



STEERER

STRUCTURING TOWARDS ZERO EMISSION
WATERBORNE TRANSPORT

D3.6 Results of the Fourth Consultation Phase: R&I Agenda & Implementation Plan



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List of abbreviations

BAU – Business As Usual

CCS – Carbon Capture and Storage

CEF – Connecting Europe Facility

CINEA – European Climate, Infrastructure and Environment Executive Agency

CCNR – Central Commission for the Navigation of the Rhine

cPP ZEWT – Co-Programmed Partnership on Zero-Emission Waterborne Transport

CSA – Coordination and Support Action type of project

EC – European Commission

EMFAF – European Maritime, Fisheries and Aquaculture Fund

ETS – Emission Trading System

EU – European Union

FF 55 – 'Fit for 55' package (set of proposals to revise and update EU legislation)

GHG – Greenhouse Gas

GSEG – Green Shipping Expert Group

GT – Gross Tonnes

H2 – Hydrogen

HEU – Horizon Europe

IA – Innovation Action type of project

IEC – International Electrotechnical Commission

IMO – International Maritime Organization

ICE – Internal Combustion Engine

IWT – Inland Waterway Transport

KPI – key performance indicator

LNG – liquefied natural gas

LPG – liquefied petroleum gas

OPS – Onshore Power Supply

RD&I – Research, Development & Innovation

RES – Renewable Energy Sources

RIA – Research and Innovation Action type of project

SAF – Sustainable Alternative Fuels

SC – Scientific Committee

SRIA – Strategic Research and Innovation Agenda

SWOT – Strengths, Weaknesses, Opportunities, and Threats (analysis)

TRL – Technology Readiness Level

WAPS – Wind-Assisted Propulsion Systems



1. Introduction

STEERER (Structuring Towards Zero Emission Waterborne Transport) coordinates the establishment and communication of a Strategic Research and Innovation Agenda¹ and an Implementation Plan **towards zero-emission waterborne transport, in cooperation with all key stakeholders needed to facilitate the transformation to clean waterborne transport.** In the definition of STEERER, as well as cutting greenhouse gas emissions, all harmful environmental emissions, water pollution and noise emissions have to be eliminated. STEERER's mission is to bring the various initiatives and sectors' stakeholders together to join forces for a combined effort with the maximum impact on the climate, people's health and Europe's economy.

STEERER is coordinated by SEA EUROPE counting with the participation of a total of eight partners from six EU countries.



Figure 1: STEERER's Partners

¹ The STEERER project will provide input to the Waterborne TP regarding the development and update of the Strategic Research and Innovation Agenda of the Candidate Co-Programmed Partnership on Zero-Emission Waterborne Transport in the framework of Horizon Europe (https://ec.europa.eu/info/sites/info/files/research_and_innovation/funding/documents/european_partnership_for_zero-emission_waterborne_transport.pdf).





In sum, STEERER aims to:

- Jointly set emission targets towards 2050 (including targets for 2025 and 2030);
- Contribute to the update of the Strategic Research and Innovation Agenda of the Co-Programmed Partnership on Zero-Emission Waterborne Transport (cPP ZEWT)² in the framework of Horizon Europe (HEU), to be able to reach these targets in time;
- Develop an Implementation Plan to reach the targets in due course while staying competitive and offering a valid business case;
- Develop and implement a communication campaign, aimed at broader awareness of the waterborne transport sector and its commitment towards zero-emission transport, to become a fully sustainable mode of transport;
- Monitor and assess the implementation of the Strategy defined and adapting where necessary, after the project's conclusion, by the Green Shipping Expert Group.

The consortium functions as a Secretariat, where the broader expertise is involved in the **Scientific Committee (SC)** and the **Green Shipping Expert Group (GSEG)**³ established by the project.

STEERER is funded by the European Commission (EC) research and innovation programme Horizon 2020, with an investment of 1.5 million euros over 36 months, starting in December 2019. STEERER plays an important role in the preparation and execution of the co-programmed Partnership on Zero-Emission Waterborne Transport which is established in the context of the new programme for Research and Innovation: Horizon Europe.

² https://www.waterborne.eu/images/documents/201021_SRIA_Zero_Emission_Waterborne_Transport_spread.pdf

³ <https://www.waterborne.eu/projects/coordination-projects/steerer/green-shipping-expert-group/member-list?view=members>



2. Task overview

The fourth phase of the consultation process served to gather input and expert opinions to review and validate two key deliverables of the STEERER team. Specifically, the consultation focused on two main outcomes of the project, i.e., a proposed set of instruments and interventions to increase the uptake and dissemination of RD&I outcomes (D2.4); and the STEERER Advice on the 2nd ZEWT Research Agenda and its Implementation Plan (D2.7).

The work on the public policy instruments and interventions and other appropriate mechanisms and incentives to increase the take-up and deployment from RD&I activities (D2.4) was based on selected outcomes of the SWOT analysis resulting from a previous assessment of the STEERER team of the Partnership's Intervention Areas and their measures (see D2.3 Areas of intervention and related actions - "implementation plan"), and subject of the GSEG third-round consultation (see D3.5, the report of that meeting). This part of the consultation was therefore heavily based on the internal research and analysis carried out by the STEERER team during the spring and summer 2022, including the initial review with the Scientific Committee (SC).

The second part of the consultation was based on the Advice on the 1st ZEWT Research Agenda and its Implementation Plan (D2.5) which was finalised in summer 2022. The objective of the fourth round of consultations was to receive inputs and comments from the GSEG members on the key sections of the Advice (targets, actions and RD&I projects) and validate the updated version of the Advice on the 2nd ZEWT Research Agenda and its Implementation Plan (D2.7).

In sum, the main tasks for the consultation with the GSEG were to:

- 1st task: review, advise and validate a proposed set of **public policy instruments and interventions and other appropriate mechanisms, to increase the take-up and deployment from RD&I activities** (D2.4);
- 2nd task: discuss and validate the **decarbonization targets per ship type** (D2.7);
- 3rd task: review and advise on a list of **actions from the cPP ZEWT six areas of intervention to achieve zero-emission targets** (D2.7);

- 4th task: advise on the **lessons learnt from the RD&I projects** and help **prioritise future research** (D2.7).

The outcomes of tasks 2 to 4 had subsequently been used by the STEERER partners to create the final version of D2.7.

The tasks are in line with the STEERER consultation process, as originally conceived at the project outset, as shown in figure 2.

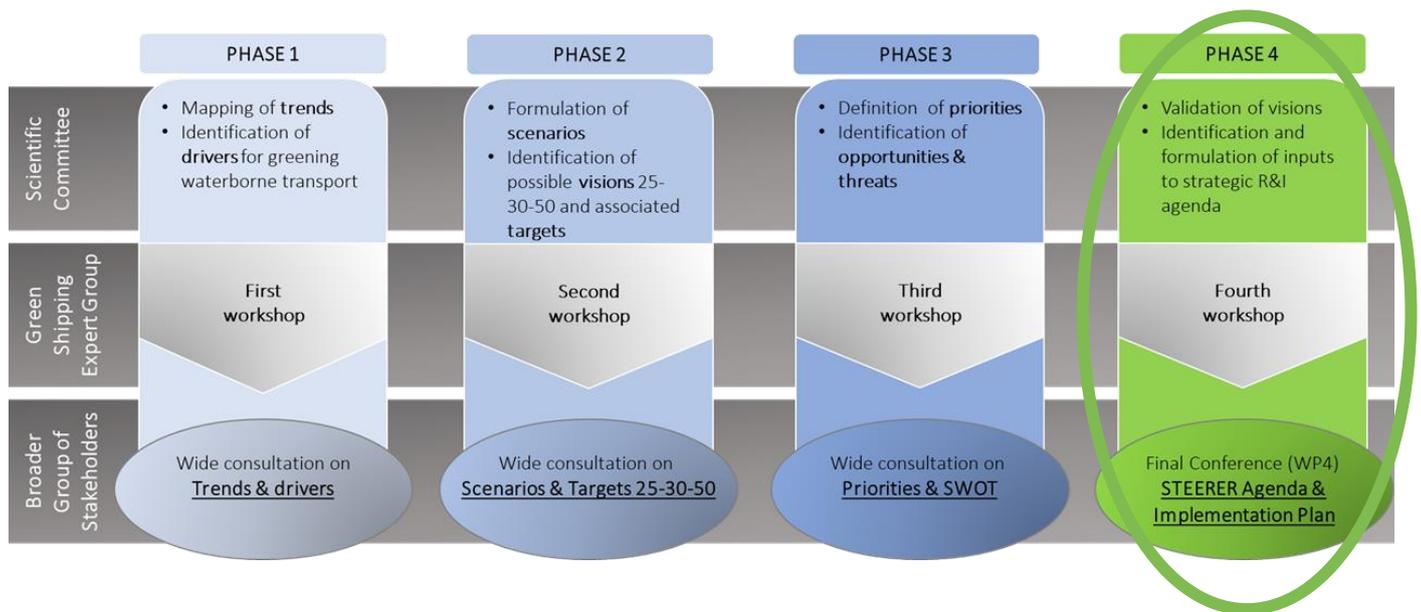


Figure 2. STEERER Consultation process overview.

Compared to previous rounds, this fourth and final round of consultations did not include a broader consultation with a larger number of stakeholders. In this case, the results were directly incorporated in the final version of both D2.4 and D2.7, and some of them also presented at the STEERER final conference which took place in Antwerp on 12 October 2022.

3. The Fourth Phase of the Consultation Process

The fourth phase of the consultation consisted of two distinct moments, each focusing on one of the two final deliverables that were the subject of the debate (D2.4 and D2.7). In both cases, the SC played a key role in revising the STEERER work and in preparing for the involvement of the GSEG.

1. Consultation on the Public policy instruments –GSEG review via email;
2. Consultation on the Advice to the SRIA – workshop with the GSEG – in person.

The following sections present in detail the discussion topics for each step of the consultation and provide for an overview on how the process was structured and how the GSEG members were involved.

3.1 Consultation on the Public Policy Instruments and Interventions (D2.4)

Public policy instruments and interventions and other appropriate mechanisms and incentives are key elements necessary to increase the take-up and deployment from RD&I activities since viable business cases are rarely found in the sector when it comes to zero emissions in waterborne transport technologies. This is since greening is currently still more driven by the political motivation than by the commercial interests. To close this gap, public policy instruments and interventions are essentially needed to achieve the climate goals.

A complex and thoughtful set of regulatory and non-regulatory instruments or combinations of instruments that may be used to boost the take up and deployment of RD&I activities was compiled by Pro Danube, in cooperation with the consortium partners. The elaboration was based on selected outcomes of the Strengths, Weaknesses, Opportunities and Threats (SWOT) analysis resulting from previous work of the STEERER team and subject of the third-round consultation (see D3.5). The potential instruments have been identified for four out of the six intervention areas of the cPP ZEWT (Use of Sustainable Alternative Fuels; Electrification; Energy-Efficiency; and Digital Green), while

Design & Retrofitting and Ports had been included as ‘transversal’ aspects in the four intervention areas listed before.

The instruments and interventions identified have been grouped in the following categories:

- Regulations;
- Incentives;
- Taxes and charges;
- Other instruments.

The draft of the analysis (D2.4) was reviewed by the **Scientific Committee (SC)** via email during June 2022. The aim of the exercise was to validate the existing structure and information, improve it and also prepared the GSEG review of the updated document version. The inputs received from the Scientific Committee were considered important on the higher level, which led the STEERER team to list those key aspects as a separate chapter in the final deliverable, under the heading ‘General findings’.

On 26 July 2022 the **GSEG members** received an invitation by email to review and contribute to the updated work. The draft of D2.4 resulting from the consultation with the SC was shared with the GSEG, together with a matrix providing details of the proposed instruments for each action of the intervention areas. The consultation was open for a month, until the end of August 2022.

Valuable concrete inputs were received as a result of the consultation, which have been incorporated in the final version of the deliverable D2.4, and those inputs which were received from the SC and the GSEG additionally to the original draft were clearly marked in the text to emphasise the added value and the reference to business cases from the field.

The final deliverable D2.4 “Public policy instruments and interventions and other appropriate mechanisms, incentives and business models to increase the take-up and deployment from R&I activities” was submitted to the European Commission and its findings were also considered in conjunction with the subsequent STEERER work, in

particular in the Advice to the 2nd ZEWT Research Agenda and its Implementation Plan, which constitutes the next and final step of the STEERER consultation process.

3.2 Consultation on the STEERER Advice to the SRIA (D2.7)

Based on the results of previous consultation rounds, an Advice on the 1st ZEWT Research Agenda and its Implementation Plan (D2.5) had already been finalised in summer 2022. This document served also as the draft version of the STEERER 2nd Advice (D2.7), and thus as the basis for discussion in this last round.

During the meeting, the experts of the Green Shipping Expert Group were updated on the further analysis carried out and information gathered by the consortium since the last round of consultations and made aware of the key messages of the advice in D2.5. In particular, the key points for discussion related to the (1) decarbonisation targets per waterborne transport segment identified in the implementation pathways of the cPP ZEWT and on the (2) priority actions under the six Intervention Areas of the Co-Programme Partnership on Zero Emission Waterborne Transport (cPP ZEWT) to achieve the decarbonization targets. An additional point of discussion was related to the (3) lessons learnt from the EU RD&I projects financed by the European Commission in the sector.

The objective of the fourth round of consultations was therefore to invite the GSEG members to address the key sections of the draft 2nd ZEWT Research Agenda and its Implementation Plan (D2.7) (targets, actions and RD&I projects), validate its content and/or provide further insights based on the latest technical, commercial and research developments in the sector, and adjust and complete the final messages.

a. The Meeting with the Scientific Committee

A dedicated meeting with the Scientific Committee took place on the 30th of August 2022 and was focused on the preparatory work made by the STEERER team in view of the consultation with the GSEG. Namely, the SC discussed the content and figures of D2.5 'Advice on the 1st ZEWT Research Agenda and its Implementation Plan' in relation to decarbonisation targets per waterborne transport segment, priority actions from the six

areas of interventions previously identified, and a first analysis of the lessons learnt from EU-funded RD&I projects.

The aim was to decide which of the key pieces of information should be submitted to the GSEG for consideration and in what form.

b. The Fourth Meeting of the Green Shipping Expert Group

The fourth meeting with the Green Shipping Expert Group was organised in person on 21-22 September 2022 in Brussels. A further online meeting was then held on 25 October 2022 to discuss the part of the agenda that could not be done in person.

As mentioned above, the main input requested from the audience was on how to update the SRIA, based on the document “STEERER Advice to 1st ZEWI Research Agenda and its Implementation Plan”, which was distributed to participants prior to the meeting.

Most members of the Green Shipping Experts Group attended both meetings and actively contributed to the discussion (see list of participants – Annex 2), and/or provided remote feedback via e-mail.

In addition to an introductory session, the meeting was structured around four key discussion blocks, three of which reflected the work of D2.5 (targets, actions and RD&I projects) and a final one examining potential opportunities for the future of the GSEG group (see Agenda – Annex 1).

- A. INTRODUCTION
- B. The ZEWI TARGETS
- C. The AREAS of INTERVENTION
- D. The EU RESEARCH & INNOVATION AGENDA
- E. The WAY FORWARD

A. INTRODUCTION

The introductory session included several presentations by the STEERER coordination team and a keynote speech by the European Commission.

Welcome and objectives of the meeting



The meeting was opened by ISINNOVA, the STEERER partner in charge of the consultation process. After welcoming the participants and sharing the pleasure of finally meeting in person after the restrictions of the pandemic, an overview of GSEG's role within the STEERER consultation process was given, emphasising the importance of the expert opinions in compiling the official project documents.

The GSEG members were also given a brief overview of the work done so far, the results (deliverables) of this work and the latest actions to be taken, in particular the revision and contribution to the STEERER D2.5/D2.7 deliverables.

The agenda of the meeting was then presented in detail, highlighting the key topics to be discussed.

Finally, the audience was made aware of the 'rules of the game', i.e. how the discussions will be conducted. The ideas that emerged during the workshop will be included in the advice regarding the SRIA update.

EC Keynote Speech

Agnieszka Zaplatka (EC, DG RTD) underlined the fact that waterborne transport and the associated RD&I activities are at the heart of the EU transport and decarbonization policies. That is why the main instrument for waterborne transport RD&I funding and activities is the newly-created ZEWT Partnership, which had been shaped in accordance with these policies. As for STEERER, though the project had started before the Partnership came to life, their objectives are similar. That is why STEERER is now acting as support to the Partnership developments and the interaction between the two initiatives is very important.

She then informed the participants about the forthcoming Horizon Europe (HEU) waterborne transport calls and provided some additional information on the available EU funding schemes. Despite the great achievements in the inclusion of the waterborne transport sector in EU programmes, there is a perceived lack of financial support to intervene in the short term and achieve the stringent emission targets.

During the discussion that followed with the GSEG and the STEERER partners, the following main points were mentioned:

- the European funding scheme for research and development – Horizon Europe – is mainly intended for projects with a low to upper-middle technology readiness levels (TRLs), as the needed research budget outweighs the funds available for demonstrations, especially when a significant part of the funding is based on depreciation costs as is common in Horizon programmes. Another financial scheme – the Innovation Fund – is more appropriate for demonstration activities (e.g. ship testing) and further deployment;
- the EC funding rules will change no earlier than 2025, but better links will be created between the HEU and the Innovation Fund. In this regard, the inclusion of maritime shipping in the Emission Trade System (ETS) could lead to a positive change for that part of the waterborne transport sector, as it may result in an additional budget for RD&I and deployment via the Innovation Fund. The EC is already creating an environment within the activities of the European Climate, Infrastructure and Environment Executive Agency (CINEA) for greater interaction between the various programmes;
- some clarification was given on the inconsistency over time of the EC definition of (near to) zero emissions, including the comparison between now and when STEERER was initiated. The EC tries to keep the definitions as consistent as possible, but some aspects change as a result of stakeholder consultations. It is therefore recommended to use the definitions of the FuelEU Maritime proposal;
- the inclusion of LNG and nuclear in the definition of zero emissions had caused confusion and concern among some stakeholders. The EC is aware of this, which is why it recommends that all stakeholders aim for ‘true clean fuels’ and other forms of clean energy (e.g. electricity) from renewable energy sources;
- it was again made clear that wind propulsion also falls within the scope of the ZEWT partnership and has already received funding in previous calls and will get attention in the upcoming calls.

STEERER Updates and Final Objectives

WaterborneTP reminded the participants about the origins of the ZEWT Partnership: it is a common effort of the WaterborneTP and its (now) approximately 120 members from 19 Member States, and 3 Directorates-General of the European Commission (Research & Innovation, Mobility & Transport, Climate Action). Moreover, the entire waterborne transport sector is consulted at different moments in time for the Partnership developments to fulfil the waterborne transport sector's very high ambitions for 2050.

STEERER supports both the update of the ZEWT Strategic Research and Innovation Agenda (SRIA) but also other activities – e.g. the input regarding the decarbonization targets to the International Maritime Organization (IMO) discussions for the revision of their GHG reduction strategy delivered by BALance (15th of September). The information developed in STEERER also helped other ambitious activities from WaterborneTP. This includes among others, the exchange of technical and legal expertise on topics such as the PLATINA3 project with the Central Commission for the Navigation of the Rhine (CCNR), an important regulatory body for the IWT sector, and the presence of STEERER in the SMM Hamburg event (6-9 September 2022), where a high-level meeting between the EC and sector representatives had been organized as well.

A detailed overview of the STEERER deliverables and actions during 2022 was also presented, followed by an overview of the topics to be discussed during this last GSEG meeting, especially the advice for the ZEWT SRIA based on the documentation circulated before the meeting (D2.5).

With STEERER coming to an end in 2022, a mandate from the project is to ensure continuity of the GSEG and the involvement of the members in the future updates of the ZEWT SRIA. In this context, the intervention ended by a short reference to the Horizon2020 and Horizon Europe projects, respectively, PLATINA3 and NEEDS, which represent the first opportunities in the post-STEERER set of activities.

B. The ZEWT TARGETS

This part of the agenda was not discussed during the in-person meeting in Brussels, but a dedicated session was organised online on 25 October 2022. The aim was to present and

discuss the updated decarbonization targets and their allocation per each ship type as described in the ZEWT SRIA.

The decarbonization targets had been developed by BALance with support from the other consortium members and their draft versions were the subject of the second round of GSEG consultation, during the meeting of the 8th of October 2021, and reported in deliverable D2.2 Scenarios with quantified targets for 2025, 2030 and 2050 - “Common stakeholder target scenarios”.

The objective of –this fourth round of consultations was to update, improve and/or correct the information and validate the contents that will be taken up in the advice to the SRIA.

The starting point for the ‘carbon budget’ approach is based on:

- the estimated amount of carbon budget (420.000 MtCO₂) left to stay below the 1,5°C global warming target, as calculated for the 2015 Paris COP 21;
- the IMO 4th GGHG Study in 2020 which revealed that shipping accounts for approx. 2,89% of the global CO₂ emissions;
- the amount of the yearly shipping emissions – 1054 MtCO₂ – from the same IMO study;

Based on the above points, the consortium could calculate the remaining carbon budget for the waterborne transport sector – approx. 8970 MtCO₂.

The MRV 2018-2020 data were used as the baseline for the current calculations of the carbon budget/decarbonization targets per ship type for seagoing vessels. Although the MRV covers only EU data for seagoing vessels, the consortium decided to extrapolate it for the calculations for the global waterborne transport sector due to the lack of such data from other regions. For inland vessels in Europe separate calculations and estimations were made, since IWT is not in scope of MRV requirements, while also pointing towards targets as developed by CCNR in view of their Roadmap for reducing inland navigation emissions⁴. IWT in Europe is also a relatively small contribution to CO₂ emissions in the

⁴ For more information: <https://www.ccr-zkr.org/12090000-en.html>

overall global waterborne sector. The IWT volume is estimated at 4.53 MtCO₂ /year, which is a share of 0.43% in the overall global Waterborne Transport segment.

In addition, the decarbonization impacts of the relevant proposals from the 'Fit for 55 package' (FF 55) were assessed.

Furthermore, the STEERER partners considered in this approach that the waterborne transport sector should be able to take care of its own emissions' reductions and not rely on positive developments in other sectors that would offset 'extra' emissions coming from waterborne transport.

It was thus calculated that maintaining the same emissions' rate as in the IMO study would deplete the waterborne transport sector carbon budget in approx. 7 years.

Three main scenarios had been considered for the coming efforts to decarbonize:

- business as usual' (BAU): the sector's carbon budget will be depleted in 2027;
- the FF55 package emissions reductions: the reduction in emissions is large, yet the zero-emissions target by 2050 (or 1.5° C target) will not be achieved by the sector;
- the Paris 1.5° C target, which means achieving zero-emissions some years before 2050, will require a very steep and sudden decrease of emissions in the decade to come.

Carbon capture and storage (CCS) may be used to rebalance the waterborne transport sector's carbon budget and in general to repair the damage done to the environment. However, it will come at a very high cost – hundreds of billions of € per year around 2050 even with a CCS price of only €50/t, namely a ten-fold decrease from today's price/t.

Subsequently, the emission reduction targets per ship type (over 5000 gross tonnes (GT) for maritime) – long distance transport, cruise, ferries, IWT, short-sea shipping and off-shore vessels – were presented and explained to the GSEG.

As STEERER partners' intermediate conclusions, current initiatives and actions at the European and international level are not ambitious enough to achieve the 1.5° C target; the transition to decarbonization needs to happen more assertively.

C. The AREAS of INTERVENTION

KBRV introduced the session. The objective was to discuss the actions within the SRIA intervention areas contained in D2.5 and to come to an agreement on a final list of priority actions and their potential ranking.

The session required active interaction with the participants. All recommendations per intervention area were printed on A3 sheets and presented to the experts. The GSEG members were asked to indicate whether the actions listed were still relevant and if so, which ones should be prioritized under Horizon Europe or the Innovation Fund. For each area of focus, a (volunteer) speaker was chosen from the GSEG members, who highlighted key actions where there was no unanimity.

A colour scheme was applied for the interactive exercise:

Green = prioritize under Horizon Europe

Yellow = prioritize under Innovation Fund

Red = outdated

The following tables are some examples to show the actions presented and the overview of how the colour code was used by the participants in their review.

Key actions		
T	Further upscaling of demonstrator projects to identify the benefits of the different fuels (Priority).	Yellow
T	Development/ further optimization of after-treatment systems to (nearly) eliminate all types of air pollutants (not CO ₂) for traditional fuels, as well as for some technologies converting sustainable alternative fuels. (Focus on the most harmful ones first). There is a big fleet of existing ships where it will not be economically viable to switch to clean SAF through retrofit. These vessels will rely on biodiesel and thus need enhanced aftertreatment systems to capture harmful air pollutant emissions such as soot, particulate matter and NO _x .	Green
T	Investigate the reliability and cost of fuel cells in the waterborne transport environment (tilting, acceleration, vibrations, etc.).	Yellow
R	Class guidelines/ES-TRIN are/is yet lacking provisions for the use of hydrogen and therefore need to be updated/adjusted where needed to facilitate the use of sustainable alternative fuels. This can, e.g. be achieved by addressing the guidelines and technical regulations in current/new IA and RIA projects under Horizon Europe	

	that are focusing on the use of sustainable alternative fuels taking into account the different waterborne transport segments.	
R	Address full life-cycle emissions when assessing a fuel (upstream + downstream for all harmful emissions).	
R	Fire- & safety regulations (training, operational rules, vessel design, etc.) need to be developed/updated where needed to facilitate the use of sustainable alternative fuels and guarantee safety.	
R	Setting up of a regulatory framework regarding onboard storage and propulsion related to the new fuels (the IWT case).	
R	Development and implementation of regulations for operating SOFC on board of a vessel.	
R	Internationally standardized WtW information on bunker notes.	
B	Insights in the cost comparison and broader impacts (e.g. loss of cargo space, bunkering time, etc.) between the different options for sustainable alternative energy as fuel and energy convertor – internal combustion engines (ICE) or fuel cells (FC) – for different vessel types and operational profiles.	

Key action		
T	Investigate, demonstrate & deploy the possibility to use reforming techniques to generate hydrogen onboard of the ship from different energy carriers (MeOH, NH ₃ , etc.).	
T	Investigate, demonstrate & deploy the maintenance needs of different hydrogen storage systems and interoperability of mobile hydrogen storage systems.	
T	Investigate, demonstrate & deploy the optimal tank type selection for different operational profiles.	
T	Clarify & demonstrate capabilities with regards to load variation and low load operations.	
T	Assess operational fit with regards to energy efficiency / density.	

Key action		
T	Further development and testing of ammonia ICE: <ul style="list-style-type: none"> - Determine optimal amount of pilot fuel (diesel: NH₃ or H₂:NH₃); - Determine when and where the fuel will be mixed with the pilot fuel; - Determine effective and efficient engine management and aftertreatment (risk of ammonia slip and laughing gas). 	
T	Upscale ammonia fuel cell demonstrators – current limit 5 megawatts (MW)).	
T	Further investigate optimal storage solutions.	
T	Investigate the feasibility of ammonia cracking to hydrogen for reducing on-board hydrogen storage requirement/increasing vessel range.	
T	Investigate alternative for operational venting (will it be acceptable to venting NH ₃ to atmosphere?).	

Key actions		
T	Developing more DC components to improve the energy efficiency.	
T	Research needed to bring down the volumetric and gravimetric density of battery technology for storage onboard to make it modular and standardised and competitive with conventional fossil diesel. This could result in other types of hydrogen carriers and convertors and new types of electricity storage technology than the ones used today.	
T	Demonstration of the battery design life in operational conditions	

The EU Research & Innovation Agenda

The session on analysis and lessons learned from EU RD&I projects was introduced by WaterborneTP. It was emphasised that there is a wealth of information and developments from EU-funded RD&I projects in the field of waterborne transport, in particular from H2020 but also from FP7. These projects not only contributed to the advancement of various technologies, but also paved the way for the ZEWT cPP.

WaterborneTP already has a non-exhaustive list of these relevant projects in its database, and the action taken in the context of STEERER was to map this current database against the SRIA intervention areas and to analyse the results.

The initial analysis had yielded the following results:

- on the ‘Energy Efficiency and Zero Emissions’ WAT topic – covering the intervention areas: ‘Use of Sustainable Alternative Fuels (SAFs)’, ‘Electrification’, ‘Energy Efficiency’ of the ZEWT SRIA – there are 15 Innovation Actions type of projects (IA), 14 Research and Innovation Actions type of projects (RIA) and 13 SME instrument type of projects (4 SME-1 and 9 SME-2) projects. This is by far the largest category in terms of both project numbers and overall funding received;
- on the ‘Digitisation & automation’ topic – covering the ‘Digital Green’ of the ZEWT SRIA – there are 3 IA and 2 RIA projects;
- on ‘Ship Design and Production’ – covering the ‘Design & Retrofitting’ of the ZEWT SRIA – there are 10 IA, 4 RIA and 4 SME-2 instrument projects. The ‘Ship

Design' project group displays the 2nd biggest concentration of high-TRL projects, the 'Off-shore' category of projects being the first one, especially if considering the SME instrument in this count. However, the Off-shore is much smaller and only partly covering the ZEWT scope. Therefore, the biggest proportion of high TRLs had been achieved or is about to be achieved within the 'Ship Design and production' type of projects;

- on 'Off-Shore Multi-Use' – covering the 'Design and Retrofitting' and 'Electrification' topics from the ZEWT SRIA – there are 3 IA, 1 RIA and 1 SME-2 projects;
- concerning 'Ports'/ 'Port Operations', there are 2 IA, 6 RIA and 3 SME projects;
- finally, the Inland Waterways Transport (IWT) part, which relates to all the 6 ZEWT ship categories, comprises 5 dedicated projects, all of them RIAs, while there are also 3 dedicated CSAs (PLATINA 1, 2, 3).

It should be noted that many projects also cover topics other than the one to which they had been assigned – for example, while IWT has only a small number of dedicated projects, many of the projects dealing with SAF, electrification, energy efficiency, etc. also include IWT-related applications.

Participants were asked to contribute to the discussion in an interactive manner, with the aim of advising the consortium how to:

- build upon the direct project results;
- support complementary technologies and actions;
- fill in the existing RD&I gaps and needs;
- avoid duplication of activities;
- focus RD&I on the technologies with large market uptake potential

The list of projects were divided per topic and printed on A3 sheets, and the GSEG members were asked to discuss the different projects outlined in the A3 sheets. The main aspects that the experts were asked to look into were:

- is the proposed methodology correct? What needs to be changed or further added?
- which projects and their follow-up are relevant for the ZEWT calls and which for the Innovation Fund or other deployment funding mechanisms such as the Connecting Europe Facility (CEF), the European Maritime, Fisheries and Aquaculture Fund (EMFAF), etc.?
- which projects' follow-up would likely not require any (RD&I) supportive funding;
- to achieve a ranking of projects' outputs importance, where possible;
- which is the market potential of these projects?

A colour scheme was applied for the interactive exercise, via which the GSEG members could indicate which are the best funding mechanisms applicable for the projects' results:

- **Green:** the ZEWT cPP, mainly for further developing technologies and concepts);
- **Blue:** Innovation Fund, CEF, etc., mainly for demonstration/deployment of mature technologies with a high impact on climate change mitigation;
- **Red:** independent developments.

A part of the exercise on the list of projects is presented below, as an example. It must be mentioned that not all projects were reviewed and assessed by the GSEG members.

Ship Design and Production		
Acronym	Full title	
ARICE (RIA)	Arctic research icebreaker consortium	
CHEK (RIA)	Decarbonizing shipping by enabling key technology symbiosis on real vessel concept designs	
FIBRESHIP (IA)	Engineering, production and life-cycle management for the complete construction of fibre-based ships	
FIBRE4YARDS (IA)	Fibre composite manufacturing technologies for the automation and modular construction in shipyards	
GATERS (IA)	Innovative rudder system to increase ship energy efficiency	
HOLISHIP (RIA)	Developing innovative ship design methodologies	
LINCOLN (IA)	Lean innovative connected vessels	
Mari4_YARD (IA)	User-centric solutions for a flexible and modular manufacturing in small and medium-sized shipyards	
NAVAIS (IA)	New, Advanced and value-added innovative ships	

NEXUS (IA)	Towards Game-changer service operation vessels for off-shore wind farms	
RAMSSES (IA)	Realisation and demonstration of advanced material solutions for sustainable and efficient ships	
RESURGAM (IA)	Robotic survey, repair and agile manufacturing	
SHIPLYS (RIA)	Ship lifecycle software solutions	
TrAM (IA)	Transport: advanced and modular	
<i>MOVE IT! (project missing, to be added; IA)</i>	<i>Modernisation of Vessels for Inland waterway freight Transport</i>	

Port Operations		
Acronym	Full title	
COREALIS (RIA)	The port of the future for the future of ports	
DataPort (IA)	A data platform for the cognitive ports of the future	
H2Ports (RIA)	Implementing fuel cell and H2 technologies in Ports	
HiSea (IA)	High resolution Copernicus-based information services and sea for ports and aquaculture	
LOGIMATIC (IA)	Tight integration of EGNSS and on-board sensors for port vehicle automation	
PIXEL (RIA)	Port IoT for environmental leverage	
PortForward (RIA)	Towards a green and sustainable ecosystem for the EU port of the future	
RAPID (RIA)	Risk-aware automated port inspection drone(s)	
RCMS (RIA)	Rethinking container management systems	

D. THE WAY FORWARD

The last block of the agenda included two key presentations examining opportunities to continue the work of the GSEG beyond the end of the STEERER project. The first presentation proposed a concrete opportunity made possible by the recently approved HEU NEEDS project, a Coordination and Support Action (CSA) type of project focusing on new sustainable fuel deployment scenarios for the European waterborne community and involving a consultation process with external experts in the field of waterborne transport. The second opportunity was more extensive and provided an overview of the different options to continue the GSEG activities in relation to the Partnership's and WaterborneTP's foreseen activities. In both cases the experts' group will live on, albeit under a different name – the STEERER Network.

Introducing the NEEDS Project

The NEEDS project, a new CSA stemming from the ZEWTP cPP calls, was presented by Guilhem Gaillard (MARIN), the NEEDS project coordinator. This project will take forward part of the work done in STEERER, in particular the SAFs-related issues.

NEEDS aims to answer part of the challenges posed by the envisaged inclusion of maritime transport proposals in the EU 'Fit for 55' package, such as the ETS, and by the foreseen increasing demand for renewable-based sustainable alternative fuels for the overall waterborne transport sector, together with their production and infrastructure aspects. The main objective is to develop a quantified and dynamic techno-economic model and an associated methodology for defining and assessing the most efficient sustainable fuel deployment strategies in different countries and regions across Europe. It will include:

- energy production and supply aspects;
- harbour port infrastructure: bunkering and logistics;
- waterborne transport activities: routes, vessels' characteristics, transport capacity.

The model will be applied to two pilot regions: the Greek coastal shipping network and the Rhine inland waterway region.

The presentation also outlined more detailed and graphic data regarding: energy carriers and power conversion; scenario simulation; benchmarking and sustainable scenarios; etc.

The GSEG – Next Steps

After a short recap of the GSEG mandate within STEERER, WaterborneTP presented the foreseen next steps for the group. The continuation of the GSEG as 'The STEERER Network' is not only a project requirement, but also the wish of WaterborneTP to have a group of experts from both WaterborneTP members and non-members that can advise on the future Partnership-related developments.

The proposed activities for the future of the GSEG/STEERER Network will be focused primarily on the advice that the experts can give to the ZEWTP Partnership on the next SRIA

updates and on other relevant topics. A consultation with the group is expected on average twice a year.

There will also be two other projects' developments to which the experts are invited to participate:

- help with the next advice given for the SRIA update, which will be done for the IWT segment in the context of the PLATINA3 project, a sister-project of STEERER (spring 2023);
- becoming the official advisory body of the NEEDS project.

The mandate of the expert group, both in connection to the ZEWT work and within the projects, will be based on the current mandate in the context of the STEERER projects, with any necessary updates.

All experts present agreed with the proposals in principle, and the following points of clarification were discussed:

- better parameters have to be defined regarding the experts' work, their input and the impact that their advice is making – with the Wind-Assisted Propulsion Systems for ship (WAPS) segment being given as a positive example. In STEERER there are the WP3 deliverables which capture the main activities of the GSEG and they are public. And this information is also fed into other content deliverables, which represent the content part of the STEERER work and which is used in the ZEWT SRIA developments. Moreover, as a partial follow-up of the GSEG discussions, the Partnership had already issued a WAPS-focused call, another one is under preparation (part of the 2023-2024 calls), and information about WAPS is and will be part of other Waterborne documents;
- such parameters, criteria, key performance indicators (KPIs), etc. will be included in the next version of the experts' mandate, which will be circulated in the coming weeks for review and approval.

4. Results from the Consultation with the GSEG

The ZEWT Decarbonisation Targets

During the Q&A session, the following main points were discussed by the GSEG and the STEERER partners, and will be reflected in the last version of deliverable D2.7:

- after the pandemic the waterborne transport emissions have increased again, registering a rise of CO₂-pollution by 4.1% in 2021. At the moment, the sector is going in the opposite direction while the current FuelEU Maritime provisions and targets are on average lower than the average FF5 emission reduction targets;
- the assumptions of linear developments of the BAU or ZEWT-scenarios are reflecting reality as this rarely happens due to the complexity and inherent developments in the sector. It was proposed to introduce a caveat and indicate which are the confidence levels for these calculations;
- the target of staying below 1.5° C warming is becoming increasingly at risk, we have already crossed the 1.1° C threshold and we are currently at around 1.3° C. Experts estimate that there is a 50% chance we will surpass the 1.5° C target in the next 5 years. And after certain tipping points the changes can be drastic for the environment while the damage is harder to mend. This aspect is also not 'matching' the linear estimations in the STEERER deliverable in particular for the short-term situation (up to 5 years) – e.g. the methane impact in 20 years is x84 that of CO₂, but in the first 5 years it approx. x120, which means that the short-term decarbonization challenges and needs are critical;
- the assumption that technology may compensate the overshoot of the CO₂-budget is a controversial topic and it is still uncertain if CCS will be the overall solution. Although it makes it more tangible, the use of the CCS price tag might lead to misleading messages. Instead, it was agreed to follow the narrative of

uncertainty and major damages of our basis of life in the future that will underline the fundamental argumentation that we need to act now and fast;

- there is always new data coming from the sector, consequently the entire calculations done so far cannot be remade, but the D2.7 final version will take into account the main developments.

The Areas of Intervention

Below is an outline of the main findings per intervention area after the GSEG review of the lists of proposed actions. The information below is complementary to the feedback given directly during the exercise on the tables of actions for the Intervention Areas.

Some of the input from the GSEG does not necessarily concern the technical aspects that are within the scope of the Partnership, but connected issues, technical and non-technical alike. Furthermore, a considerable amount of feedback focused on deployment aspects rather than RD&I, which indirectly confirms that both STEERER and the Partnership are on the right track and that many of the major hurdles appear towards the market roll-out.

With respect to the Use of Sustainable Alternative Fuels (SAFs), the GSEG noted that:

- where feasible, it would be better to invest in clean technologies right away rather than investing in aftertreatment systems, since clean technologies (e.g. batteries, fuel cells, clean 'ICE's in combination with renewable fuels. etc.) address the root cause(s) of the emissions.;
- all (internal combustion) engines have some emissions and/or slips, and the latter not just when using liquefied natural gas (LNG) but also hydrogen, methanol, biodiesels, all having certain direct or indirect effects on climate change acceleration. Consequently, it is better to focus on reducing or eliminating the more harmful ones first;
- ammonia-related proposals are in general very well perceived, but at the same time they bring about high health and safety concerns due to the toxicity from

slips, leakages etc., especially from the perspective of IWT and ports given their presence in or near highly (densely) populated areas;

- costs of bunkering and charging infrastructure very much depend on the considered energy source. For instance, more than 80% of the fuel cost of ammonia would come from the investment in new infrastructures, whereas synthetic diesel fuel could use the existing ones. A hub-network could be a solution to distribute the sustainable alternative fuels, as it will be the case for the green corridors;
- one clear necessity is the standardization of systems using ammonia in waterborne transport;
- some of the best ammonia tests can be done in liquefied petroleum gas (LPG) carriers, as these ships are already used to carry it.

Regarding Ports, the main GSEG findings are:

- there is a need to stimulate the development of bunkering infrastructure for the SAFs, especially along the transport routes and in smaller ports;
- for on-shore power supply (OPS), there is a concern regarding the availability and connectivity of the electricity needed for the ships, especially when having to service all ships. This is a reality in other ports of the world and interesting developments are happening. For instance, OPS is a reality in California since 2014 and all eight ports in California, not just Long Beach, will make it compulsory for all ships to connect to the OPS as of January next year. However, during the last heat waves Californian authorities derogated from this rule due to the lack of available electricity. These aspects need to be considered in the EU framework where we have our own energy scenario(s) and specific concerns, in particular due to the war in Ukraine. OPS in EU ports will require a lot of electricity and the question is where we will pull this energy from;
- also regarding OPS, there are existing standards from the International Electrotechnical Commission (IEC), the International Organization for Standardization (ISO) and the Institute of Electrical and Electronics Engineers

(IEEE) for connection between the ships and the onshore power: IEC/ISO/IEEE 80005-1, 80005-2, IEC 62613-1 . Transformers can be used in case the shore frequency is not the same as the ship's equipment. An impact study is needed to assess whether this should be installed on board of the vessel versus provided by the terminal. However, any future development of OPS for international shipping should comply with this International Standard;

- the energy needs for OPS (and battery charging) in ports can be met in the period towards and after 2030 through the developments of off-shore wind farms, based on the forthcoming EU's Off-shore Renewable Energy Sources (RES) Strategy. This is something agreed to and supported by the EU ports.

Concerning the 'Design and Retrofit' intervention area, the GSEG noted that:

- for the use of hydrogen and methanol in the auxiliary engines in vessels, there is both the need for deployment actions (Innovation Fund) and further research (HEU) on re-designing ships for the use of dual fuels engines or the new SAFs;
- compact exhaust gas cleaning systems are needed, both for their actual purpose but also considering the future retrofits needed in vessels for which it is not feasible to integrate the clean technologies, and the space savings of such smaller equipment;
- engine manufacturers are taking very high risks when developing new propulsion systems. If this appears to be a failure, it will be a big loss for them with stranded assets. Public funding will support high risk, high capital developments and enhance not just the innovation but also entrepreneurship, especially from the SMEs.

As for 'Digital Green', the GSEG discussions highlighted the following aspects:

- there is an abundance of data available, which can be shared fairly easily. The real challenge is now to make value out of it. We need standards on how to share data and how to use it. Some standards already exist but more work may be needed;

- it is necessary to measure and compare the different data in order to extract more of the necessary information – e.g. with the inclusion of maritime transport in the EU ETS, some of this data will be increasingly linked to financial aspects. Some of this data can also be used to work on removing the subsidies for various (fossil) fuels.

In the case of 'Energy Efficiency', the GSEG have noted that:

- it is good to have a frequent update of the legal annexes that describe technologies used for energy savings from the relevant EU legislation (e.g. FuelEU Maritime, the EU Taxonomy, etc.);
- there is a general support to the proposal for an online knowledge platform where a clear overview can be found of different energy efficiency measures including the parameters that determine GHG reduction potential, the maturity level and which vessel or operating profile would be the best fit;
- concerning the wind-assisted propulsion systems (WAPS), the technologies to use excess wind energy on-board – recharging batteries or generating e-fuels – are not mature enough and will need more support;
- a number of digital tools already exist and there is no need to develop new ones. However, there is the need to standardize the digital tools that quantify the value of wind-related energy/gains on any ship and any route;
- all energy efficiency technologies should be made eligible for green financing.

The EU Research & Innovation Agenda

Below is an outline of the main advice and remarks from the GSEG on the list of RD&I projects presented, complementary to the information directly given during the exercise on the tables of projects. They are organized per category as follows:

Ship Design and Production:

- there are three projects to add to the list: [RESHIP](#) (HORIZON-CL5-2021-D5-01), started on 1 Sept 2022, tackling both maritime shipping and inland waterway

transport; [MOVE-IT](#); and [AEGIS](#). The latter is already known to WAT and other STEERER partners, that is why it has not been added on the list for the GSEG consultation;

- Some of the projects already have a connection with the recent ZEWT calls (and the projects originating from some of those calls);
- The RIA-type projects in this category can be investigated for their potential inclusion upcoming ZEWT activities.

Digital-related:

- Some projects cover broader aspects of digitalization/'digital green', e.g. safety and use of the Galileo system. It should be found out which of their topics can be taken-up by ZEWT and which not;
- AUTOSHIP is very much related to the ZEWT work, and it has a partial follow-up through the SEAMLESS project, which originates from the call "Seamless safe logistics through an autonomous waterborne freight feeder loop service", Topic ID: HORIZON-CL5-2022-D5-01-05;
- Many of the projects listed under the IWT list can also be mentioned here, as they have a strong digital component.
- No projects are assessed as delivering mature technologies which fit in scope of Innovation Fund.

Ports:

- There are three projects to add to the list: [MAGPIE](#) (H2020 Green Ports call); [PIONEERS](#) (H2020 Green Ports call); and [MultiReload](#);
- There is a significant difference in how some of the projects have been assessed by the experts, in particular the projects that deal with the 'ports of the future': COREALIS, DataPorts and PortForward;

- The ICT-related developments are very important, and they must be connected to the current and forthcoming projects that are funded via the CEF.

Off-shore:

- Carbon capture and storage (CCS)–related projects would be of relevance for ZEWT, as well as those dealing with off-shore constructions since they can be used for container terminals, floating hubs or wind farms.

Energy Efficiency and Zero Emissions:

- A number of projects were indicated as having developed or developing technologies that are worth considering within the ZEWT Partnership such as AIRCOAT, BioSFERA, e-SHyIPS, EMERGE, ENGIMMONIA, FLEXI-GREEN FUELS, etc. The challenge when having such a long list of projects and the Partnership's calls is, among others, to see how to integrate the different technologies and their investment horizons into a harmonised approach.

5. Conclusions and Way Forward

The amount of knowledge shared and reported in this document is reflected in the update of the STEERER Advice to the 2nd ZEWT Research Agenda and its Implementation Plan (D2.7). The main updates implemented concern three sections of that document: the decarbonization targets up to 2050 per ship type, the proposed actions under each SRIA intervention area to ensure the decarbonization of the waterborne transport sector, and the lessons learnt from the past and current RD&I projects.

Concerning the section with the decarbonization targets, the main updates from the GSEG are:

- the rate at which the carbon budget is consumed by the waterborne transport sector has been increasing in the last few years. The same is applicable for many other economic sectors. This means not only a bit less carbon budget than anticipated at the beginning of the calculations, but also the fact that, overall, Earth is approaching the 1.5° C warming limit faster than anticipated. The challenge to decarbonize our sector is therefore increasing;
- the decarbonization targets for short sea shipping and off-shore vessels have been validated by the GSEG members;
- while there will be no time to remake the full calculations of the decarbonizations targets, the STEERER consortium will consider the increased decarbonization challenge when updating and finalizing this chapter.

For the proposed actions under the SRIA Intervention Areas to ensure the (faster) decarbonization of the sector, the GSEG advice helped the STEERER consortium to:

- improve a significant number of proposals based on the experts' knowledge and the up-to-date needs and challenges of the stakeholders from the different waterborne transport segments. Most changes concern the Intervention Areas of SAFs, Energy Efficiency, Design & Retrofitting and Ports;

- refine the split of proposals per funding mechanism available. Thus, a number of proposals are seen as clearly being within the remit of the ZEWT Partnership or other types of calls from HEU, while others should be addressed by deployment mechanisms, such as the Innovation Fund, CEF, etc.;
- eliminate several of the initially proposed actions as they are either no longer very important or have already been addressed by other actions;
- a significant part of the discussions had focused either on the deployment mechanisms or on complementary measures that need to be addressed (including through the projects' activities), such as standards, new regulations, policy advice, etc. This aspect has also shown that the STEERER proposals on RD&I actions are largely confirmed by the participants, and that many of the challenges lie closer to market deployment. These aspects are also included in the D2.7 text, including in other chapters, according to their relevance.

While the exercise on RD&I projects has not allowed a very in-depth review due to the long list of projects and the restricted time, it has nonetheless shown that the consortium approach in this case is also solid. Furthermore, a number of projects and their outputs have been identified as being very relevant either for continued support in the near future via the ZEWT/HEU calls, or via the deployment funding mechanisms mentioned above. This exercise is essential to avoid the duplication of efforts and also to better target the technologies that should receive support via the HEU calls. In the last update phase of the deliverable, the STEERER partners had also cross-checked the information on the projects with the one from the (updated) proposals under the Intervention Areas, for a better consolidation of the final advice to be delivered to the Partnership.

In addition to the more specific results gathered during the fourth consultation, some general conclusions can be drawn at the end of the whole STEERER consultation process, which can be summarised as follows:

- there is a clear need to speed up the decarbonization initiatives in the waterborne transport sector while at the same time avoiding duplication of work;

- in addition to a general approach for waterborne transport, each segment within the sector needs to receive specific attention, especially IWT as it has a completely different legal framework (it's not under IMO, not under the scope of FuelEU Maritime, not under the scope of ETS inclusion...);
- both newbuilds and retrofiting are key to ensure the sector's decarbonization;
- there are clear differences and needs between liner and tramp services, and transport services provided through long term contracts and on the spot market, and more research and solutions are needed for each of them;
- in addition to funding for research and development, there is also a growing need for funding for deployment and how to make the most of it.

Finally, it is important that all these developments will help maintain and even increase the competitiveness of the broader European waterborne transport sector.

Annex 1. Agenda of the 4th meeting with GSEG

Agenda, 4th Meeting Green Shipping Expert Group (GSEG)

21-22 September 2022

Venue: DoubleTree Hilton Hotel, 3 Rue Gineste, Bruxelles

Wednesday, 21 September

Time	Topic	Format
12:00 -13:30	<i>Welcome lunch and Registration</i>	
13:30 – 14:30	<ul style="list-style-type: none"> • Welcome and objectives of the meeting (ISI) • Keynote speech, EC • Updates from the STEERER project and final objectives (WAT) • Presentation of the discussion topics (WAT) • Rules of the game for the two-days (ISI) 	Plenary
The ZEWT TARGETS		
14:30 – 15:30	The Sector's Decarbonization Targets per Ship Type (BAL)	Plenary
15:30-15:50	<i>Coffee Break</i>	
The AREAS of INTERVENTION		
15–50 - 18:00	Main Actions under the SRIA Areas of Intervention (KBRV)	Breakout sessions
20:00	<i>Dinner</i>	<i>Restaurant</i>

Thursday, 22 September

Time	Topic	Format
08:40-09:00	Welcome coffee & Registration	
The EU RESEARCH & INNOVATION AGENDA		
09:00 – 10:50	Analysis of and Lessons Learned from EU R&I Projects	Breakout sessions
10:50 – 11.10	<i>Coffee break</i>	
The WAY FORWARD		
11:10 – 12:00	D2.6 Monitoring and evaluation arrangements from the ZEWT SRIA agenda and its implementation (BAL)	Plenary
12:00 – 12:40	The NEEDS project: continuation of the GSEG (MARIN)	Plenary
12:40 – 13:00	Wrap up & Conclusions (ISI and WAT)	Plenary
13:00 – 14:00	<i>Lunch</i>	

Participants: GSEG members, STEERER Consortium and representatives of the European Commission.

Annex 2. List of participants to the 4th meeting of the GSEG

	Surname	Name	Organisation
1.	Allwright	Gavin	International Windship Association
2.	Andreopoulos	Ioannis	Union of Greek Shipowners
3.	Barcanescu	Mihai	Waterborne Technology Platform
4.	Blanco Rios	Moises	European Commission, DG RTD
5.	Boyer	Benjamin	CCNR
6.	Bruinsma	Jogchum	Nedstack Fuel Cell Technology
7.	Bucknall	Richard	UCL
8.	Dejarnac	Marius	ECSA
9.	den Heijer	Sander	Netherlands Maritime Technology
10.	Dogliani	Mario	SDG4MED
11.	Faziki	Monia El	SEA Europe
12.	Flachi	Manuela	MagellanCircle
13.	Friedhoff	Benjamin	DST e. V.
14.	Gaggi	Silvia	ISINNOVA
15.	Gaillarde	Guilhem	MARIN
16.	Gebraad	Jaap	Waterborne Technology Platform
17.	Guntermann	Captain Wolfram	Hapag-Lloyd AG



STEERER

STRUCTURING TOWARDS ZERO EMISSION
WATERBORNE TRANSPORT

	Surname	Name	Organisation
18.	Huyskens	Pieter	Damen Shipyards
19.	Iafrati	Alessandro	Institute of Marine Engineering - National Research Council of Italy
20.	Janssens	Gudrun	KBRV
21.	Karaarslan	Salih	SPB/EICB
22.	Nicolini	Francesco	Fuels Europe
23.	Paulsen	Ketil O.	Kongsberg Maritime AS
24.	Quispel	Martin	SPB/EICB
25.	Rachieru	Irina	ISINNOVA
26.	Selén	Valter	European Sea Ports Organisation
27.	Smidt	Hélène	KBRV
28.	Swoboda	Lennart	Bernhard Schulte GmbH & Co. KG
29.	van der Blom	Erik	Royal IHC
30.	Zaplatka	Agnieszka	European Commission, DG RTD



Annex 3. Overview of the participatory exercise

