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STUDY ON FINANCING THE ENERGY TRANSITION TOWARDS A ZERO-EMISSION EUROPEAN IWT SECTOR

CCNR Member States:



Study consortium:



ECORYS



In partnership with:



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Study on Financing the energy transition towards a zero-emission European IWT sector

Deliverable – Research Question I

Final report

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List of abbreviations

CCNR	Central Commission for the Navigation of the Rhine
IWT	Inland Waterway Transport
RQ	Research Question
EU	European Union
EBU	European Barge Union
EIB	European Investment Bank
EIB Group	European Investment Bank Group ¹
EIF	European Investment Fund (part of EIB Group) ²
ESO	European Skippers' Organisation
ESC	European Shippers' Council
BAU	Business As Usual
TCO	Total Cost of Ownership
GHG	Greenhouse Gas
OPEX	Operating Expenditures
CAPEX	Capital Expenditure
CEF	Connecting Europe Facility
ICE	Internal Combustion Engine
RED2	Renewable Energy Directive
SPV	Special Purpose Vehicle
RQ	Research Question
PM	Particulate Matter (air pollutant emission)
NOx	Nitrous oxide (air pollutant emission)

¹ [Homepage | European Investment Bank \(eib.org\)](https://www.eib.org)

² <https://www.eif.org>

Executive Summary

Research element I can be seen as the concluding part based on the findings from the reports on research questions A-H of the CCNR study on energy transition towards a zero-emission inland navigation sector. All these reports should be understood as a basis for a wide-ranging discussion process at Rhine, European and international level with the aim of:

- scoping the funding and financing requirements for the IWT sector's energy transition,
- making recommendations for the development of a European funding and financing instrument intended to support this transition, and,
- paving the way for political decisions.

It needs to be remarked that there are economic, technical, legal and practical feasibility questions which remain to be addressed with regards to the creation of a European funding and financing scheme.

The main question of research question I is:

- *What is the added-value of a new European funding and financing scheme for IWT and how could this work?*

Research element I is broken down into eight sub-questions. The main findings are summarised into three paragraphs explaining the need for a new European funding and financing scheme, the possible benefits and added value, and the recommended features and characteristics. **In the context of this study, a fund refers to a financial instrument.** The word 'scheme' refers to a broader set of measures which are combined and linked in order to create synergies in reaching the emission reduction objectives. This broader set of measures (scheme) can consist of:

- loans (financing);
- grants (funding);
- differentiated earmarked contributions from the private sector to feed the fund;
- accompanying incentives based on the emission/energy performance of the vessel;
- accompanying legal framework to enable the above-mentioned measures.

In general, the answer to the main question is that with the adoption of the appropriate legal framework **there is an added value for a new European funding and financing scheme.** It is clear that the IWT sector cannot make the investments on its own, due to the **lack of the business case** for (near) zero-emission technologies as well as the lack of own resources and incentives (as made clear in the report on research question A). The business-as-usual scenario will therefore not reach the emission objectives as stated in the Mannheim declaration from October 2018. **A new European funding and financing scheme would therefore focus on providing grants (non-repayable funds) to close the gap in the business case.** In addition, the following financial instruments, pay-per-use and leasing schemes, joint procurement and fuel hedging (analysed in research questions D, E and F) can have some added value. However, they are expected to have only a relatively small contribution on closing the gap. A European funding and financing scheme

based primarily on providing grants shall give the major contribution to close the gap between 'business as usual' and the transition pathways³ for the European IWT fleet. This in order to reach the intermediary and final objectives of the Mannheim declaration by 2035 and 2050⁴, as presented in research question C.

In particular, such a **new scheme could introduce a contribution by the sector** to support its energy transition. Since it is unrealistic that the public sector will provide the full volume of resources needed to provide grants, a contribution by the IWT sector would provide⁵ a substantial amount of private resources. This could take the form of a dedicated contribution taking into account the emission performance of the vessel. A differentiated approach also provides an additional incentive and follows the principles of the 'polluter pays'. Such a fund-raising scheme can be based for example on the fuel consumption for a longer period, 2025- 2050. Introducing such a fund-raising mechanism is however **prohibited within the current Rhine legal regime** and requires a **careful examination by the CCNR which is competent on this issue**⁶ (see report on research question G and H for a more in-depth analysis⁷).

Assuming that the legal framework can be arranged, the result would be a mix of public and private funds provided as resources for the new funding and financing scheme. Subsequently, these resources are to be used primarily as grants **to compensate the vessel owner for the higher total costs of ownership (TCO)** of using powertrain equipment and more expensive fuels which contribute to reaching the emission targets for 2035 and 2050. The private resources brought together by the sector with an earmarked purpose are to be **co-financed by public parties** (e.g. national governments and EU). It can be linked to multiply the grants for vessel owners in order to close the gap.

The geographic scope of such a scheme is **European (connected waterways in Europe)** and therefore goes beyond the European Union and includes non-EU Member States, such as Switzerland, Serbia and Ukraine. This is important to make sure that there is no loophole in the scheme. In order to ensure effectiveness, it must not be possible to circumvent or otherwise avoid the purpose of the scheme. Furthermore, there cannot be a significant negative impact on level playing field between IWT operators in Europe.

³ For the purpose of this study, it has been requested to identify two transition pathways towards zero-emission in 2050, a conservative one and a more innovative one. The conservative pathway refers to a pathway in which mainly alternative fuels and techniques are considered which are relatively easy to implement and cost efficient. The innovative pathway takes a more innovative approach with less internal combustion engines into account.

⁴ - Reduce greenhouse gas emissions by 35% compared with 2015 by 2035

- Reduce pollutant emissions by at least 35% compared with 2015 by 2035

- Largely eliminate greenhouse gases and other pollutants by 2050.

⁵ See also deliverable for RQ G and H for more information as regards the earmarked contribution.

⁶ See Article 3 of the Mannheim Act of 17 October 1868 – *'In application of Article 3 of the Mannheim Convention, the Member States must refrain from imposing any toll, tax, duty or charge based directly on the fact of navigation.'* <https://www.ccr-zkr.org/11020100-en.html>.

⁷ [Deliverable RQ_G-H_Oct2020.pdf \(ccr-zkr.org\)](#)

Preferably the scheme would be a **'one-stop-shop' approach** for the beneficiary (vessel owner) to ease the process as much as possible. In such a case, the vessel owner would only need to submit his request for funding and financing to one organisation which will take the request into account. The organisation would take care of both the funding (grants) and financing (loans) needed, taking into account the estimated total costs of ownership compared to using the conventional drivetrain using fossil fuel. Furthermore, in advance of submitting a request, this vessel owner could contact the organisation to get technical assistance and guidance in choosing the right techniques/fuel given the type of vessel and the operational profile of the vessel. The organisation could also provide assistance and guidance in the application procedure. There are already today some examples of online research tools providing support to project owner looking for financial support, being general in their scope or targeting the inland navigation sector⁸.

Therefore, a possible funding and financing scheme could take the form of a public-private partnership, with a multilateral framework. For consolidating earmarked contributions at a European level, a new international convention would be needed to extend the scope of the initiative to non-EU Member States as well⁹. **In addition, an agreement would be necessary to amend the Belgrade Convention and the Mannheim Act in order to allow raising funds from the vessel operators, particularly earmarked contributions that flow back to the sector.** Last, a multilateral framework is also needed to align all the (EU and non-EU) member states as regards their public contribution (grants) to the funding scheme. However, it is important to note that the start-up costs of a fund are generally funded by public grants or other type of non-refundable contributions, and not by a loan. In such a case the EIB Group could not play this role, unless a mandate is provided to the EIB Group by the European Commission for instance. On the other hand, the actual fund financial resources (to be deployed to vessel operators via grants, loans etc.) must be provided partly upfront or at least in installments based on the expected disbursements of the funds over time.

Additionally, the EIB Group could also play a role in providing attractive loan facilities for the investments required in vessels (the part of investment possibly not covered by the grant).¹⁰ In particular, a scheme aiming at reducing barriers for loans to vessel owners, using guarantees from EU and Member States as well as complementing loans could be explored. The EIF, given the characteristics of its business, appears better suited to servicing the needs of Small and Medium Enterprises. This possibility may include intermediated financing. It is also understood that the EIB would focus more on financing the infrastructure required for the supply of alternative fuels and energy, as typically larger investments are required in this case.

⁸ Examples: European Investment Advisory Hub: <https://eiah.eib.org/find-support/wizard-page/index> ; research tool to help identifying financial support solutions for inland shipping activities set up by Netherlands Enterprise Agency (RVO) <https://www.rvo.nl/onderwerpen/duurzaam-ondernemen/green-deal/instrumenten-duurzame-binnenvaart-wssj>; EIBIP Platform: <https://eibip.eu/funding/>

⁹ See Annex I of this report for the relevant conclusion of deliverable RQ G-H on this aspect or consult the entire report which can be found on: https://www.ccr-zkr.org/files/documents/EtudesTransEner/Deliverable_RQ_G-H_Oct2020.pdf (p.68-69)

¹⁰ The minimal ticket size of the EIB should be considered. The EIB usually works with a minimal ticket size of €50 mln.

In this summary, answers are provided for each sub-question in a concise and structured way.

RQ 11: What could be the added value of a fund for the transition towards zero-emission IWT? &

RQ 14: Which approaches can be joined together into a new scheme with European coverage?

The findings from research question C present the financial challenge to reach the emission targets as defined by the CCNR. The BAU scenario (Business as Usual) shows that the emission targets for 2035 and 2050 are not achieved without intervention measures in addition to the current legal framework. The **main challenge is to create a positive business case for greening technologies** and the transition towards reaching the final 2050 objective (at least a 90% emission reduction compared to 2015 volumes of GHG emissions and air pollutant emissions (NO_x and PM). Research question C made clear that there is a significant gap in the TCO between the BAU scenario and both transition pathways, taking into account a bandwidth of price assumptions for technology hardware costs and energy/fuel prices.

In the **conservative pathway as compared to the BAU scenario** the TCO gap (total of 30 years, 2020-2050) is approximately:

- €2.43 bln in the minimum price scenario
- €2.67 bln in the average price scenario
- €6.38 bln in the maximum price scenario

In the **innovative pathway as compared to the BAU scenario** the TCO gap (total of 30 years, 2020-2050) is approximately:

- €5.26 bln in the minimum price scenario
- €7.80 bln in the average price scenario
- €10.19 bln in the maximum price scenario

It was concluded that the **financial capacity of the IWT sector is very limited** (research question A). Hence, only the owners of a few commercial freight vessels in the overall European IWT sector can bear the costs themselves. Moreover, **currently, grants by public organisations (both EU and national) are only certain for the short term and are not sufficient to close the financial gap to reach the emission targets in 2035 and 2050.**

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. Focusing on the latter only, is expected to result in loss of market share of IWT and reverse modal shift resulting in higher external costs (more traffic jams, GHG emissions, noise, infrastructure cost, etc.). These effects are in contradiction with the policy goals.

Given the funding gap to be bridged to achieve the transition, **it is unrealistic to expect that the energy transition in IWT will be funded completely with public resources.** Therefore, a **significant contribution by the sector itself is expected.** As also reflected in the latest EU policy

documents, each mode of transport shall take its responsibility and work on a fair and efficient system to create the right incentives to reduce the negative externalities and reaching the goals for GHG emission reduction and reduction of air pollutant emissions.

From the research for questions G and H, it became clear that a contribution by the sector would only be acceptable for the sector if **the collected resources from the private industry would be earmarked** to be used effectively for supporting the vessel owners and operators to adopt and operate the greening technologies. Furthermore, **a pre-requisite for the sector representatives is the co-financing of the contribution by the private sector with funds from the public sector.**

Different options have been analysed in research question G and H on how to raise funds from the private sector taking into account the polluter pays principle. It was concluded that **raising earmarked funds based on the fuel consumption and the emission profile of the vessel is most appropriate and feasible option.** Other options such as ETS and a contribution based on transport performance or transport volume were concluded to be less feasible and effective. Moreover, the findings of questions G and H concluded that based on market conditions in year 2020, earmarked contributions of on average €0,04/l and to a lesser extent €0,08/l of fuel could be acceptable for the IWT sector. Such contributions would not be expected to lead to significant market disruptions¹¹ or reverse modal shift. This could result in **total revenues collected from the IWT sector of €1.3 bln to € 2.6 bln within a time period of 25 year (2025-2050).** On the level of individual companies and vessels, the contribution could be differentiated. This could work as a bonus-malus system to provide an additional incentive. Vessel owners could be rewarded to make steps towards zero-emission performance. An energy index or emission label system could be an instrument for this differentiation.

Alongside other advantages that such a fund would represent, **a key one would be to enable and consolidate on a European level an earmarked sector contribution combined with a stable and long-term multilateral commitment of grants provided by public bodies** (budgets of national governments and EU) to ensure level playing field, effectiveness and acceptance. Such a European approach would enable a possible solution to feed the fund and provide incentives in order to close the financial gap in the TCO between the BAU scenario and the transition towards reaching the 2050 objective.

Such a scenario to compensate the vessel owners for the higher TCO as a result of the fund, would result in **synergies with other financial instruments** (analysed in research question D, E and F). In such a situation, **economies of scale** can be created due to the significant number of vessels to be retrofitted or newbuild, equipped with new and clean technologies. Such a wave of investment projects can be pooled together to profit from **joint procurement**. Moreover, when there is a business case because of compensation of the higher TCO with the new fund, more

¹¹It needs to be noted that this study (research question A, carried out in Q4 2019 and Q1 2020) does not yet take into account the impact of the COVID-19 crisis, which probably has temporarily further reduced the financial capacity of the IWT sector.

vessel owners will be willing to engage in a **pay-per-use scheme** for electric sailing, e.g. using swappable batteries from third parties.

In addition to financial support, it is important to note that regulatory solutions could be implemented additionally, in order to further decrease the operational advantage of conventional fossil fuels over renewable fuels/energy and thereby improving the business case for cleaner technologies.

RQ 12: How could a fund with European coverage be structured and what would be its characteristics? & RQ 13: How can such a fund be managed and what are the expected management costs? & RQ 18: What should the governance of such a new European scheme look like?

The fund should have a **long-term approach** to cover at least the period until 2050 and should have a full European coverage for the **connected waterways in Europe** (Rhine and Danube corridors) to prevent loopholes and to ensure level playing field. This scope therefore includes **also non-EU member states** directly connected to the waterways in the EU, such as Switzerland for the Rhine corridor and Serbia, Bosnia and Herzegovina, Ukraine and Moldova for the Danube and its tributaries. This inclusive scope will require the backing of international regulations and agreements and significant time might be needed to prepare these framework conditions.

A typical fund will have a **structure consisting of a number of 'roles'**, such as the fund initiator, manager, investment, administration, advisory and the beneficiaries. It is advisable to delegate the fund management (including the selection and due-diligence of actual investments) to a professional body such as a private-sector asset manager or a financial institution. The selection and oversight process of such a fund manager could benefit from the advice and experience of the EIB Group in selected financial intermediaries under different mandates. Similar mandates were for instance managed by EIF such as JEREMIE¹² or debt funds under EFSI. The related fund management costs can be around 0.75%-1.50% of the total fund size depending on the exact fund size.¹³

Assuming a substantial contribution by the private sector based on the fuel consumption, the **governance board** should include organisations representing the transport chain (shippers, forwarders, vessel operators and owners) such as EBU, ESO and ESC to cover the interests of the vessel owners/operators, intermediaries, and shippers.¹⁴

RQ 15: What could be the share between funding and financing (loans)? & RQ 17: How would the funding be backed? What share by public bodies and what share by private sector, e.g. by means of 'polluter-pays' revenues?

¹² http://www.eif.europa.eu/what_we_do/resources/jeremie/index.htm Joint European Resources for Micro to Medium Enterprises (JEREMIE)

¹³ Based on own elaboration of Rebel.

¹⁴ In case of a European fund without an earmarked contribution from the private sector, an Advisory Board with industry representatives is recommended.

The TCO gap and the limited financial capacity of the IWT sector itself illustrate the **very limited effect of repayable loans**. Loans will only be of use to the few entrepreneurs who can bear the costs themselves, i.e. with own capital and commercial financing. If there is no business case for a greening technology (no return on investment) there is no solid basis for a bank to provide a loan as it will be risky and uncertain if the loan can be repaid. However, assuming a significant share or grants to make the business case (at least a financial break-even situation for a longer time period, e.g. 10 years) loans can play a role. Loans can be used for financing the share of the investment costs that do not belong to the unprofitable top. The unprofitable top is determined by the additional TCO in comparison with the investment (CAPEX). The additional TCO is defined as the difference with investing and operating state-of-the art technologies using fossil fuel. The assumption is that the TCO gap is compensated by means of a grant. The share of CAPEX which is left would therefore still need a financial arrangement. This part could be served by loans in case the vessel owner does not have or want to use own capital to cover this remaining part of the CAPEX.

Earmarked contributions of €0,04/l and to a lesser extent €0,08/l of fuel is deemed bearable for the IWT sector and is not 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 year (2025-2050). Again, for the sake of simplicity, this amounts to an average of €1.95 bln. of total revenues.

Assuming an appropriate legal framework is in place to ensure the effective collection of this contribution, the IWT sector could roughly provide for 37% of the TCO gap itself by means of the earmarked contributions linked to fuel consumption. The remaining part should then be covered with public grants to make the business case (closing the TCO gap).

RQ 16: How can pre-financing be arranged for such a scheme; what could be the role of EIB or InvestEU or others?

The fund would need a first pre-financing round to get through the start-up phase and fund the management of the fund as well as the first investments. The European Reserve fund for inland shipping could possibly provide a small contribution in this respect. The reserve fund contains currently €26.8 mln which would most probably cover the fund management costs and the first few investments in greening the fleet in the very first phase of the fund.¹⁵

In general, it would be expected that the pre-financing would take place by means of a grant. However, it could also be further explored that an additional need for pre-financing could be covered by loans from organisations such as the EIB Group.¹⁶ It should be considered though that such loans are often commercial with commercial rates. Furthermore, the need for pre-financing in the start-up phase may not be substantial. Most expenditures of the fund would probably taking place after 2035, assuming that clean fuels and technologies (e.g. H₂, batteries) have become more affordable by then. It depends on the type of pathway. For innovative zero-

¹⁵ Conditions to use the Reserve Fund are analysed in the Deliverable for RQ G and H, specifically in chapter 8.4 of the report.

¹⁶ In relation to EIB group financing, this would concern loans with attractive pricing and long financing terms that match the economic life of each project.

emission like hydrogen fuel cell and battery electric technologies it makes sense to wait until they are cheaper and related infrastructure is available (e.g. recharging and bunkering of H2 carriers). In the meantime, the contribution by the sector could be operational (e.g. from 2025 onwards) which could result in a cash flow surplus.

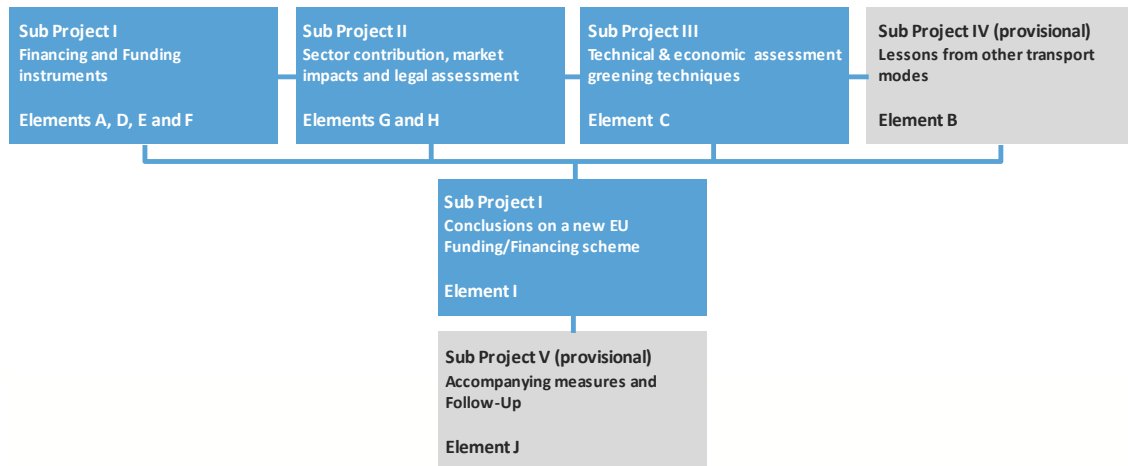
As indicated, the role of the EIB Group, more specifically the EIF, could be to become involved in a dedicated investment platform to provide easier access to repayable loans for vessel owners for the part not covered by the grant. Guarantees for loans from EU or on national level could help to lower the threshold for acquiring loans for investments in green technologies.

However, it is important to highlight that the provision of such loans depends on the ability of the vessel owner to repay it. In other words, that a competitive business case can be demonstrated. This requires that the total cost of ownership of the green technology is competitive with a conventional powertrain. Therefore, the majority of the challenge lies in the provision of grants and other economic incentives to create this business case and ensure access to such loans is possible in the first place. Lower interest rates for loans would only have a very modest contribution in reduction of the total cost of ownership in this respect.

1. Introduction

Figure 1 below provides a visual overview of the sub-projects that together form the CCNR study on energy transition towards a zero-emission inland navigation sector.

Figure 1: overview study



Source: Own elaboration

Given the provided answers on all previous research questions (A-H), research question I, will analyse what the added value would be of a new overall European funding/financing scheme.

This could be a scheme which includes the analysed possible funding and financing instruments/constructions such as pay-per-use, joint procurement, grants (in a fund or not) and backed by loans.

This scheme should take the analysed conditions and requirements regarding greening techniques, level-playing-field considerations, etc. into account.

The main question of research element I is:

What is the added-value of a new European funding and financing scheme for IWT and how could this work?

The corresponding sub-questions are:

- RQ I1: What could be the added value of a fund for the transition towards zero-emission IWT?
- RQ I2: How could a fund with European coverage be structured and what would be its characteristics?
- RQ I3: How can such a fund be managed and what are the expected management costs?
- RQ I4: Which approaches can be joined together into a new scheme with European coverage?
- RQ I5: What could be the share between funding and financing (loans)?
- RQ I6: How can pre-financing be arranged for such a scheme; what could be the role of EIB or InvestEU or others?

- RQ 17: How would the funding be backed? What share by public bodies and what share by private sector, e.g. by means of 'polluter-pays' revenues?
- RQ 18: What should the governance of such a new European scheme look like?

Research element I, first analyses the added value of a fund complementary to the analysed funding and financing solutions within research questions A-H. It then places things in a broader perspective and explores the potential of a new European funding and financing scheme/programme which could incorporate the analysed funding and financing solutions taking into account the conclusions of all research elements (e.g. also as regards the techniques and fuels in RQ C and the financial position of the IWT sector in RQ A).

2. The need for a fund

Research questions D, E, F, G and H analysed a number of possible financing and funding options for the energy transition towards a zero-emission IWT sector. These options are:

- The market potential for pay-per-use schemes and leasing (D);
- The potential of polluter-pays-schemes and corresponding market impacts and level playing field considerations (G&H);
- The potential for joint procurement (collaborations) (E);
- The potential for price hedging (F7);
- The expected funding (grants) from EU and national and regional sources (F1-6,8) and financing schemes and products with EU financial backing (F2).

The conclusions for these considered options will be summarised in short before going into the added value of a fund.

The financial challenge

Existing financial instruments, either funding or financing instruments, are not sufficiently supporting the transition towards a zero-emission IWT fleet from a business economic viewpoint. There is a big TCO gap between the business as usual (BAU) scenario towards 2050 and the two transition pathways (conservative and innovative pathways) for reaching the 2050 objective of the Mannheim declaration, i.e. to reach an emission reduction (both pollutant and GHG emissions) of at least 90% by 2050 compared to 2015.

In the BAU scenario the emission reduction levels that can be achieved towards 2050 are as follows:

Table 1: Emission reduction levels IWT fleet compared to 2015 in BAU scenario

	CO ₂ e / GHG	NO _x	PM
2020	4%	5%	8%
2025	7%	28%	32%
2030	9%	30%	34%
2035	14%	57%	63%
2040	17%	68%	74%
2045	19%	72%	79%
2050	22%	76%	83%

Source: Report RQ C

Table 1 clearly shows that both the intermediary 2035 and final 2050 objectives to reduce Green House Gas (GHG) emissions by 35% and at least 90%, respectively, is not expected to be reached in the BAU scenario. However, the goal to reduce pollutant emissions by 35% in 2035 will be

reached and the foreseen reduction of pollutants in 2050 are already close to the 90% reduction target. The main challenge will therefore be to reach the GHG reduction targets for 2035 and especially 2050.

Following the contrast in the emission reduction levels the results from RQ C clearly indicate the TCO gap. The total accumulated TCO gap (total of 30 years, period 2020-2050) in the **conservative pathway as compared to the BAU scenario** is equal to approximately:

- €2.43 bln in the minimum price scenario
- €2.65 bln in the average price scenario
- €6.38 bln in the maximum price scenario

The total accumulated TCO gap (total of 30 years, 2020-2050) in the **innovative pathway as compared to the BAU scenario** is equal to approximately:

- €5.26 bln in the minimum price scenario
- €7.80 bln in the average price scenario
- €10.19 bln in the maximum price scenario

It can be seen that the innovative pathway is more demanding in view of financing and funding in comparison to the conservative pathway.

Tables 5, 6 and 7 in Annex II give clear insights into the CAPEX, OPEX and TCO for the BAU scenario and the two transition pathways. The results from RQ C show that the financial gap between the BAU and the two pathways mainly consists of higher capital costs which is the result of higher CAPEX. On the other hand, it turns out that the OPEX for the pathways is around the same level or in some cases even lower than the OPEX for the BAU scenario on the long run (2035 - 2050).

It should be kept in mind though that the pathways pay more attention to efficiency measures which also results in less fuel consumption (30% reduction in the two pathways compared to 15% impact in BAU). However, overall, this means that there may even be a business case for some specific cases (fleet families and techniques/fuels) on the long run, as lower OPEX may cover the additional CAPEX costs in case indeed additional fuel consumption saving are possible. In general, though and on a fleet level, there is a gap in the TCO which needs to be filled if the 2050 objectives are to be realised. It should also be considered that the accumulated TCO gap in the period 2020-2050 does not include the total CAPEX gap. The capital costs for investments made after 2030 will continue to have an impact on the TCO gap beyond 2050 until 2070. However, it may be assumed that the BAU scenario has a limited validity throughout time. In the pathway scenarios the economic advantage of BAU may be eliminated by new regulations from 2050 onwards.

The sector will not be able to close this gap on its own and even with the current financing and funding options available. The results from RQ A showed that the status quo is characterised by mortgage financing from commercial banks, the conventional form of financing in the IWT sector and temporary grant schemes at European level or national/regional level.

As regards the ability of the sector to bear the investment costs for greening on its own, the results from RQ A show that even only a very limited part of the IWT sector can bear the investment cost on its own. Even for the electrification of a vessel, i.e. making a vessel “electric ready” for future fuel cell and battery pack applications, around 50% grants are needed on

average for the considered fleet categories. This amount will be much higher for the more expensive investments in zero-emission techniques such as fuel cells, hydrogen tanks and batteries. Indeed, the cost of electrification alone is a pittance (i.e. a few percent) compared with the investment in total fuel cells and battery systems. In addition, higher OPEX must also be taken into account because of, for example, higher fuel costs and maintenance costs related to these greening techniques/fuels.

The study analysed multiple potential financial instruments which could provide a solution in this respect.

Pay-per-use and leasing

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 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.

Moreover, the parties developing pay-per-use solutions are larger companies and these companies have better ability to use existing financing and funding instruments, such as CEF Blending and possibly also the DG CLIMA Innovation Fund. However, such instruments do not provide solutions for the vast majority of small individual vessel owners to electrify their vessels, while the funding and financing needs are especially high for these type of vessel owners.

Earmarked contributions

There are possibilities to introduce a scheme based on the theory of the polluter pays principle.¹⁷ The potential scheme could consist of earmarked “contributions” from the sector which are in turn used for greening the fleet when accompanied by public grants. **However, the legal basis for introducing such a contribution is currently missing within the Rhine regime.** An evolution of the Rhine regime would be required to implement such an earmarked contribution by the sector. **This therefore** requires a careful examination by the CCNR which is competent on this issue.

According to RQ G and H, a contribution from €0,04/l and to a lesser extent €0,08/l could be acceptable for the IWT sector and would not be expected to lead to significant market disruptions.¹⁸ Assuming a European wide contribution of vessel operators to a greening fund, ranging from an average contribution of €0,04/l to €0,08/l bunkered fuel, the possible revenues could be between €52mln and €106mln per year. Assuming a system for contributions would start in 2025 and continue until 2050, the total revenues within this period would be in the range of €1.3 bln to € 2.6 bln.

¹⁷ The deliverable for RQ G and H considered multiple instruments based on the polluter pays principle. The European Union’s Emission Trading System (ETS), based on a cap-and-trade approach, is one of the analysed instruments. The European IWT sector is a relatively small and fragmented one, for example as compared to the European aviation industry or heavy industrial sector, which are both included in the ETS. Hence, the possible deployment of an ETS like scheme for the IWT would simply be too complex and expensive to operate. The cap-and-trade approach with its trade element and stringent accounting measures are a too heavy burden for a relatively fragmented sector such as the IWT sector.

¹⁸ This is based on the market situation in 2020. Hence, new and other market interventions increasing the fuel price and/or changing the market conditions and competitiveness with other modes, might result in different values. This needs to be taken into account as soon as the contribution level would be established in a possible deployment situation of the fund.

In the context of RQ G and H, the IWT industry clearly stated as a pre-requisite that grants from public bodies should be demanded in parallel. A second pre-requisite from the legal perspective, would be that an international regulation is needed to underpin the scheme for connected waterways in Europe as basis for such an instrument, in particular, to address the legal barriers for the introduction of such a scheme at regional level, including the Rhine and Danube. This is a pre-requisite to ensure level playing field and effectiveness of the measures.

Joint procurement

In general, joint procurement in the IWT-sector could lead to cost reduction, stimulation of market development and innovation. Furthermore, joint procurement could also lead to an increase of standardisation. The cost reductions which can be achieved by joint procurement are due to economies of scale: larger orders will lead to lower prices for parts and is expected to increase efficiency.

Joint procurement is a theoretical possibility within the IWT-sector. There are no legal constraints that make joint procurement impossible. However, due to the limited economies of scale and other (cultural) settings within the IWT sector, only a small impact is considered reduce costs for the transition of IWT sector towards zero emission. In case of IWT, the financial benefits of joint procurement would be limited, in the order of 1 – 5% of total investment costs.

Price hedging

Despite the commonly used principals of fuel hedging in sea shipping and aviation, fuel hedging is not common practice in the inland waterways. For individual vessel owners working in the spot market, current hedging possibilities are cumbersome, potentially costly and not suitable for individual vessel owners to secure the price advantages in the long term.

Funding

Current grant schemes, either at the national or European level, are providing some stimulus for greening in the IWT sector. However, at the European level this mainly concerns the first few pilot vessels to demonstrate innovative techniques. In addition, large scale roll-out of technology for mobile equipment is not in scope of existing European funding schemes. As a result, the EU funding (grants) does not result in a large-scale uptake of greening techniques.

On the national level, the available grant schemes have limitations in duration and funding rate.¹⁹ Moreover, there is no consistent and coherent approach in Europe on national level as to the funding priorities for the energy transition and no certainty for the longer-term funding and priorities. As a result, it is not expected that existing grant schemes will provide sufficient and stable stimulus in the transition towards getting a zero-emission fleet by 2050. On the Danube however, the GRENDL project developed a concept for a State-Aid scheme which may be applied by several countries. It is uncertain however if this recommendation will in practice be followed and implemented.

Need for a fund

The findings show that there is a TCO gap related to the two transition pathways as compared to the BAU scenario for reaching the 2050 objective. There is very limited financial capacity within the sector to bear the costs of the transition, it is safe to say that only a few in the overall European IWT sector can bear the costs themselves, i.e. with own capital and commercial bank financing. It needs to be noted that this study (research question A, carried out in Q4 2019 and Q1

¹⁹ The Netherlands however recently decided to invest larger funds into greening the fleet (€92 mln until 2030) mainly to overcome the urgent nitrogen emission problems in Nature2000 areas which cause economic damage as construction works are being halted. The scheme is designed to retrofit approximately 920 vessels with SCR installations, this can therefore be seen as a substantial roll-out of this particular technology for existing engines. However, it is not a zero-emission solution, as it only addresses the NOx emissions and not GHG and PM emissions.

2020) does not yet take into account the impact of the COVID-19 crisis, which probably has temporarily further reduced the financial capacity of the IWT sector.

It is clear that there will be no business case for the transition towards becoming zero-emission compared to the business-as-usual scenario (fossil diesel combustion engine) for the vast majority of vessel owners. There may be some exceptions for specific cases on the long run, for example for battery-electric sailing for small ferries on short distances. Furthermore, public bodies contracting work for IWT may also provide incentives for green vessels. The use of **guarantees** for providing loans by commercial banks, such as the BMKB guarantees in the Netherlands, may further strengthen these limited number of positive business cases. However, in general and without the required (framework) conditions no or little investments will be done in greening towards a zero-emission fleet by 2050 based on the status quo.

The analysed potential financial instruments are expected to have only a limited financial effect on the realisation of the transition, especially in the BAU scenario, since the potential of possible solutions like pay-per-use and joint procurement will be very limited given the technology distribution in the BAU scenario that consists mainly of ICE's with diesel. Significant grants are needed for vessel owners in order to create positive business cases for investments fitting into the zero-emission pathway, this is a minimum requirement. The current grant schemes provide some stimulus for greening in the IWT sector, but they do not necessarily provide solutions for the vast majority of vessel owners/operators and all geographic areas. Higher amounts of funding than those deployed today, both at EU and national levels, are necessary. To maximise the use of grants by the IWT sector, visibility and accessibility must also be enhanced.

In addition, assuming that the current legal regime allows for it²⁰, there could be possibilities to introduce a scheme of earmarked "contributions" from the sector which could be in turn used for greening the fleet when accompanied by public grants. A strong contribution by the sector would be necessary as it would be unrealistic to expect that the energy transition will be funded by public funding only. A contribution by the sector would however only be acceptable for the sector if the revenues are earmarked to be used effectively for supporting the vessel owner/operators to adopt and operate the greening technologies.

Furthermore, it is recommended that policy makers should focus first on improving financial instruments, at least in parallel to imposing strict limits or bans to be imposed for existing inland waterway vessels. Focusing on the latter only could indeed cause reverse modal shift, loss of markets and other market disruptions, especially if it would be a fragmented approach with different regulations across Europe.

This recommendation is also made because of the structure of the supply side of the sector and limited possibility by the sector to make investments and offset increased operational costs. This needs to be seen from the viewpoint of competitiveness with other modes and the modal shift ambitions of the European Green Deal. As a result, cost increases compared to other modes shall remain limited to avoid reverse modal shift.

The findings reveal the ingredients for a possible solution in which a fund could play a role. An instrument is needed to channel possible subsidies and earmarked contributions from the sector.

²⁰ This is currently prohibited under the Rhine legal regime and would require a careful examination by the CCNR which is competent on this issue

3. Added value of a fund

A possible fund shall aim at, in a first step, providing grants to vessel owners to support them in making the right investments which fit in the technology pathway towards zero-emission in 2050. The weak financial capacity of vessel owners/operators and the lack of the business case of greening technologies is the main bottleneck to be solved by the fund.

The study for RQ C identified two pathways with a set of techniques and fuels considered for both pathways. In practice, there may be a middle ground between the two pathways. This will not affect the techniques and fuels considered, but it will affect their share in the total technique/fuel mix as compared to their share in either of the pathways.

In addition to grants, also financial or regulatory solutions would be needed to eliminate the operational advantage of conventional fossil fuels over renewable fuels. There are different instruments which may support this such as the usage of the RED2 directive²¹ and stimulating the uptake of alternative energy sources for IWT. 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.

The following paragraphs will explain the specific advantages of having a European fund.

3.1 Needed intervention to reach 2050 objective

The current instruments and framework conditions are not sufficient to reach the 2050 emission objective.

Only if there is a business case and risks are acceptable for the vessel owner, may loans be of additional value within the fund. This can be secured in the current conditions only if a sufficient level of grants is mobilised to close the financial gap.

The results from RQ C show, that there is no positive business case for the considered fuels and techniques and the given fleet families in the considered time period. Of course, there might be some exceptions for specific vessels and trajectories within a given fleet family, but not for the majority. The findings in RQ C illustrate though that the TCO gap between alternative fuels and techniques as compared to clean diesel engines running on diesel or HVO is narrowing towards 2050. If this trend is extended to the period after 2050, a positive business case may possibly arise for certain technologies/fuels and fleet families. This will however be too late to reach the 2050 target to have at least 90% GHG emission reduction compared to 2015.

Thus, loans will be of no additional value for financing the gap between BAU and the pathways towards zero-emission. However, if assumed that the fund only focuses on the unprofitable top, the additional costs of the transition compared to BAU, then the costs related to the BAU would in any case be financed by own means (own capital and commercial financing). The CAPEX in BAU for example amounts to € 2.6 bln, for which attractive loan conditions may be beneficial. Possibly the EIB Group, notably EIF, can play a role here, directly through the fund or indirectly by facilitation of green loans via commercial banks. Certain commercial banks that have traditionally worked with the IWT may be well suited to act as financing intermediaries and conduct the due

²¹ Directive (EU) 2018/2001 on the promotion of the use of energy from renewable sources: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2018.328.01.0082.01.ENG&toc=OJ:L:2018:328:TOC

diligence required with each loan application. Therefore, an additional financing measure to stimulate the transition, outside the scope of the fund, could be more attractive commercial loans (e.g. green financing with interest rebates) to finance the part that does not fall under the unprofitable top.

1.1 One-stop-shop and tailor made to IWT

a ‘one-stop-shop’ solution would be needed for the vessel owner, which shall provide better conditions compared to traditional commercial loans (e.g. lower interest rates and less requirements for collateral backing-up of the loan). Applicants shall receive reasonable consultancy during the application procedure free of charge. It is interesting to note that there are already today some examples of online research tools providing support to project owner looking for financial support, being general in their scope or targeting the inland navigation sector²². Such a tool targeting inland navigation at European level could also be seen as added value to facilitate access of vessel owners to financial support.

In the ideal case the application is a one-stage process for the applicant, with an open call procedure, meaning that the submission of an application is always possible. Having a fund could make it possible to come up with a one-stop-shop solution to facilitate the vessel owner.

Given the IWT sector which consists predominantly by small family-owned companies, a particular approach is needed to facilitate these companies as much as possible. This mainly requires an easy application procedure resulting in low costs for the applicant. In addition, a possibility for applicants to apply to the scheme either through a national agency or with the support from regional contact points, would certainly be of added value and make the scheme more accessible. Such regional contact points may have close relations with both the grant providers as well as commercial banks. Such regional contact points may provide strong support in technical advice for the appropriate investment (which technology to select), the application processes to acquire the grants and accompanying loans. In this way a ‘one-stop-shop’ could be provided for small companies, providing technical, financial and legal support to the companies. This will also help to reduce administrative costs.

Positive experience resulting from the setting up of such local contact points exists, such as the project Vergroeningsconsulent, which ran until March 2021 in Flanders (Belgium). Other examples of support services to companies are the Expertise and Innovation Centre for inland Barging (EICB) in The Netherlands and the European Inland Barging Innovation Platform “EIBIP”, a European platform of regional innovation facilitation centers, to promote the uptake of innovation by the Inland Waterway Transport sector²³. EIBIP was co-funded by the European Commission between 2016 and 2019 and key partners were EICB, VNF, ProDanube and Mariko. This aspect should be investigated further in future work, to ensure the feasibility of such an approach.

1.2 Consolidation and alignment of financial contributions

The added value of a fund could also allow to enable and consolidate on European level an earmarked sector contribution combined with a stable and long-term flow of grants provided by public bodies to ensure level playing field, effectiveness and acceptance. Such a European

²² Examples: European Investment Advisory Hub: <https://eiah.eib.org/find-support/wizard-page/index> ; research tool to help identifying financial support solutions for inland shipping activities set up by Netherlands Enterprise Agency (RVO) <https://www.rvo.nl/onderwerpen/duurzaam-ondernemen/green-deal/instrumenten-duurzame-binnenvaart-wssl>; EIBIP Platform: <https://eibip.eu/funding/>

²³ <https://eibip.eu/>

approach enables a possible solution to feed the fund and provide incentives in order to close the financial gap in the TCO between the BAU scenario and the transition towards reaching the 2050 objective.

1.3 Structural solution towards 2050

Given the challenge in realising the transition towards 2050 and the lifetime of powertrains and vessels, a structural solution is needed. It must take into account the standard refurbishment cycles, resulting in a gradual and cost-effective replacement (avoiding capital destruction). Furthermore, a structural approach is also needed to monitor the emission development of the fleet to make sure that the intermediary and final emission objectives are met. In addition, it is also needed to follow the technological and political developments seen the current uncertainties. A periodic update on the TCO gap should be made, in order to adjust the required financial support from the fund and how to provide it.

Moreover, the appraisal method for applications by vessel owners to the fund can act as reference for other organisations, to promote and give incentives for green IWT. This results in synergies (e.g. port dues, long term contract with shippers, loan conditions of private banks, regional grants schemes).

In **summary**, establishing a **structural** common framework for the application of the contribution by the sector, national resources and EU contribution leads to:

- **ensures level playing field** in Europe for shippers/clients and vessel owners as result of a common approach for state-aid for enabling the transition towards zero-emission IWT.
- **awareness and political priority** setting to bring more financial resources (grants and loans) together in a long term and multilateral approach.
- **cost-effectiveness and economies of scale**, making the transition more affordable (more emission reduction for each euro) allowing also joint procurement and pay-per-use schemes. It shall duly take into account the lifetime of equipment and current uncertainties as regards policies and technologies.
- **one-stop-shop approach for vessel owner/operators**, tailored to the specific structure of the IWT sector (many micro size companies) creating better accessibility and visibility for the sector to financial resources, both loans and grants. Moreover, also providing technical assistance in making the right investment for the vessel and the operational profile.
- **insight in the development of the emission performance** of the fleet, as result of monitoring and consolidation of expertise and know-how.
- **linking other incentives** to the appraisal method of the fund as a basic model, resulting in synergies (e.g. port dues, long term contract with shippers, loan conditions of private banks, regional grants schemes).

4. Recommended features and characteristics

The fund should be a European instrument providing a structural solution, i.e. having a long term approach to cover at least the period 2025-2050. In order to secure level playing field and effectiveness, the fund should have a Pan-European coverage including also non-EU member states on the international corridors represented in the River Commissions, backed by international regulations.

There would be the need for an international regulation to underpin the scheme for connected waterways in Europe as basis for such an instrument.

One possibility to extent the scope of the initiative to non-EU Member States as well, is by creating a new international convention. The different river commissions together with the European Commission could play a role in drafting the convention and ask active support of their Signatory States to support the convention.

Furthermore, concerning a potential EIB Group participation, the fund should be structured in a way that not only financing to vessel owners in the EU but also outside may be made available. Good practices could also be taken from the H2020 programme which provides the opportunity for organisations outside the EU to participate in H2020 projects (e.g. Switzerland). The associated country provides a financial contribution proportional to its GDP and on the basis of an international agreement with the EU.²⁴

The possible fund could follow a common fund structure consisting of the following roles:

Table 2: Fund structure

Person	Description
Fund initiator	Typically those financing the fund; e.g. EU, (EU) Member States along with other financing parties (e.g. shippers & IWT sector) ²⁵
Fund management	Responsible for total funding and risk management on behalf of fund initiator
Fund investment	Activities related to the actual investment process (upfront)
Fund administration	Administering the financing (back office)
Fund advisory board	Stakeholders from sectors, finance, governments, NGO
Beneficiaries	Applicants of funding (e.g. vessel owners)

Source: own elaboration

It is advisable to delegate the fund management (including the selection and due-diligence of actual investments) to a professional body such as a private-sector asset manager or a financial institution. The selection and oversight process of such a fund manager could benefit from the

²⁴ https://ec.europa.eu/info/research-and-innovation/strategy/international-cooperation_nl

²⁵ A seat in the governance board for EBU, ESO and ESC is recommended to cover the interests of the vessel owners/operators, intermediaries, and shippers.

advise an experience of the EIB Group in selected financial intermediaries under different mandates. Similar mandates were for instance managed by EIF such as JEREMIE²⁶ or debt funds under EFSI.

Delegating the fund management will make sure that the actual funding on the level of individual entrepreneurs is not mixed up with political and administrative or private interests. The fund management structure should also safeguard the European scope and approach, since the objective will be to green the overall European IWT fleet. This should be considered as a criterion when choosing an external fund manager.

The related fund management costs can be around 0.75%-1.50% of the total fund size depending on the exact fund size. With a larger fund, the costs per transaction will be relatively lower. In the first two years the fund management would typically be high in relation to portfolio development. Gradually fund management costs should decrease and the number of transactions increase. If the investment process has finished, an administrative fund remains that would have substantially lower costs.

Furthermore, recruiting an external fund manager will be done through a tender process which results in competition and the option to select the organization providing best value for money.

The fund would need a first pre-financing round to get through the start-up phase. Results from RQ G and H show that the European Reserve fund for inland shipping could possibly provide a solution in this respect. The reserve fund contains of €26.8 mln which will most probably cover the fund management costs and the first investments in the starting phase.

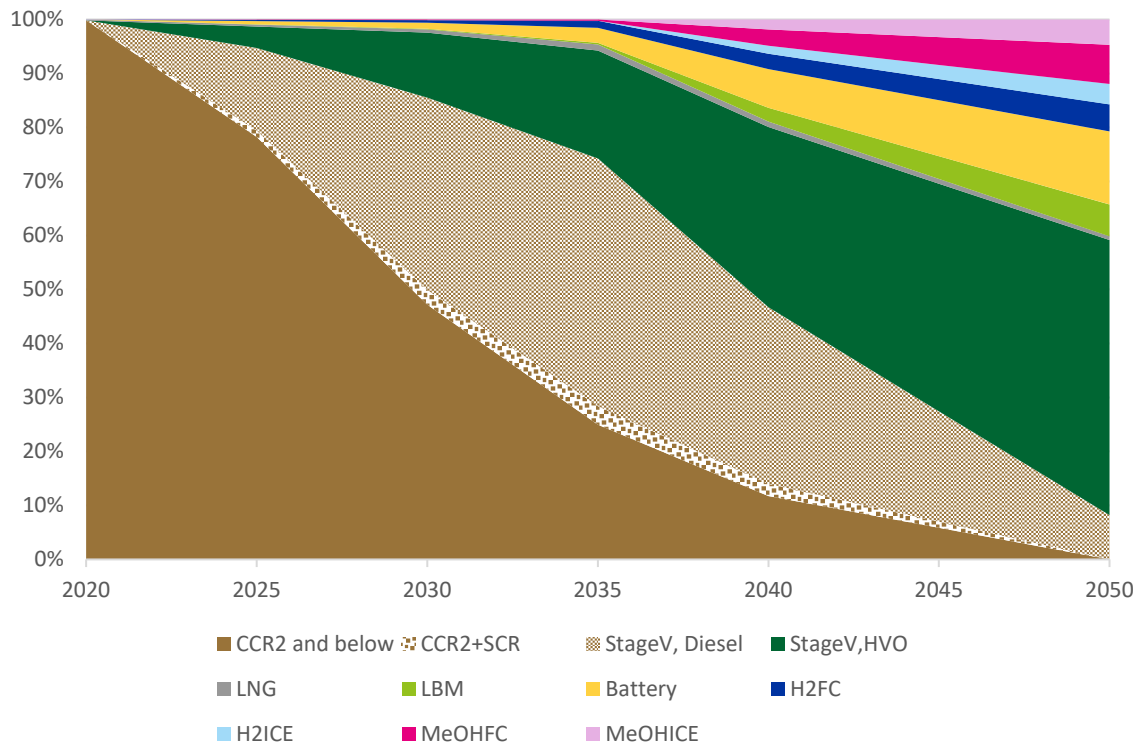
In general, it would be expected that the pre-financing would take place by means of a grant. However, it could also be further explored that an additional need for pre-financing could be covered by loans from organisations such as the EIB Group.²⁷ It should be considered though that such loans are often commercial with commercial rates. The EIB Group will most likely require guarantees that the loans provided will be paid back as well as the interests. It is important to note that the start-up costs of such funds with a strong societal benefit are generally funded by public grants or other type of non-refundable contributions, and not by a loan. In such a case the EIB Group would not play this role, unless a mandate is provided to the EIB by the European Commission for instance. On the other hand, the actual fund financial resources (to be deployed to vessel operators via grants, loans etc.) must be provided partly upfront or at least in installments based on the expected disbursements of the funds over time.

Furthermore, the need for pre-financing in the start-up phase may not be so important as initially expected. Indeed, the results from RQ C show that investments in greening technologies (in both transition paths) only really get going after 2035. This can also be seen figures 2 and 3.

²⁶ http://www.eif.europa.eu/what_we_do/resources/jeremie/index.htm Joint European Resources for Micro to Medium Enterprises (JEREMIE)

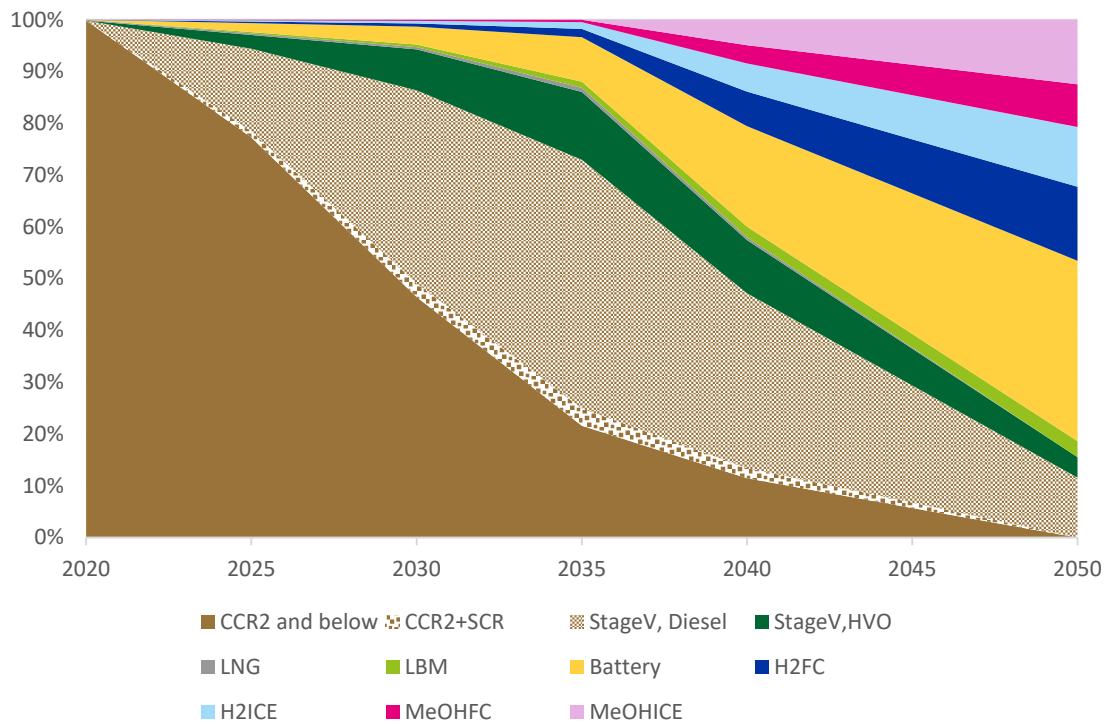
²⁷ In relation to EIB group financing, this would concern loans with attractive pricing and long financing terms that match the economic life of each project.

Figure 2: Technology development conservative pathway



Source: report RQ C

Figure 3: Technology development innovative pathway



Source: report RQ C

The overall distribution in the financial resources of a possible fund will depend on a number of factors. Given the results from RQ C there will be a TCO gap in the range of €2.43 bln and €10.19

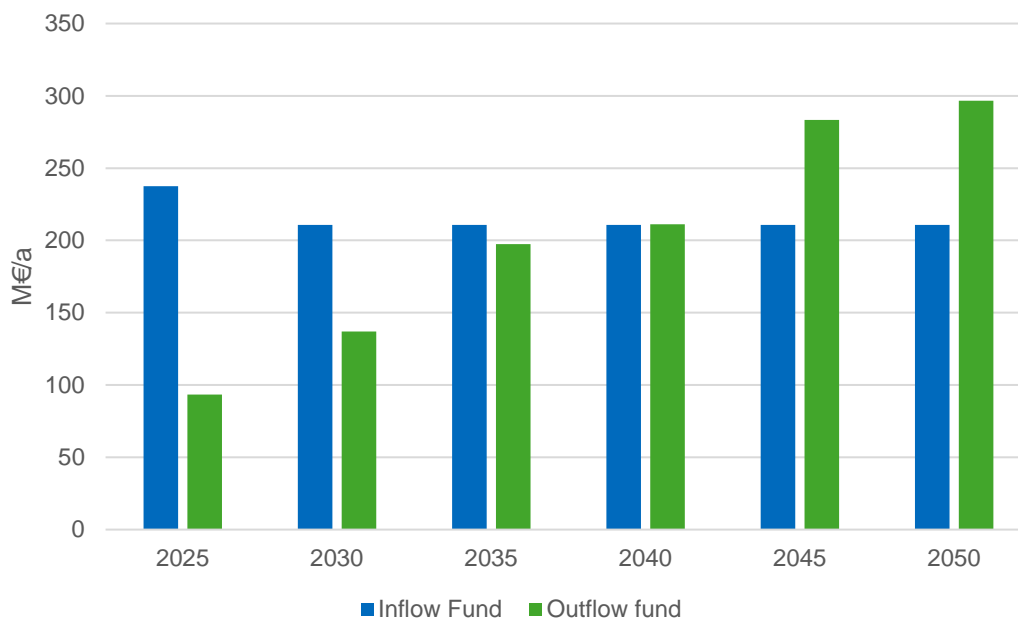
bln depending on the specific transition pathway and assumed price scenarios. The average TCO gap of both transition pathways, assuming the average price scenario, would be €5.22 bln.

Assuming that the current legal regime allows for it, results from RQ G and H show that 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 year (2025-2050). An average value of €0,06/l would result in total revenues of €1.95 bln.

Assuming earmarked contributions of €0,06/l on average, the sector could roughly provide for 37% of the TCO gap itself if the average figures are applied for the pathways and price scenarios. The remaining part would need to be covered with public grants in order to make the business case. This was also clearly stated by the sector as a pre-condition in the results of RQ G and H, in order to accept the principle of a sector contribution. However, given the assumptions within the study for RQ C, in practice the TCO gap will be higher both in the innovative pathway scenario or even at the maximum price scenario for the conservative pathway, which would eventually result in a need for a much higher share for public support as compared to the sector contribution. In the case of technological breakthroughs and price reductions for innovative techniques and fuels, it can of course work the other way.

The following figure provides a simplified overview of the possible financial flows flowing in and out of the fund. This simplified overview is made based on the average TCO gap of both transition pathways assuming the average price scenario, as compared to the TCO of the BAU scenario again assuming the average price scenario. The inflow consists of the earmarked contributions, assuming total revenues of €1.95 bln. evenly distributed over 25 years, and complementary the same amount of grants.

Figure 4: Fund inflow and outflow per year for given years



Source: Own elaboration based on results from report RQ C

The figure shows that the volume of investments in the first years would still be relatively low, in line with Figures 2 and 3 and this would support the assumption that pre-financing from the

reserve fund, together with earmarked contributions and grants, may be sufficient for the start-up phase of the fund.

Funding, by public bodies for example, is usually being provided based on the investment costs (CAPEX) and not the OPEX. Hence, the most common approach for the fund would be to address the CAPEX for providing grants. The CAPEX represents a value of the asset which can be seen as collateral for the grant in case of issues. Indeed, it is common banking practice that OPEX are typically not funded by investment loans, as they consist in recurring incremental costs, not in an investment. The only example of an EU funding mechanism covering part of the OPEX which exists to date seems to be the Innovation Fund²⁸. In addition, funding for OPEX with public financial resources may be a critical issue with regards to EU state aid rules. In order to support for OPEX cost, laying focus on regulatory solutions which could allow vessel operators to recover the higher OPEX cost related to investment in technologies would therefore need to be identified. The Renewable Energy Directive 2 may provide the legal framework to implement a regulatory solution to make sure that a certain share of the energy provided to inland waterway vessels will be from renewable sources.

However, as closing the TCO gap is key to eliminating the unprofitable top, the grant size to be provided by the fund for investment costs (CAPEX) should be equal to the TCO gap. Any remaining CAPEX (CAPEX-TCO gap) is the volume which can be addressed by loans. Such loans may further decrease the barrier for investments by means of lower interest rates and better access to capital. This could also follow the principles of the CEF Blending programme. Such an approach would result in the following overview for the given scenarios.

Table 3: backing of CAPEX (in million euros)

	Price scenario	Accumulated TCO Gap 30 years	Accumulated CAPEX 30 years	Capex-TCO Gap (absolute numbers)	Potential share loan/own capital in Capex	Share Grant in Capex
Conservative Pathway	Min	2430	5969	3539	59%	41%
	Avg	2646	6649	4003	60%	40%
	Max	6384	7157	773	11%	89%
Innovative Pathway	Min	5257	7884	2626	33%	67%
	Avg	7801	9344	1543	17%	83%
	Max	10186	10443	257	2%	98%

Source: Own elaboration based on results from report RQ C

As indicated, the role of the EIB Group, more specifically EIF, could be to become involved in a dedicated investment platform to provide easier access to repayable loans for vessel owners for the part not covered by the grant. There is an initiative ongoing in cooperation with European Commission DG MOVE where EIF (part of EIB Group) would set-up a guarantee scheme by 2022 supported by InvestEU targeted at financial intermediaries, partly removing the perceived risks of commercial banks in financing investments of a wide spectrum of eligible borrowers, including vessel owners. The EIF, given the characteristics of its business, appears better suited to servicing the needs of Small and Medium Enterprises. This possibility may include intermediated financing. It is also understood that the EIB Group would focus more on financing the infrastructure required for the supply of alternative fuels and energy, as typically larger investments are required in this case.

²⁸ https://ec.europa.eu/clima/policies/innovation-fund_en

Guarantees for loans from EU or on national level could help to lower the threshold for acquiring loans for investments in green technologies. Thresholds may be the share of own capital to be invested, requirements on private collateral as security for the loan as well as financial indicators for the company willing to make an investment such as the profitability and solvability over the past years and the projected revenues and costs for the next years and the risks assessment.

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.

Moreover, the EIB Group will follow the guidelines provided in the Taxonomy regulation Delegated Acts²⁹, which may bring limitations, depending on their evolution. An example of such a limitation in the current Delegated Act for the area of Climate Mitigation is the exclusion of vessels dedicated to the transport of fossil fuels.

Monitoring and regular evaluation should be an important element of the execution phase of the fund.

Indeed, it is essential to understand the cost of the energy transition and the financial gap that must be covered by vessel owners/operators in order to switch from vessels equipped with state-of-the-art propulsion compared to vessels equipped with zero or near-zero emission technology.

This also greatly depends on the emission reduction objective that will be pursued by policy makers for IWT by 2050 (e.g. 90% or 100% by 2050) and the defined pathway and price scenario to achieve such an objective. Of course, it also depends on other accompanying measures, such as more awareness on carbon foot printing in IWT and incentives and pressure on shippers, ports to promote clean IWT.

This requires regular reviews and updates on the BAU scenario and updating the pathways. This includes monitoring of the fleet development (including their engines), cost developments and the emission reduction achieved as well as reviewing emission targets and the accompanying policy measures. This results in updates on the estimated TCO gap. Subsequently, contributions to and expenditures by the fund can be adjusted accordingly.

In addition to the fund, also financial or regulatory solutions would be needed to eliminate the operational advantage of conventional fossil fuels over renewable fuels. There are different instruments which may support this such as the usage of the RED2 directive³⁰ and stimulating the uptake of alternative energy sources for IWT. 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.

²⁹ Texts available on the following website: https://ec.europa.eu/info/publications/210421-sustainable-finance-communication_en#taxonomy

³⁰ Directive (EU) 2018/2001 on the promotion of the use of energy from renewable sources: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2018.328.01.0082.01.ENG&toc=OJ:L:2018:328:TOC

5. Fictional Examples

This chapter presents a **fictional example** of a vessel owner submitting an application to the fund to obtain funding/financing for an investment in a greening technique, fitting into the transition towards the 2050 emission objective. The different steps and considerations are presented below in bullet points:

- We assume the following fleet family/representative vessel: Motor Cargo Vessel (MCV) larger than 110m. We assume a newbuild vessel which needs to invest in a Stage V type approved powertrain by a Swiss entity.
- We assume a funding/financing scheme with a full European coverage including the required bilateral/multilateral agreements with non-EU member states. In other words, an instrument ensuring a completely levelled playing field. Therefore, it should not make a difference whether the beneficiary is based in an EU or non-EU member state.
- Depending on the eventual structure of the scheme, the vessel owner would need to apply for a grant at either a national agency or a central European agency, e.g. directly to the fund manager. It is important that this process is easily accessible and without too many administrative burdens for the vessel owner.³¹ Hence, an option could be to have national/regional contact points representing the central European agency. This would make it more accessible for a vessel owner, if only because of the language barrier experienced by many small vessel owners.
- Based on the average TCO Gap for this fleet family in the period 2025 and 2045, the TCO Gap in the conservative pathway is €167.925.630 in the period 2025-2045 and in the Innovative pathway it is €725.557.096 (assuming an average price scenario). This means that the fund size for the average vessel in this fleet family (690 vessels on average in 2025-2045) is €243.370 for the conservative pathway and €1.051.532 for the innovative pathway (total TCO Gap /number of vessel).

However, this is an average. There should be a differentiation in the funding to be received based on, for example, the expected emission reduction potential given the chosen technique/fuel. So, investments in full zero-emission powertrains may receive more funding as compared to investments in near zero-emission powertrains (combustion engines). Furthermore, a differentiation could also be based on the emission reduction potential in absolute terms (e.g., in total tons CO₂, PM and NO_x per year), so large fuel consumers could receive more funding compared to small fuel consumers. Of course, it should be ensured that this does not result in an adverse effect. An emission label/Energy Index could be used as basis for defining the differentiation.

It could also be considered to fund the CAPEX based on a fixed and variable share. The variable share could be based on the energy consumption of the vessel and related contribution to the emission reduction to be realised by the greening investment.

³¹ The deliverable for RQ F lists recommendations for a tailor-made IWT instrument going into details as the governance, applications procedure and eligible elements. These recommendations should be taken into account.

However, this will make the management of the instrument more complex due to required monitoring and enforcement.

- Given the price uncertainties for fuels and techniques, and the uncertainty about applicability of fuels and techniques for particular vessel types, the fund manager should perform an in-depth yearly update to prices of fuels/techniques and applicability of techniques/fuels for certain vessel types, expected renewal cycles, etc. This would make it possible to have a strong understanding of the fund in terms of expected project applications, expected costs to be funded, etc.
- We assume that in any case the CAPEX is eligible for grants. If the TCO Gap exceeds the CAPEX, then additional measures/incentives are needed to close the OPEX gap. However, this depends on the assumed pricing scenario for the fuels/techniques and the pathway, contributions by public and private parties, exact structure of the funding/financing scheme, willingness of public bodies to develop complementary measures (e.g. yearly refund to close OPEX gap), obligatory blend of renewable fuels, ban on fossil fuels, etc.
- Assuming investment for this specific case in 2025 the CAPEX is:
 - o € 836,078 for an investment in MeOHICE
 - o € 3,114,181 for an investment in H2 Fuel Cell system
- The total TCO for a Stage V Diesel powertrain for 20 years (assumed total lifetime of powertrain) is € 5,739,045 in the BAU scenario. The total TCO for MeOHICE and H2 Fuel Cell system is € 6,880,861 and € 14,469,700, respectively, in the pathways. Concluding, the TCO gap for MeOHICE is € 1,141,816 and for H2 Fuel Cell system it is € 8,730,656.
- Concluding for this fictional case, the TCO gap is significantly larger than the CAPEX. It is therefore expected that in any case the total CAPEX needs to be funded for a 100% by the fund (earmarked contributions + public funding). The question is how the remaining gap in the TCO costs will be funded, and into what extent. The CAPEX grant would only cover 73% of the total TCO gap in case of an investment in MeOHICE and 36% in the case of the H2 Fuel Cell system.
- The CCNR study took the total fleet as a starting point, hence all the calculations are based on a fleet level. The conclusion is that the total TCO Gap needs to be funded. However, for an individual case, this may deviate depending on the vessel type, chosen technique/fuel, additional measures in place by public bodies, expected emission reduction potential, differentiation measures, etc.

6. Further considerations

The points indicated in the Fictional Example (previous chapter) clearly show the complexity and the further decision making which needs to take place³².

In particular, the following questions should be answered when reflecting about the implementation of a possible European funding and financing scheme:

- Ambition level and choice for one of the two pathways, or an alternative new one? Possibly a mix of other policy measures and a fund?
- Will there be additional measures with an impact in realising the emission objective in 2050 and as such also having an impact on the TCO gap and the fund size requirement (for grants). This could be non-financial measures taken by public bodies or the industry itself (e.g. by shippers)? And how to ensure that the fund interacts with the results of these additional measures?
- Whether there will be an earmarked contribution by the sector and at what level, what revenues to be expected and for which time period? What specific amendments to the existing legal framework are necessary to allow the raising of funds from vessel operators? The existing legal bottlenecks for the introduction of such a contribution will need to be addressed first.
- Will there be a fund and corresponding long-term program, either with a centralised or decentralised structure (e.g. fund with decentral contribution by public bodies or centralised in which the fund consolidated all the contributions (earmarked contribution from the sector and from public bodies))?
- What will be the structure of the foreseen fund and what will be the roles (e.g. fund manager, administration, etc.), and who will perform these roles?
- What is the geographic scope? Will there be a full European scope, including also non-EU Member States? What is the scope in terms of vessel types and markets (freight, passenger, also other vessels (e.g. mobile equipment)? Will there be a different scope between providing grants and loans, or can it be the same?
- What to be expected from public bodies in terms of funding contributions to the fund? This is a key question as the relative amount of grants versus repayable financial products (loans, guarantees, etc.) will have a huge influence on the design of a fund, its modalities and governance structure.
- What would be the agreed duration of the fund, can it be 2050 to structurally support the transition towards (near) zero-emission in 2050?
- Which prices to assume for techniques and fuels and for which period (1 year/5 year/...?) for setting up the offer to the vessel owners for the first. I.e., the fund needs to be able to make a good estimation of the expected costs for the expected applications in the first

³² Indeed, all the reports drafted in the context of this CCNR study allow to shed light on possible economic, technical, legal and practical feasibility questions that remain to be addressed with regards to the creation of a European funding and financing scheme and which should take place in the context of a wide-ranging discussion process at Rhine, European and international level.

phase, in order to match this with an adequate volume of grants and the corresponding funding rate. The fund manager needs to know at which funding rate, the vessel owner will decide to make the step towards the investment.

- Which investments will be eligible? Only focus on CAPEX, or also OPEX? While this fund should be technology neutral, depending on the size of the fund and its funding capacity, funding priorities will need to be agreed between the contributors of the fund.
- Would it be possible to apply to the scheme through national or regional agencies? Or would the application process be made directly to a Central European agency?
- Will there be a differentiation, if yes based on, which criteria and with which magnitude? Would such a differentiation address both the contribution by the sector and the provided grant rates/levels by the fund? On which basis (label, energy index, Taxonomy...)? This would be particularly relevant in cases where a vessel owner has already invested in greener vessels.
- How to structure the eligibility conditions and co-funding rates of companies and moreover the assets? Will this take into account where the asset is registered, where it needs to be deployed and for how long?
- What are contractual conditions to provide a grant to the vessel owners (e.g. with respect to the operation of the vessel, keeping the equipment on board / stable ownership for a certain time period...)³³

³³ E.g. in CEF the following applies as condition: Vehicles concerned must have been authorised for operation in at least 1 Member State before the submission of the proposal. CEF-funded vehicles must remain and operate in EU/EEA territory for at least 5 years following the action completion (transit through non-EU/EEA countries does not compromise this obligation). The rules above apply to vehicles used for public passenger transport and other categories of transport (2014 ERTMS FAQ 1.10). Mobile equipment supported by the CEF grant must remain registered & operated in an EU Member State for at least 5 years. Example: retrofitting of vessels to use alternative fuels or conversion for LNG bunkering (2015 Innovation FAQ 14)

Annex I

The analysis in chapter 4 of the deliverable for RQ G and H shows that the legal framework is complex and that not all sources of law allow for the introduction of a sector contribution based on the polluter pays principle. In essence, the European legislation does explicitly allow for such a contribution (see Article 191 TFEU). However, the scope and details of such a contribution need to be further specified in a new legislative act (either regulation or directive) in order to come in force.

Adopting EU law might pose conflicts with law issued by river commissions and countries not being a member to the EU. In Table 4, for each main actor a summary is provided, indicating whether the introduction of rights (e.g. fees, charges, tolls etc.) is allowed under the legal frameworks, whether the legal frameworks allow for the introduction of a contribution based on the PPP and how an EU initiative would work with the other legal framework.

Table 4 : Overview of possibilities to introduce a sectoral contribution based on PPP³⁴

	Possibility for rights on navigation	Possibility for PPP	Link with EU
Rhine	No – see Article 3	No, difficult to align with Article 3	For EU law to apply on the Rhine check with Mannheim act is needed. CCNR is able to issue binding rules for all Signatory States.
Danube	No – See Articles 1 + 42	In principle no, unless all 11 countries agree	EU law only applies to 7 countries. Danube Commission cannot oblige other 4 to consider as well
Sava	Yes, but earmarked	Yes, but currently only for water pollution	EU law only applies to two countries. Sava Commission could issue binding rules based on EU law which apply to all.
Moselle	Yes, but earmarked	Yes, but only if Signatory States wish to do this	All countries are EU Member States, so EU law will apply
Switzerland	No specific charges	No legal basis in place	Not an EU Member State. Also no agreement to adopt EU law. Nevertheless, when initiative is adopted by both EU and CCNR, rules will apply.
Ukraine	No specific IWT law yet (upcoming).	No legal basis in place	The Association Agreement should be reviewed.
Serbia	No specific charges	Not applicable to IWT, but possibility exists	In the process of becoming an EU Member State. Serbia should implement new EU law.

³⁴ This table refers to the results from the deliverable for RQ G and H which was delivered by October 2020. Please note that in the meantime specific IWT legislation has been approved in Ukraine.

An EU initiative will not cover all countries connected to European waterways. This means that the initiative will most likely not cover all vessels using those waterways. This will lead to a disruption of the level playing field within the IWT sector. One possibility to extend the scope of the initiative to non-EU Member States as well, is by creating a new international convention. The different river commissions together with the European Commission could play a role in drafting the convention and ask active support of their Signatory States to support the convention. Once the convention is concluded, each country should ratify the convention.

Annex II

Table 5: Annual investment costs (CAPEX) in Million € in the BAU and the two pathways per year and the total accumulation over 30 years

		2020 to 2025	2025 to 2030	2030 to 2035	2035 to 2040	2040 to 2045	2045 to 2050	Total
BAU	Minimum	134	104	102	98	38	34	2.549
	Average	137	110	103	99	40	35	2.624
	Maximum	140	107	104	101	41	37	2.648
Conservative Pathway	Minimum	148	151	239	229	220	208	5.969
	Average	152	164	258	261	253	242	6.649
	Maximum	156	156	277	292	284	265	7.157
Innovative Pathway	Minimum	189	190	328	315	293	262	7.884
	Average	208	216	381	375	357	332	9.344
	Maximum	227	217	430	431	412	372	10.443

Source: report RQ C

Table 6: Annual OPEX in Million € in the BAU and the two pathways per year and the total accumulation over 30 years

		2020	2025	2030	2035	2040	2045	2050	Total
BAU	Minimum	875	844	858	895	934	925	911	26,751
	Average	942	923	956	1,034	1,118	1,052	1,029	30,231
	Maximum	1,009	1,001	1,043	1,172	1,303	1,287	1,263	34,620
Conservative Pathway	Minimum	875	896	883	900	907	857	781	26,138
	Average	942	982	1009	1036	1045	945	863	29,238
	Maximum	1009	1080	1135	1300	1421	1390	1308	37,037
Innovative Pathway	Minimum	875	909	898	907	887	804	677	25,529
	Average	942	1003	1029	1072	1089	998	895	30,125
	Maximum	1009	1107	1155	1326	1382	1304	1147	36,133

Source: report RQ C

Table 7: TCO in Million € in the BAU and the two pathways per year and the total accumulation over 30 years

		2020	2025	2030	2035	2040	2045	2050	Total	Total GAP with BAU
BAU	Minimum	877	901	956	1.033	1.108	1.115	1.115	30.443	-
	Average	944	981	1.059	1.174	1.296	1.246	1.238	34.026	-
	Maximum	1.012	1.060	1.145	1.314	1.483	1.484	1.476	38.461	-
Conservative Pathway	Minimum	877	959	1.012	1.139	1.219	1.241	1.223	32.873	2.430
	Average	944	1.048	1.162	1.288	1.383	1.370	1.362	36.672	2.646
	Maximum	1.012	1.145	1.279	1.559	1.782	1.847	1.840	44.845	6.384
Innovative Pathway	Minimum	877	997	1.069	1.256	1.368	1.403	1.360	35.701	5.257
	Average	944	1.101	1.231	1.455	1.631	1.689	1.708	41.827	7.801
	Maximum	1.012	1.210	1.352	1.723	1.975	2.058	2.022	48.646	10.196

Source: report RQ C

Study consortium:



In partnership with:



Throughout the project there were exchanges with the CCNR, the steering Committee composed of representatives of CCNR member States and a stakeholder group consisting of :

European Commission (DG MOVE)
Danube Commission
Mosel Commission
European Investment Bank (EIB)
European Investment Advisory Hub (EIAH)

Clinsh
European Barge Union (EBU)
European Federation of Inland Ports (EFIP)
European Shippers' Council (ESC)
European Skippers Organisation (ESO)
IWT platform
Shipyards and maritime equipment association of Europe (SEA Europe)
Association for inland navigation and navigable waterways in Europe (VBW)

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