development (lower TRL levels) where the feasibility in CLINSH should mainly focus on the large-scale roll-out of emission-reducing techniques.

4.5 Revision of the Energy Tax Directive

By revising the Energy Taxation Directive the European Commission seeks to align the taxation of energy products with EU energy and climate policies, promote clean technologies and remove outdated exemptions and reduced rates that currently encourage the use of fossil fuels. In fact, the ETD de facto favours fossil fuel use. Highly divergent national rates are applied in combination with a wide range of tax exemptions and reductions. The wide range of exemptions and reductions are forms of fossil fuel incentives, which are not in line with the objectives of the EGD.

The main proposed change for the ETD in relation to the objectives of CLINSH concerns the taxation of fuels according to their energy content and environmental performance rather than their volume, helping businesses and consumers alike to make cleaner, more climate-friendly choices. By setting higher rates for fossil fuels and lower rates for renewables products, the use of fossil fuels would be discouraged. In order to provide an incentive to their use, sustainable alternative fuels (including sustainable biofuels and biogas, low-carbon fuels, advanced sustainable biofuels and biogas, and renewable fuels of non-biological origin) and electricity would have a minimum rate of zero for ten years.

Next to that, exemptions for certain products and home heating will be phased out. Thus, fossil fuels can no longer be taxed below minimum rates.

Regarding onshore power supply, the proposed legislative amendment of the ETD provides that "a different level of taxation should be allowed to be applied to the use of energy products and electricity for regular intra-EU shipping, fishing and freight transport and their respective activities at the berth ". The specific nature of those applications justifies lower levels of taxation than those applicable to the general use of motor fuels. In order to encourage the use of sustainable alternative fuels and electricity, these fuels and electricity should be tax-exempt for ten years.

5. Characteristics of required financing instruments

This section will examine financial instruments that may have further applicability in realizing CLINSH objectives. The support of newly developed schemes can be provided in the form of the following or their combination:

- Loans
- Joint Procurement
- Leasing and pay-per-use schemes
- Earmarked contributions
- Blending Operations/non-repayable grants

5.1 Loans

Banks consider several factors when financing the transition to a Stage V engine. The market value of a vessel is determined by its age. Ships younger than 15 years receive a maximum of 70% of the market value of the vessel. While ships older than 50 years receive a maximum 40% of the market value of the vessel. For the older vessels this means that a large amount of financing must be obtained from other sources such as own contribution etc. The duration of the financing period varies from 7 to 8 years for older ships to 15 or even 20 years for new-build vessels with banks nowadays financing for between 2.0% and 2.5%. For newer builds, banks are prepared to support innovative techniques through adjusted financing durations, higher financing contributions and limited interest discounts. The existing outstanding assets of a shipowner are also taken into account.

Table 6: Capability of vessels to invest in a Stage V (compliant) engine (CCNR - Panteia, 2020)

Cargo Capacity (Tones)	Own Capital	Bank financing	Amount needed	TCO Gap	% Grant needed
250 – 400	€ 23,070	€ 40,971	€ 94,653	€ 30,611	32.3%
400 – 650	€ 47, 369	€ 40,116	€ 146,068	€ 58,583	40.1%
650 – 1000	€ 43, 593	€ 63,559	€ 192,431	€ 85,279	44.3%
1000 – 1600	€ 100,492	€ 98,516	€ 284, 572	€ 85,563	30.1%
1600 – 2500	€ 138,976	€ 124,203	€ 432,567	€ 169,388	39.2%
> 2500	€ 85,055	€ 360,577	€ 722,409	€ 276,776	38.3%

An approximation of the grant amount is given in Table 6 for different size classes of ships in relation to the required investment in a Stage V engine. The figures have been derived from the Stichting Abri Cost database and draft inputs from Research Question C of the CCNR study. It can be seen that the average grants needed are the highest for vessels between

400 to 1000 tones. Here, grants equalling more than 40% of the initial investment are needed to bridge the gap between the own capital that can be brought in and commercial bank financing. For vessels between 250 and 400 tones, a grant of approximately 33% is needed; for vessels between 1000 and 1600 tones, grants of 30% are needed and for vessels larger than 1600 tones, a grant of 39% is needed (CCNR - Panteia, 2020).

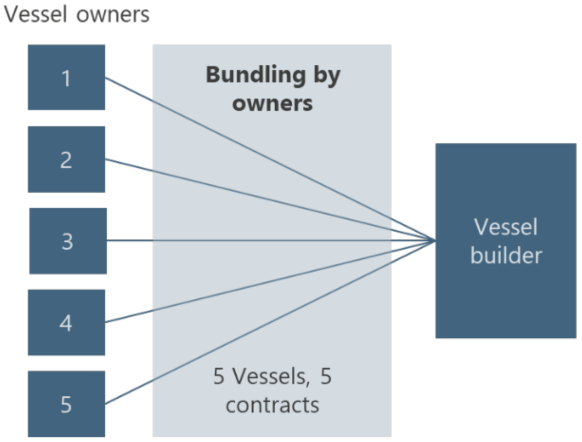
Companies operating a single motor vessel with a cargo carrying capacity less than 1000 tons will have severe problems acquiring finance for investment decisions for Stage V engines. Their financial situation will not allow for any step towards zero-emission without large grants of approximately 60% to 65%. The more secure the income of an IWT company is, the more likely they are to invest in more sustainable drivetrains and also to receive loan approvals from a financial institution. Poor financial situation of vessel owners will not lead to loans provided from a financial institution.

It is important to stress that such loans can only be repaid if there is a competitive business case, meaning that the total cost of ownership of the green technology is competitive with a conventional powertrain. Therefore, the vast majority of the economic challenge to close the gap is to provide the grants and other economic incentives to make the business case. Lower interest rates for loans only have a very modest contribution in the reduction of the costs for the vessel owner/operator (CCNR - EICB, 2021).

5.2 Joint Procurement

Joint procurement is a method that allows for financing through a cooperative or another collaborative organization to reduce investment costs. As investments in green(er) powertrains are generally considered to be significantly higher than investments in traditional powertrains, parties look to ways to lower investment costs. These collaborations have the potential to speed up the development of mass production and therefore, increase the benefits of economies of scale and reduce the costs per unit. Furthermore, it can stimulate innovations in the IWT for greening techniques and can be a driving force for standardisation (CCNR - REBEL, 2020).

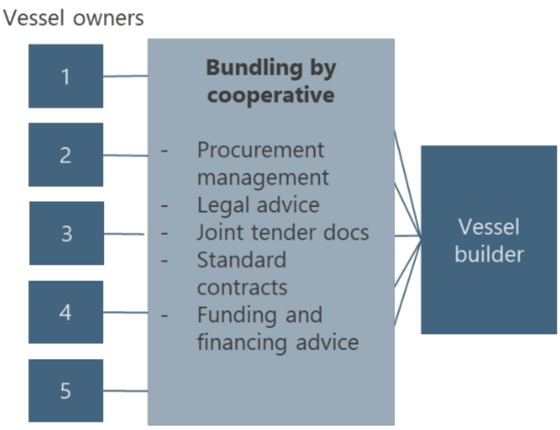
Joint procurement can occur in different levels of organizations from individual to centralized structures. In joint procurement by independent vessel owners, the independent vessel owners join forces in order to put out an order for a larger number of vessels e.g., Stage V engines. The powertrains will be built based on the specifications of the different vessel owners, however, the most benefits are attained when these specifications are as uniform as possible (i.e., a fleet group applying for the most optimal powertrain such as Stage V). The different owners have separate contracts with the shipbuilder and are separately responsible for arranging funding and maintenance contracts of the vessels Figure 5.



Parameter	Specifics/ Responsibility
Level of organization	Low
Ownership of vessels	End user
Responsibility for procurement procedure	End user
Responsibility for Finance	End user
Responsibility for Maintenance	End user

Figure 5: Joint procurement by individual shipowners (CCNR - REBEL, 2020)

In joint procurement by cooperatives, shipowners still remain responsible for the final procurement contract but cooperatives are involved in managing the procurement, drafting tender documents, drafting contracts, and provide advice on legal aspects, funding and financing (Figure 6).



Parameter	Specifics/ Responsibility
Level of organization	Moderate
Ownership of vessels	End user
Responsibility for procurement procedure	Cooperative
Responsibility for Finance	End user*
Responsibility for Maintenance	End user*

Figure 6: Joint procurement by cooperatives (CCNR - EICB, 2021)

Another joint procurement scenario involves the involvement of a third party operated fleet owning entity that leases vessels. This entity is known as a Special Purpose Vehicle (SPV) which acts as a vehicle for the investment, procurement, and maintenance of the vessels which takes all the risk from the previous vessel owners, now named 'end-users'. For this service end-users pay a monthly lease to the SPV and the vessels will be the property to the SPV. It's critical that vessel owners see the benefits of joint procurement and are therefore willing to give up some level of autonomy since this level of autonomy is deeply rooted within the IWT sector, benefits need to be substantial in order to persuade vessel owners to cooperate in a joint procurement scheme. (CCNR - REBEL, 2020).

In essence the strength of joint procurement lies in the price decreases due to economies of scale. However, there are challenges in creating financial advantages for ship-owners through joint-procurement, clustering the purchase of 10 or 20 engines is not expected to result in significant financial advantages and the market for newly-built vessels and re-motorisation has not been extensive after 2020 and is limited to less than 100 per year. Based on this the opportunities for joint procurement are not abundant (CCNR - REBEL, 2020).

Original Equipment Manufacturers expect the cost reduction of economies of scale for joint procurement to be in the range of 1% to 5%. This is the expected range for joint procurement of a range of 10 – 20 vessels. This might not seem as a large number of vessels, but regarding the current situation in the IWT sector this level of aggregation is already considered to be a significant challenge. There has been limited number of tries over the last decades to set up a form of joint procurement in the IWT-sector. However, these attempts have not led to success but if a significant number of fleets from a vessel group can be persuaded to switch to a Stage V engine (which the technology is mature) and the financial savings are significant then there is a potential for significant reduction of costs for ship-owners. This approach is more complicated to implement for zero-emission technologies since the supply chains are not mature yet.

5.3 Leasing Schemes and Pay-per-use schemes

The potential of pay-per-use and leasing schemes for the European IWT market in the context of the transition towards a zero-emission fleet in 2050 will be rather limited on the short and medium term based on current conditions. Leasing potential for powertrains are very limited as such schemes cannot be combined with mortgage financing of vessels.

The situation is a bit more beneficial for pay-per-use schemes for exchangeable equipment. It is foreseen though that the potential will be, especially at first instance, limited to just a few hundred vessels until 2030/2035. However, the current potential of just a few hundred vessels is subject to change depending on future developments to change framework conditions or new vessel concepts possibly triggered by autonomous sailing (CCNR - EICB, 2021).

5.4 Earmarked contributions

Deliverable RQ G and H of the CCNR study also presented a polluter-pays scheme in where earmarked contributions from the ship-owners are accumulated for the realization of this fund. Assuming that the current legal regime allows for it, earmarked contributions of €0,04/l and to a lesser extent €0,08/l fuel could be acceptable for the IWT sector and would not be expected to lead to significant market disruptions. This could result in total revenues of €1.3 bln to € 2.6 bln within a time period of 25 years (2025-2050). An average value of €0,06/l would result in total revenues of €1.95 bln (CCNR - EICB, 2021).

5.5 Blending operations

Blending means the combination of grants (non-repayable forms of support) with non-grant resources such as loans, equity and guarantees from financial institutions as well as commercial loans and investments in order to achieve a leveraged development impact (CCNR, 2020). Two funding programs which allow for blending and have significant relevancy for the IWT sector is the InvestEU fund and the CEF fund.

6. Recommendations and Conclusions

As emphasized earlier, current **EU funding (grants) do not support large-scale uptake** of greening techniques and the **roll-out of technology for mobile equipment such as vessels is not in the scope of existing funding schemes** (CCNR - Panteia, 2020). On the national level, the available grant schemes have limitations in duration and funding rate. Based on the research carried out into the needs and wishes of the inland shipping sector in the field of emission reduction and the existing financing instruments some summary conclusions are presented in this chapter.

Policy recommendations to achieve the CLINSH scenario

- The socio-economic analysis shows that Stage V (including Euro VI) engine renewal is **optimal from a societal perspective** for many ship types. The moment of engine revision would be best in terms of cost/benefit to stimulate accelerated Stage V engine renewal. The relatively high investment costs for Stage V engines are partly compensated by improved fuel efficiency and low emissions as demonstrated for the Euro VI engines in the monitoring fleet. SCR-DPF (with lower investment costs than engine renewal) and GTL (especially for smaller vessel types with lower fuel consumption) also score well. **An incentive scheme should make at least Stage V, SCR-DPF and GTL attractive for the entrepreneurs to invest in.**

- The EU and Member States should provide incentives for this accelerated adoption through an **IWT Greening Fund or grant schemes**. The fund should be open to both emission reducing and zero emissions technologies until 2035; thereafter the fund could be for zero emissions technologies only once the Stage V (equivalent) mandate enters into effect for all vessels.

- Ship owners who use clean technologies or fuels could receive a reduction or exemption on the existing waste disposal charges.

- Budget for the fund or grant schemes could be raised by **earmarking revenue from the taxation** of IWT fuels that is proposed in the Energy Tax Directive. A levy on the fuel, similar to the CDNI regulated waste disposal charge paid by vessel operators when bunkering, but differentiated to the emissions performance of the vessel, could also be considered.

- The monitoring demonstrates that it is difficult to reach the Stage V emission limits with retrofit after-treatment technologies and alternative fuels under real-life sailing conditions. The performance of after-treatment technologies **should be monitored** to make sure it is functioning well **in practice**.

- The widespread adoption of Stage V (equivalent, including marinized Euro VI) engines and optimised after-treatment systems could be stimulated by applying the **Stage V (equivalent) emission standard to the *existing* fleet in 2035.** This would also increase the effectiveness of the Greening Fund because shippers will have an additional rationale to re-motorise before 2035, while not precluding the adoption of ZE technologies when these become widely available from 2030 onwards.

- Given the scarce capital availability in the IWT sector it is commendable to seek permission to **provide investment support up to 80%** over the price difference notwithstanding EU State aid laws; also, for Stage V engine renewal even though this is the ruling emission standard for new engines. If subsidizing Stage V (including Euro VI) engines is not allowed, then support could be funnelled via grants for replacement and scrappage of old engines. The level of support (percentage applied) could be differentiated according to the emission reductions potential of the technologies.

- In order to reduce CO_2 emission reductions along with NO_X and PM emissions, CLINSH also endorses the development of **policies for accelerated uptake of biofuels and (sustainable hydrogen based) e-fuels** in IWT fleets. Such uptake is in line with the CCNR Zero emission Transition study's Conservative pathway, which involves mainly the biofuel Hydrotreated Vegetable oil (HVO) for diesel engines and liquid biomethane (LBM) for LNG engines. Also, HVO/GTL blends or in future e-fuels/GTL blends may be attractive for shipowners, as those blends would make the price difference to diesel smaller than with 100% HVO or e-fuels.

- CLINSH also endorses **policy for promoting Zero Emissions technology**: more research on application of ZE technology (battery electric, hydrogen); funding for pilots/demonstrations towards creating a Zero emissions IWT corridor with battery swap stations and fuel stations for flow cells and fuel cells; and investments in making batteries, flow cells, fuel cells and hydrogen cheaper.

- Hybrid-electric, i.e., a diesel or gas engine providing power for an electrified driveline, is an interesting option to **prepare for Zero Emission**. Hybrid can for some ship categories be the next best option from social cost perspective, and a benefit for the ship owner is that the electric driveline has residual value when the combustion engine will be replaced in future by batteries or fuel cells. The development and implementation of cheaper and better generator sets for hybrid drive should also be supported by the aforementioned IWT Greening Fund.

- Supporting Stage V engine renewal until 2035 is no-regret with the Zero emissions target for 2050 in mind, as with expected new engine lifetime of 15-20 years ship owners can switch to zero emissions technologies before 2050. In the meantime, Stage V engines can already contribute to emission reduction and climate goals by adopting biofuels and e-fuels in their diesel or gas engines, provided the engine warranties allow use of the certified fuels.

- **Local regulations** can help make the transition via lower emission technologies towards Zero Emissions. Aligned with financial support for engine renewal until 2035 (Greening Fund) and ahead of the proposed Stage V (equivalent) emission standard for the existing fleet in 2035 could be implementation of **low emission zones in ports**, i.e., access to port basins to Stage V only. This could be succeeded by zero emission zones in ports e.g., in 2050. CLINSH recommends investigating the feasibility and impact of such zoning. More widespread adoption of differentiation of port dues (exempt for ZE, medium for Stage V, highest for CCNR 0-1-2 until phased out), harmonized across the Rhine states, would provide another incentive for greening the fleet and would level the playing field for owners who already invested in greening technologies.

- Instead of emissions standards, **labelling** can be used as the basis for regulation. Using input from the CLINSH consortium, the Netherlands are developing a labelling method that rates both air pollutant and climate emissions. The label could be used for differentiating port dues and for environmental zoning. A proposal is being readied in the Netherlands, to be applied across Europe.

7. References

Bond, T. C., Doherty, S. J., Fahey, D. W., Forster, P. M., Bernsten, T., DeAngelo, B. J., . . . Zender, C. S. (2013). Bounding the role of black carbon in the climate system: A scientific assessment. *JGR Atmospheres*, 5380 - 5552.

CCNR - DST - EICB. (2021). *Study on Financing the energy transition towards a zero-emission European IWT sector - Assessment of technologies in view of zero-emission IWT Edition 2 - Research Question C.* Rotterdam: Central Commission for the Navigation of the Rhine.

CCNR - EICB. (2020). *Study on Financing the Energy Transition Towards a Zero-Emission European IWT Sector - Research Question D.* Rotterdam: Central Comission for the Navigation of the Rhine.

CCNR - EICB. (2021). *Study on Financing the energy transition towards a zero-emission European IWT sector - Research Question I.* Rotterdam: Central Commission for the Navigation of the Rhine.

CCNR - Panteia. (2020). *Study on Financing the energy transition towards a zero-emission European IWT sector - Research Question A.* Zoetermeer: Central Commission for the Navigation of the Rhine.

CCNR - REBEL. (2020). *Study on Financing the energy transition towards a zero-emission European IWT sector - Research Question E.* Rotterdam: Central Comission for the Navigation of the Rhine.

CCNR. (2020). *Study on Financing the Energy Transition Towards a Zero-Emission European IWT Sector - Research Question F.* Vienna - Rotterdam: Central Commission for the Navigation of the Rhine.

CCNR. (2021). *Study on Financing the energy transition towards a zero-emission European IWT sector - Final overall study report.* Rotterdam: Central Commission for the Navigation of the Rhine.

DST. (2020). *Assessment of technologies in view of zero-emission IWT.* Duisburg: DST.

European Commission. (2012). *Energy, transport and environment statistics — 2012 edition.* Luxembourg: Publication Office of the European Union.

European Commission. (2020). *Energy, transport and environment statistics — 2020 edition .* Luxembourg: Publications Office of the European Union.

European Commission. (2021). *A strategic rollout plan to outline a set of supplementary actions to support the rapid deployment of alternative fuels infrastructure.* Brussels: European Commission. Retrieved from https://ec.europa.eu/info/sites/default/files/strategic_rollout_plan_support_rapid_deployment_of_alternative_fuels_infrastructure.pdf

European Commission. (2021). *NAIADES III: Boosting future-proof European inland waterway transport.* Brussels: European Commission.

Eyring, V., Isaksen, I., Bernsten, T., Collins, W., Corbett, J., Endresen, O., . . . Stevenson, D. (2010). Transport impacts on atmosphere and climate: Shipping. *Atmospheric Environment*, 4735 - 4771.

Hulskotte, J., & Denier van der Gon, H. (2010). *Methodologies for Estimating Shipping Emissions in The Netherlands.* RIVM.

Moldanová, J., Fridell, E., Popovicheva, O., Demirdjian, B., Tishkova, V., Faccinetto, A., & Focsa, C. (2009). Characterisation of particulate matter and gaseous emissions from a large ship diesel engine. *Atmospheric Environment*, 2632 - 2641.

Nagtegaal, C. (2021). *On towards Future-proof Inland Waterway Transport (IWT) in Europe (2021/2015 (INI)).* European Parliament.

Petzold, A., Hasselbach, J., Lauer, P., Baumann, R., Franke, K., Gurk, C., . . . Weingartner, E. (2008). Experimental studies on particle emissions from cruising ship, their characterisitc properties, transformation and atmospheric lifetime in the marine boundary layer. *Atmospheric Chemistry and Physics*, 2387-2403.

Scholten, P., & Otten, M. (2021). *Fleet Scenarios CLINSH - Deliverable D2.4.* Delft: CE Delft.

Scholten, P., & Otten, M. (2021). *Socio-economic study of the CLINSH project - Deliverable C1* . Delft: CE Delft.

Twin, A. (2020, July 28). *Total Cost of Ownership – TCO*. Retrieved from Investopedia : https://www.investopedia.com/terms/t/totalcostofownership.asp

Annex

Fuel usage is defined in two ways: Sailing hours or volume of Fuel used. This dual distinction exists due to the two different methodologies used to define these values.

Annex Table 1: Fuel usage categories based on sailing hours and volume of fuel

	Sailing hours (annual)			Fuel use (m^3 annual)		
	high fuel use	normal fuel use	low fuel use	high fuel use	normal fuel use	low fuel use
Passenger vessel <250 kW	1,939	940	366	22	11	4
Passenger vessel 250 - 500 kW	1,372	695	311	53	27	12
Passenger vessel 500 - 1000 kW	1,237	735	304	77	46	19
Passenger vessel >1000 kW	3,098	1,750	938	767	433	232
Push boats <500 kW	2,302	1,420	895	133	82	52
Push boats 500-2000 kW	4,343	3,000	1,974	231	160	105
Push boats ≥2000 kW	7,325	7,258	6,656	2,323	2,100	1,926
Motor vessels <80 m. length	2,100	1,500	966	81	47	23
Motor vessels dry cargo typical 80 and 86 m ship	2,043	1,600	1,168	170	133	97
Motor vessels dry cargo typical 105 m ship	2,400	1,886	1,381	396	311	228
Motor vessels dry cargo 110 m ship	2,489	1,943	1,488	393	307	235
Motor vessels dry cargo >130 (135 m ship)	3,559	2,831	2,374	593	472	396
Motor vessels liquid cargo 80-109m length (typical 86 m ship)	2,025	1,707	1,211	323	272	193
Motor vessels liquid cargo 110 m ship	2,600	1,943	1,211	475	355	221
Motor vessels liquid cargo >130 (135 m ship)	4,433	2,831	1,932	551	352	240
Coupled convoys	3,576	2,513	1,786	784	551	392
Ferry	1,547	750	292	45	22	8

Tugboat and workboat	1,869	916	387	42	21	9

Annex Table 2: Total investment costs per ship for baseline and CLINSH scenario in 2020 – 2035 (Source: (Scholten & Otten, Socio-economic study of the CLINSH project - Deliverable C1 , 2021))

Vessel Type	Total investment costs baseline in 2020-2035	Total investment costs CLINSH scenario in 2020-2035	Additional investment costs	Additional investment costs (euro per litre fuel) (15 years)
Passenger vessel <250 kW	€ 26	€ 51	€ 25	€ 0,30
Passenger vessel 250 - 500 kW	€ 23	€ 48	€ 25	€ 0,27
Passenger vessel 500 - 1000 kW	€ 8	€ 19	€ 11	€ 0,29
Passenger vessel >1000 kW	€ 84	€ 164	€ 80	€ 0,06
Push boats <500 kW	€ 15	€ 34	€ 20	€ 0,11
Push boats 500-2000 kW	€ 33	€ 49	€ 16	€ 0,08
Push boats ≥2000 kW	€ 22	€ 22	€ 0	€ 0,00
Motor vessels <80 m. length	€ 86	€ 247	€ 161	€ 0,17
Motor vessels dry car go typical 80 and 86 m ship	€ 91	€ 233	€ 142	€ 0,11
Motor vessels dry car go typical 105 m ship	€ 55	€ 133	€ 78	€ 0,07
Motor vessels dry car go 110 m ship	€ 103	€ 235	€ 132	€ 0,08
Motor vessels dry car go >130 (135 m ship)	€ 103	€ 156	€ 53	€ 0,03
Motor vessels liquid c argo 80-109m length (typical 86 m ship)	€ 67	€ 189	€ 122	€ 0,09
Motor vessels liquid c argo 110 m ship	€ 149	€ 348	€ 200	€ 0,08
Motor vessels liquid c argo >130 (135 m ship)	€ 107	€ 172	€ 65	€ 0,07
Coupled convoys	€ 96	€ 137	€ 41	€ 0,04
Ferry	€ 62	€ 94	€ 32	€ 0,16
Tugboat and workboat	€ 62	€ 104	€ 42	€ 0,28
Total	€ 1.191	€ 2.435	€ 1.244	€ 0,08

Annex Table 3: Total social costs per ship category for baseline and CLINSH scenario in 2020 - 2035

Vessel Type	Total social costs baseline 2020-2035	Total social costs CLINSH scenario in 2020-2035	Difference (Baselin-CLINSH)
Passenger vessel <250 kW	€ 208	€ 191	€ 17
Passenger vessel 250 - 500 kW	€ 241	€ 212	€ 30
Passenger vessel 500 - 1000 kW	€ 102	€ 88	€ 14
Passenger vessel >1000 kW	€ 2.818	€ 2.314	€ 504
Push boats <500 kW	€ 364	€ 299	€ 65
Push boats 500-2000 kW	€ 409	€ 374	€ 35
Push boats ≥2000 kW	€ 614	€ 614	€ 0
Motor vessels <80 m. length	€ 1.943	€ 1.590	€ 353
Motor vessels dry cargo typical 80 and 86 m ship	€ 2.645	€ 2.080	€ 566
Motor vessels dry cargo typical 105 m ship	€ 2.066	€ 1.648	€ 418
Motor vessels dry cargo 110 m ship	€ 3.236	€ 2.571	€ 665
Motor vessels dry cargo >130 (135 m ship)	€ 2.749	€ 2.421	€ 328
Motor vessels liquid cargo 80 -109m length (typical 86 m ship)	€ 2.717	€ 2.127	€ 590
Motor vessels liquid cargo 11 0 m ship	€ 5.098	€ 4.126	€ 972
Motor vessels liquid cargo >130 (135 m ship)	€ 1.709	€ 1.533	€ 176
Coupled convoys	€ 1.932	€ 1.740	€ 192
Ferry	€ 492	€ 458	€ 34
Tugboat and workboat	€ 357	€ 324	€ 32
Total	€ 29.701	€ 24.709	€ 4.992

Annex Table 3 shows the total social costs per ship category for both scenarios. We can see that a large share of social costs originates from the motor vessel and passenger vessels >1000 kW category. These assortments of ships require the highest share of greening investments to alleviate NOx and PM emissions.

Annex Table 4: An overview of TCO per ship category for baseline and CLINSH scenario in 2020 – 2035 (Scholten & Otten, Socio-economic study of the CLINSH project - Deliverable C1 , 2021)

Vessel Type	Total TCO costs baseline 2020- 2035	Total TCO costs CLINSH scenario 2020- 2035	Additi onal TCO	Addtional TCO (euro/ liter diesel) (15 years)
Passenger vessel <250 kW	€ 97	€ 116	€ 19	€ 0,23
Passenger vessel 250 - 500 kW	€ 115	€ 130	€ 15	€ 0,17
Passenger vessel 500 - 1000 kW	€ 48	€ 54	€ 7	€ 0,18
Passenger vessel >1000 kW	€ 1.044	€ 1.086	€ 42	€ 0,03
Push boats <500 kW	€ 127	€ 141	€ 13	€ 0,07
Push boats 500- 2000 kW	€ 204	€ 212	€ 8	€ 0,04
Push boats ≥2000 kW	€ 293	€ 293	€ 0	€ 0,00
Motor vessels <80 m. le ngth	€ 703	€ 811	€ 108	€ 0,12
Motor vessels dry cargo typical 80 and 86 m ship	€ 906	€ 989	€ 83	€ 0,06
Motor vessels dry cargo typical 105 m ship	€ 706	€ 751	€ 45	€ 0,04
Motor vessels dry cargo 110 m ship	€ 1.120	€ 1.195	€ 75	€ 0,05
Motor vessels dry cargo >130 (135 m ship)	€ 1.077	€ 1.111	€ 33	€ 0,02
Motor vessels liquid car go 80-109m length (typical 86 m ship)	€ 904	€ 971	€ 66	€ 0,05
Motor vessels liquid car go 110 m ship	€ 1.783	€ 1.895	€ 112	€ 0,04
Motor vessels liquid car go >130 (135 m ship)	€ 742	€ 785	€ 43	€ 0,05
Coupled convoys	€ 793	€ 818	€ 25	€ 0,02
Ferry	€ 207	€ 238	€ 31	€ 0,15
Tugboat and workboat	€ 165	€ 192	€ 27	€ 0,18
Total	€ 11.035	€ 11.787	€ 753	€ 0,05

Annex Table 5: Estimated emissions of the European fleet in 2015 (DST, 2020)

2015		
CO_2	NO_x	PM
[t]	[t]	[t]
4281650	47307	2386

Annex Table 6: Extended table of funding instruments available for the IWT sector

Name of the funding program for 2021 - 2027	Type of support project in relation to IWT	Available Budget/Grant Amount	Co-financing/Subsidy Rate	Suitability for large-scale roll-out of emission-reducing measures in IWT
Connecting Europe Facility (CEF)	Within the theme of funding for the transport sector in the CEF there are several actions that relate to the IWT sector: Safe and secure mobility → sustainable freight transport services → resource and carbon efficiency (…driving/steaming, systems and operations planning) *Safe and secure mobility* → new technologies and innovation… alternative fuels infrastructure for all modes of transport → transition to innovative and sustainable transport technologies…stimulating energy efficiency, introduction of alternative propulsion systems, electricity supply systems, provision of corresponding infrastructure… reduction of external costs, such as congestion, damage to health and pollution of any kind including noise and emissions… resilience to climate change	€42.3 billion – Total • €30.6 billion – Transport sector • €8.7 billion – Energy sector • €3 billion – Digital sector	Shall not exceed **30%** of the total eligible cost. The co-financing rates may be increased to a maximum of 50% for actions supporting inland waterways… These co-financing rates may be increased to a maximum of 85% for actions relating to cross-border links.	Mostly targeted to shore infrastructure actions such as ports with a significantly lower focus on mobile assets. CEF has potential to fulfil some of the challenges that the IWT sector faces. It's unclear if a large-scale implementation of readily applicable pollution control mechanisms can be utilized through the fund (i.e., suitability for CLINSH)

Horizon Europe	Contains a cluster focusing on climate, energy and mobility related issues with high relevance for the IWT sector however it is mostly focused on research & innovation initiatives.	€100 billion – Total €15 billion budget related to Climate, Energy and Mobility cluster	Innovative actions: up to 70% of the total eligible costs – 100% for non-profit legal entities Program co-fund actions: at least 30% of total eligible costs, 70% in duly justified cases	The program does not support the large-scale roll-out of IWT emission reduction techniques and is limited to research and testing on a low number of vehicle units
Innovation Fund	A fund financed from the EU ETS. Supports the demonstration of low-carbon technologies, environmentally safe CCS and energy storage technologies. Potential investments comprise: new engines and propulsion concepts as soon as they reach the stage of implementation in real-life demonstrations and large-scale roll out and other technologies reducing GHG emissions.	€10 billion – Total	Co-financing rates of up to 60% of additional costs related to innovative technology (capital and operating costs for up to 10 years). Possible 100% coverage of project development related costs.	The fund is open for projects from the waterborne transport sector. Exact definition of criteria is under development. Focused on Research/Innovation and demonstration of best practices. Not for large-scale deployment.
LIFE program	A fund contributing to the shift towards a sustainable, circular, energy efficient, renewable energy-based, climate-neutral and resilient economy and to protect, restore and improve quality of the environment, including air, water and soil.	European parliament proposed €5.4 billion at 2018 prices	Up to 60% of eligible costs for action grants Up to 70% or the eligible costs, in case of operating grants Up to 75% of eligible costs for technical assistance under the second multiannual work program.	Offers possibilities that are limited to testing and showcasing greening technologies, but does not support deployment on a broader scale.

European Regional Develop-ment Fund (ERDF)	The European Regional Development Fund (ERDF) aims to strengthen economic, social and territorial cohesion in the European Union by correcting imbalances between its regions. In 2021-2027 it will enable investments in a smarter, greener, more connected and more social Europe that is closer to its citizens.			Offers possibilities that are limited to testing and showcasing greening technologies, but is not there to support deployment on a broader scale.
National and regional schemes (NL)	Energy Investment Allowance (EIA) Milieu Investeringsaftrek/Versnelde afschrijving milieuinvesteringen (MIA/VAMIL)	€114 million for MIA €25 million for Vamil	Dependent on the type of investment	Certain investment types have direct relation to ship related investments and upgrades
InvestEU	Development of sustainable and safe transport infrastructures and mobility solutions for the inland waterway infrastructure is mentioned. Supporting a transition towards zero-emission IWT is within the scope of all 4 policy windows. All actions supported by the InvestEU program have to address market failures or sub-optimal investment situations.	€38 billion split over four policy windows: • Sustainable infrastructure: €11.5 billion • Research, innovation and digitization: €11.25 billion • SMEs: €11.25 billion • Social investment and skills: €4 billion	30% of the budget will be allocated towards climate change activities.	Renewal and retrofitting of transport mobile assets and the development of sustainable inland waterway infrastructure including ports is explicitly mentioned.

CLINSH

SUSTAINABLE WATERWAY TRANSPORT, CLEAN AIR

CLEAN INLAND SHIPPING

WWW.CLINSH.EU