Klimatomställning av torrbulksflottan

Slutrapport till Trafikverket för projekt TRV 2021/100899

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Sammanfattning

Responsible Shipping Initiative (RSI) är ett initativ från svenska köpare av torrbulktransporter med syfte att förbättra arbetsvillkor, hälsa och säkerhet ombord. I det här projekt har medlemmarna i RSI hanterat det akuta behovet av att förnya den åldrande flottan av mindre bulkfartyg och styckegodsfartyg som är avgörande för svensk basindustri och kraftvärmeverk. Klimatomställing av denna flotta är väsentlig när nya regleringar och företagsspecifika utsläppsmål träder i kraft.

RSI har i det här projektet samarbetat med DNV vars rapport till oss ligger som bilaga. De huvudsakliga slutsatserna och dess rekommendationer sammanfattas nedan.

I en konsekvensanalys till Internationella sjöfartsorganisationen (IMO) beräknade DNV nyligen att sjötransportkostnaderna kommer att öka med 16-47 % till 2030 och mer än 80 % till 2050. Lägre totala kostnader möjliggörs genom att förbättra transport- och energieffektivitet. Vårt engagemang som transportköpare för att möjliggöra investeringar och systemförändringar i denna riktning främjar på så sätt vår konkurrenskraft.

Projektet var uppdelat i tre arbetspaket:

- WP1: Identifiering av transportvägar, laströrelser och fartyg med den högsta potentialen för förnyelse av grön flotta. Upprätta en utsläppsbaslinje för varje företag. Utforska synergier mellan projektpartners för att identifiera potentiella tjänster med hög fartygsutnyttjande.
- WP2: Kartläggning av tekniska lösningar och bedömning av miljövinster och merkostnader för nya gröna fartyg. Marknadsdialog med rederier och drivmedelsleverantörer.
- WP3: Utveckling av en modell för förnyelse av flottan för att förstå den takt och omfattning som krävs för att nå utsläppsmålen. Ge rekommendationer för varje projektpartner

WP1 började med att fastställa en utsläppsbaslinje för varje RSI-medlem. Inget av företagen hade några strukturerade sätt att samla in primära utsläppsdata från sina rederier, så AIS-baserad modellering användes för att uppskatta utsläppen utifrån fraktlistor. Därmed kunde de viktigaste rutterna för varje företag vad gäller transporterade volymer och utsläpp bestämmas och användas för fallstudier i de efterföljande arbetspaketen. Dessutom kan de olika lastflödena från RSI-medlemmarna överlappas för att identifiera fall där kombinerade volymer skulle kunna utgöra ett mer transporteffektivt kommersiellt fall än marknadsgenomsnittet (mindre än 30-40 % ballast).

I WP2 undersöktes kostnaderna för att introducera gröna fartyg längs de viktigaste rutterna för varje RSI-medlem. Uppskattade kostnader och prestanda för nya fartyg av olika relevanta storlekar användes för att beräkna den ”gröna premien” till ~5 EUR per ton last, genom att jämföra ett nytt fossildrivet fartyg med ett fartyg som kunde drivas med e-metanol. Eftersom dessa fartyg tillbringar halva sin tid i hamn, blir fartygets relativt högre CAPEX viktig vid sidan av det dyrare gröna bränslet: även om bränslet är dubbelt så dyrt är de totala kostnaderna för att äga och driva fartygen bara 10-20 % dyrare per ton last. Olika åtgärder undersöktes som kunde ändra detta, som statligt investeringsstöd, högre utsläppskostnader (t.ex. ETS) och även förbättrad transporteffektivitet som minskad tid i hamn. Utöver analysarbetet hölls workshops inom projektet och även med externa parter som rederier och drivmedelsproducenter. Här var en nyckelpunkt att även om rederier uppskattar ambitiösa långsiktiga mål, behöver de kortsiktiga mål för att fatta rätt kommersiella beslut.

I WP3 användes en modell för förnyelse av flottan för att visa effekterna av att ta olika strategiska val vad gäller utsläppsminskningar. T ex välja att inte förnya flottan och att bara blanda in biobränslen för att minska utsläppen jämfört med att tidigt byta ut många fartyg mot nya som kan gå på alternativa bränslen. Även om modellen var enkel, kunde den illustrera effekten av investeringar i energieffektivitet. För de RSI-medlemmarna som hade ambitiösa utsläppsmål i närtid gav modellen tvetydiga resultat för vad som är bäst på kort sikt. Slutsatsen där blev att undersöka kostnader och resultat i praktiska engagemang med leverantörer.

Efter projektet kan vi ge oss själva och andra en rad praktiska rekommendationer:

1. Om det inte redan är på plats, etablera en intern ansvarig för sjöfartens klimatomställning som kan arbeta tillsammans med funktioner som inköp, logistik, försäljning, hållbarhet etc.
2. Upprätta ett robust ramverk för utsläppsmätning för att skapa faktiska utsläppsbaslinjer för rutter och för avtalsparter. Detta är väsentligt för att kunna sätta avtalsenliga utsläppsmål och för att följa upp framstegen.
3. Förstå hur dina egna mål och väntade lagkrav kommer att påverka kostnader och utsläpp från dina sjötransporter.
4. Förstå potentialen för att förbättra energieffektiviteten i den befintliga flottan genom att samarbeta med specifika leverantörer. Baserat på de erfarenheterna utveckla rutiner för uppföljning av leverantörer på energieffektivitet.

5. För de som har nollutsläppsmål nära i tid, utnyttja det befintliga marknadsintresset att tillhandahålla noll- och lågutsläppstjänster för att få faktiska uppgifter om kostnader och utsläpp på specifika rutter.

Därutöver kan vi lyfta fram behovet av ökat samarbete mellan rederier, lastägare och bränsleleverantörer. Detta för att hantera de större riskerna som måste tas. Bättre samarbete kan möjliggöras genom att översätta långsiktiga ambitioner till kortsiktiga mål i varje kontrakt.

RSI GREEN FLEET (224844)

Decarbonising the general cargo fleet serving Swedish energy and industry sectors

Billerud, EFO AB, Lantmännen, SSAB, Stockholm Exergi, Södra

Report no.: 10384189-1, Rev. 3
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1 EXECUTIVE SUMMARY

This project has addressed the urgent need to renew the aging fleet of smaller bulkers and general cargo vessels that are crucial for Swedish basic industries and combined heat and power plants. The decarbonization of this fleet is essential as new regulations come into force and company-specific emission targets are implemented. The project has been led by Responsible Shipping Initiative (RS), comprising Billerud, EFO, Lantmännen, SSAB, Stockholm Exergi and Södra, supported by DNV. It has been co-funded by the Swedish Traffic Administration (Trafikverket).

In an impact assessment to the International Maritime Organization (IMO), DNV recently projected that maritime transport costs will increase 16-47% by 2030 and more than 80% by 2050 (DNV, 2024). The lower bound of costs are made possible by improving transport and energy efficiency, which in turn requires the deeper involvement of cargo owners and charterers, such as the RSI members. Their involvement to enable the right investments and system changes is then beneficial for their competitiveness going forward by keeping the costs of maritime decarbonization down.

Prior to this project, RSI and DNV identified a series of barriers that stand in the way of renewing the fleet supporting an appropriate emissions trajectory: lack of knowledge and information on impacts of regulation from the transport buyers' side; more urgent projects to reduce emissions within their own operations (Scope 1 emission reductions); shipping contract lengths constrained by their own contracts on import/export of goods; a competitive market historically favouring low cost vessels; lack of coordination to improve transport and energy efficiency; and more.

The project was divided into three work packages, constructed to break the identified barriers by finding ways to optimise energy and transport efficiency; by increasing transparency on costs and emissions; and, by building new practical knowledge in each project party about the impact of decarbonisation on the specific maritime transport network. The work was divided into three work packages (WPs).

1. WP1, Opportunity Identification: Identifying transport routes, cargo movements, and vessels with the highest potential for green fleet renewal. Establish an emissions baseline for each company. Explore synergies between project partners to identify potential services with high ship utilization.
2. WP2, Solution Development: Mapping technical solutions and assessing environmental benefits and additional costs of new green vessels. Market dialogue with shipping companies and fuel providers.
3. WP3, Practical Realization: Developing a fleet renewal model to understand the pace and scale required to meet emission targets. Set recommendations for each project partner

In WP1, emissions baselines were created for each project partner based on their shipping lists and AIS data. Interviews were carried out to understand how each project partner handled maritime shipping in relation to their production. On that basis, more detailed assessments could be made. In WP2, the cost implications of introducing green vessels were calculated, finding that the green premium for new vessels running on e-methanol is about 18% higher than fossil-fuelled vessels. Various levers such as state investment support and improved port efficiency can reduce this premium. Utilisation of vessels could also be improved by pooling cargo volumes going in opposite directions in a single contract. A workshop with the wider value chain indicated the need for operationalizing the long-term targets that many transport buyers have (such as 50% reduction 2030) by having short-term targets, for example yearly.

In WP3, modelling showed that both renewing the fleet and improving energy efficiency in the existing fleet can be cost-effective ways to meet emission targets in the short term to 2030. Only blending in biofuels in the existing fleet is the most expensive option.

Practical recommendations for the project partners were made based on the results from all WPs:

1. If not already in place, establish maritime decarbonisation responsible to work across functions like procurement, logistics, sales, sustainability etc.
2. Establish robust emissions measurement framework to create actual emissions baselines for routes and for contracted parties. There already exists frameworks for this such as Sea Cargo Charter.[1] This is essential to be able to set contractual emission goals and to follow-up on progress.
3. Understand the potential for improving energy efficiency in the existing fleet by engaging with specific suppliers and then develop follow-up procedures
4. For the project partners with near-term zero emission goals, utilise the existing market interest in providing zero- and low-emission services to get actual data on costs and emissions on specific routes.
5. Work with your own customers to find ways to absorb costs of the maritime emission reductions.[2]

These results were found to be generally applicable to all project partners, which is why they are likely generalisable to other buyers of maritime transport services.

[1] See https://www.seacargocharter.org/
[2] See https://www.sodra.com/en/global/pulp/conscious-delivery/

2 INTRODUCTION

Maritime shipping is an infrastructure: a large-scale system supporting what actually needs to be done. Changes to infrastructure require time and negotiations, and adaptations with other parts. No single actor can decide on changing an infrastructure on their own (Star, 1999). However, the roles of some actors are clearer than others. For example,

- Shipyards, shipping companies, ship designers, technology suppliers need to design, order, build and operate new climate-efficient ships.
- Energy suppliers need to ensure that infrastructure is built to deliver new fuels.

The role of transport buyers (or as they may also be referred to: cargo owners, shippers, or charterers) in the climate transition of shipping is receiving more and more attention. In Sweden, a number of research projects have covered this topic, such as Styhre et al. (2017). Ultimately the increased costs for more expensive, more climate-efficient ships and fuels will be sent onwards to the transport buyers before they are passed on to the end consumer.

Already transport buyers are setting long-term ambitions and goals for decarbonization of shipping. This project is about what constructive role the transport buyers can play by operationalizing their long-term ambitions into practical short-term action. The project is limited to dealing with dry bulk and general cargo transport, i.e. products to and from our forest industries, mines, steelworks, heating plants, cement factories, agriculture, etc. For Swedish basic industry and combined heat and power plants and others, this is the most important shipping segment. Other important segments are of course container and RoRo/RoPax, but in these segments, each transport buyer typically only uses a small part of each ship's capacity and has on their own a limited power to influence.[3] For the vessels in the scope of this project, the transport buyer – or charterer – is typically using the entire capacity of the vessel and has higher ability to influence its performance.[4]

The project parties – Billerud, EFO, Lantmännen, SSAB, Stockholm Exergi and Södra – have already been organized for a number of years in the Responsible Shipping Initiative (RSI), which works through ship inspections to raise the social standard and safety of ships. They see that a green fleet renewal in this smaller general cargo or dry bulk segment is important in many ways. The ships, due to their age, will soon need to be replaced. It is imperative that these kinds of companies clearly signal the need to follow climate trajectories. Currently, the vessels mostly utilised fall outside the scope of current decarbonization regulation due to their size (< 5000 GT) It would be unfortunate if the renewal of the fleet does not take place in step with climate ambitions.

This is a segment where investments in more expensive high-performance vessels have not been rewarded by the market. A pressured market has historically made it difficult for shipping companies to compete with better performance. For larger dry bulk vessels, research shows that more energy-efficient dry bulk vessels rarely get paid better (Adland et al., 2017).

A number of known barriers, mainly related to a lack of information and knowledge, as well as to how business models and contracts are created, can be said to prevent sufficiently climate-efficient ships from being built and operated (Rehmatulla and Smith, 2020; Poulsen et al., 2022).

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[3] The exception is insetting of alternative fuels, by which shipping companies blend in for example biofuel somewhere in their fleet and then sell the associated savings to willing cargo owners. See https://www.dnv.com/services/biofuel-insetting/

[4] Research has shown the strong pull of charterers: ships under time charter contracts, where the charterer pays the fuel and not the shipping company, see a greater implementation of energy efficiency measures than ships that sail under spot or Contract of Affreightment, where the shipping company pays the fuel (and benefits directly from energy efficiency savings).

Some of them were elaborated further between the project parties in the process of creating this project.

1. Transport buyers often have large, more urgent, decarbonization projects in their own operations (so called Scope 1 emission reductions[5]).[6] A transport buyer only has indirect control over the emissions from maritime transport. Resources and the driving forces are typically lacking to engage in these emissions. The departments of the shipping buyer dedicated to maritime logistics may be small and focused on optimizing current operations including costs, not driving development projects.

2. Transport buyers may lack the resources or tools to articulate their preferences in terms of climate performance. This requires in-depth knowledge of upcoming legislation and its possible consequences, costs and performance of various possible technical solutions for reduced energy consumption, different types of fuels, etc. As a result, shipping companies may not have the full information about transport buyers' actual preferences. Shipping companies that want to order climate-efficient ships need to know that there is a willingness to pay to charter the ships at a cost that makes it profitable to operate them over their lifetime. In addition, transport buyers cannot simply talk to each other, and jointly signal what the market is interested in, due to risks surrounding competition legislation.

3. Currently everyone across the value chain lack knowledge of what actual regulations will apply and to what extent these will equalize the cost differences between new and existing ships. It may also be unclear what public supports will be available and how they are applicable.

4. The (short) length of the agreement between the transport buyer and the shipping company does not allow the shipping company to take the more expensive that a more climate-efficient ships entail. Making agreements longer is difficult as the transport buyer also has shorter contracts with their customers, and cannot commit to buying sea transport that may not be needed.

5. New vessels need to be able to compete against existing vessels. Buyers of dry bulk sea transport in Sweden and neighbouring countries choose vessels in a mature and established market. It mainly concerns non-Swedish-flagged ships, even if a couple of Swedish shipping companies are active. The entire short sea shipping fleet in Europe is aging: over half of the vessels are older than 20 years, and the order book is only 3.5% of the fleet size (Splash 24/7/Toepfer Transport, 2021). This can be compared to the global fleet, where the order book is approximately 10% of the fleet size, which in itself is considered to be historically low. Old ships may have insignificant CAPEX, and it is difficult to bring new ships to the market that differ drastically in cost from the existing ones.

6. There is a chicken-or-egg problem when it comes to getting the infrastructure for the new fuels as well. Neither ports nor fuel manufacturers are interested in investing without a commitment from shipping companies that they will buy the fuel. In addition, there are uncertainties surrounding the availability of electricity, which many of the new fuels for shipping will require. Research shows that only a small part of CAPEX in the maritime

[5] See e.g. https://ghgprotocol.org/corporate-standard

[6] Among the project partners SSABs investments in zero emission steel and Stockholm Exergi's in Bioenergy Carbon Capture and Storage (BECCS) can be mentioned.

decarbonization process is in new ships; the majority lies in new fuel infrastructure (DNV 2022).

In DNV experience there are important driving forces to harness to enable the transition despite the above barriers.

1. Energy and transport efficiency should be maximized to offset greater costs. This can be done through increased ship size, lower speed, reduced ballast ratio (minimize trips that take place without cargo), increased load factor to make maximum use of the ship's capacity, and increased efficiency in cargo handling and port calls. Transport buyers typically do not share the data required to perform such analyses, either with other freight buyers or with shipping companies. If such data can be collected and processed, new knowledge emerges about how logistics chains can be optimized.

2. Increased transparency between shipping companies and cargo owners about the costs and performance of the new vessels is necessary, so that the parties can, for example, enter into longer collaborations or in other ways share the risks of the conversion.

3. It is important to generally increase the knowledge on the side of cargo owners about shipping's opportunities and challenges in climate change. On the shipping companies' side, it is important to create an increased understanding of the cargo owner's situation, who in their product stages and contracts with customers do not have the opportunity to sign longer contracts.

In the project, these driving forces are used to solve the above five barriers. Dissemination of information to the actors of the transport system is central to the success of the project. That this is done by a third party is also necessary to avoid risks related to competition law.

This report has the following structure: Section 3 provides the basis for the project, including scope of work. Section 4 details the methods employed in the various work packages. Section 5 presents the results. Section 6 concludes.

3 BASIS FOR WORK

Maritime shipping is set to decarbonize by 2050 at the latest according to the strategy decided by countries in the IMO, as shown in Figure 1 below.

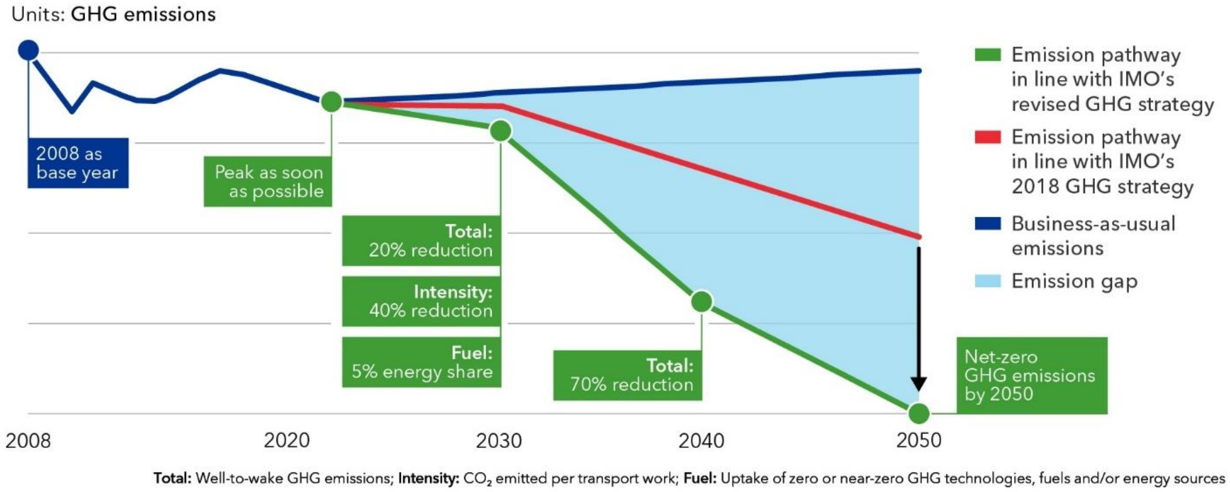

Figure 1 – Emission trajectory for international shipping following IMO trajectory (DNV, 2023)

Ship specifications, particularly related to engines and fuels, will need to change to reduce emissions. Technologies like sails, batteries and air-lubricated hulls are being developed and implemented to existing and new vessels to reduce energy demand. All this will reduce emissions and increase costs. There is also still a large difficult-to-quantify potential for improving transport efficiency (increasing vessel size, improving utilisation) and operational energy efficiency (ship and engine technical conditions, speed management etc.). In projections from the latest DNV Maritime Forecast, the total costs are expected to rise by around 20% 2030 and extending from 70-110% for different segments by 2050, displayed in Figure 2. This will have far-reaching implications for the buyers of maritime transport.

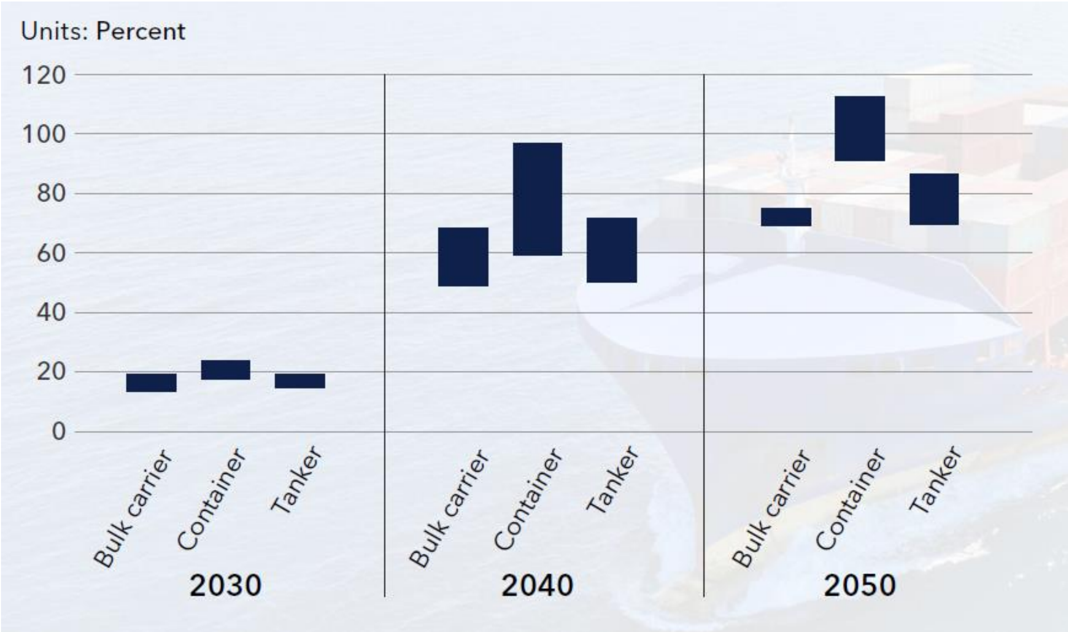

Figure 2 – Range of increase in total costs per transport work (USD/DWT-nm for bulk and tank, USD/TEU-nm for containers) from decarbonization in 2030, 2040, and 2050, relative to a business-as-usual scenario (from DNV, 2024)

The regulatory frameworks for maritime decarbonization are currently being established on international as well as regional and even national levels. At the IMO, countries are discussing a market-based measure and a GHG intensity measure. It has been decided to adopt these measures by 2025 and have them come into force in 2027. An impact assessment on the regulatory instruments done for the IMO by DNV, UNCTAD and others, showed that the least costly scenarios are those that include a high cost of emissions, not only a GHG intensity measures.[7]

In the EU, two instruments have already been introduced. Shipping is now in the EU Emissions Trading Scheme (ETS) since Jan 1, 2024. From Jan 1, 2025, ships are also subject to FuelEU. Both instruments apply to 50% of the emissions from voyages between EU ports and non-EU ports, and 100% of the emissions in voyages within the EU, as shown in Figure 3.

[7] See e.g. https://www.lloydslist.com/LL1149935/Exclusive-IMO-carbon-levy-at-$150-$300-would-result-in-least-GDP-impact-on-global-economy

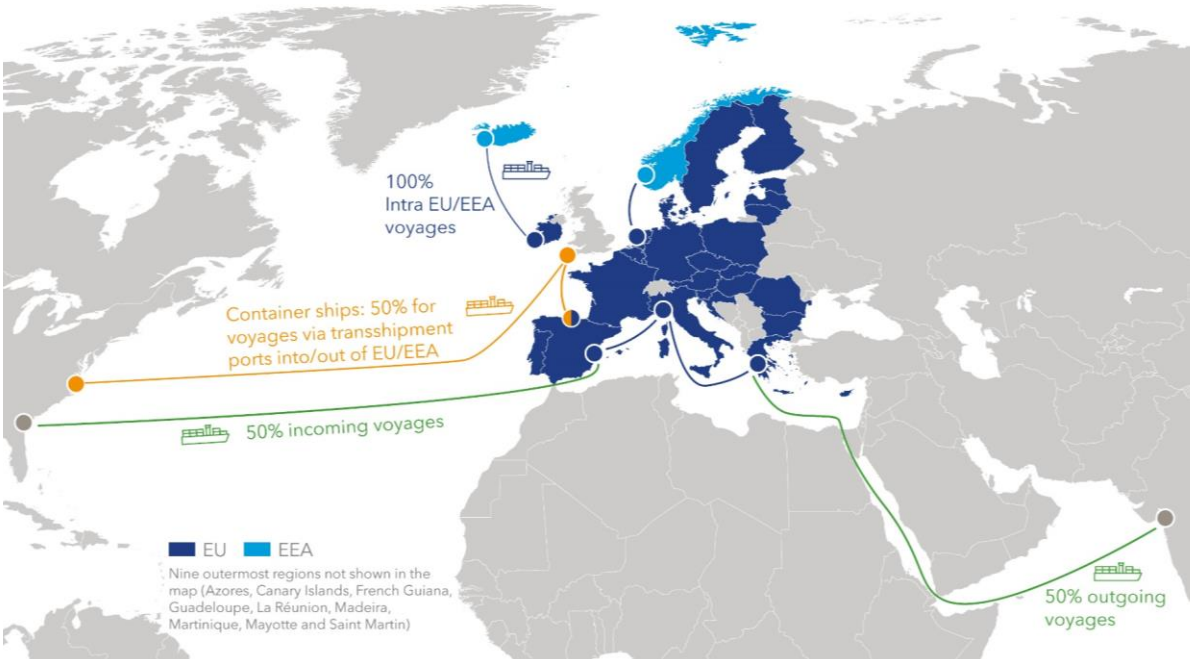

Figure 3 – Application of EU ETS and FuelEU

The timeline of the ETS regime is shown in Figure 4 below. There is no grandfathering to ease implementation, but shipping companies will have to surrender emission allowances for 40% of their 2024 emissions, 70% of their 2025 emissions and then 100% of their emissions. Here it can be seen also that the smaller vessels < 5000 GT often used by the RSI members will start to report their emissions by 2025 and their inclusion in ETS could be from 2027. Currently, only vessels above 5000 GT are required to log and report their emissions to IMO DCS and EU MRV, and are subject to regulation such as CII, EU ETS and FuelEU Maritime. As will be discussed further below, this creates a great deal of uncertainties for the shipping treated in this project. How much can the transport buyers rely on regulatory pressure to reduce emissions and how much action do they need to take themselves?

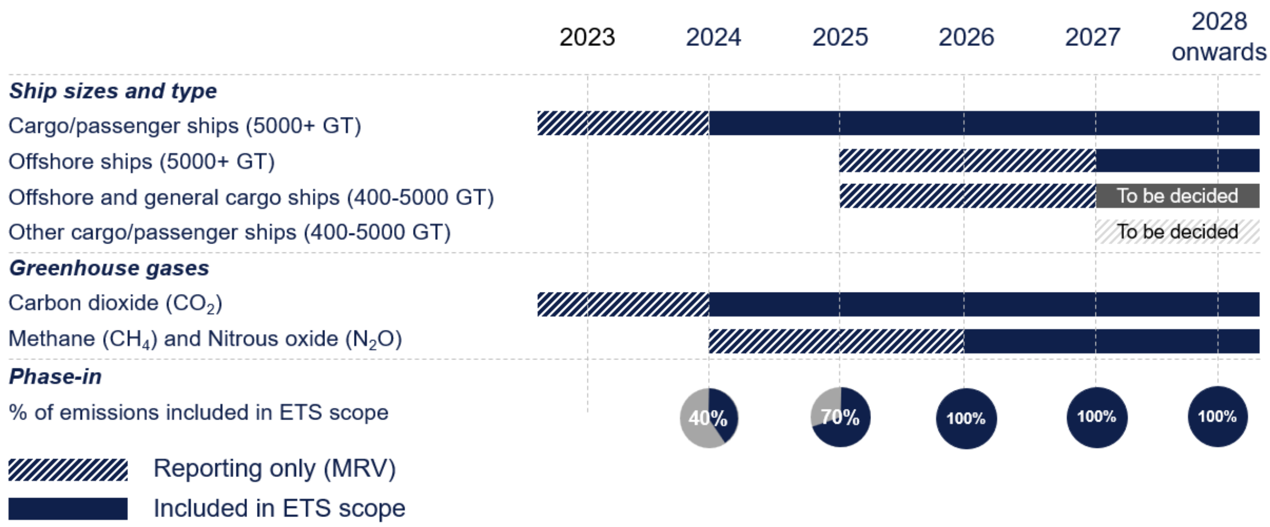

Figure 4 – EU ETS introduction timeline

The mechanism by which the EU reduces emissions through the ETS is to continuously reduce the cap on total emission allowances. The current revision of the ETS directive is set to reduce emissions by 62% by 2030 compared to 2025. The yearly reduction factor is 4.3% until 2027 and 4.4% by 2028. The cap is expected to be 0 by 2040, which will continue to raise the price of the allowances; corresponding to the EU Commissions recommended 90% reduction target by 2040.[8]

FuelEU also applies only to vessels above 5000GT. Here, vessels have to reduce the GHG intensity of the used fuels according to a set reduction timeline, as illustrated in Figure 5.

$$Well\ to\ Wake\ GHG\ intensity = \frac{gCO_{2eq}}{MJ}$$

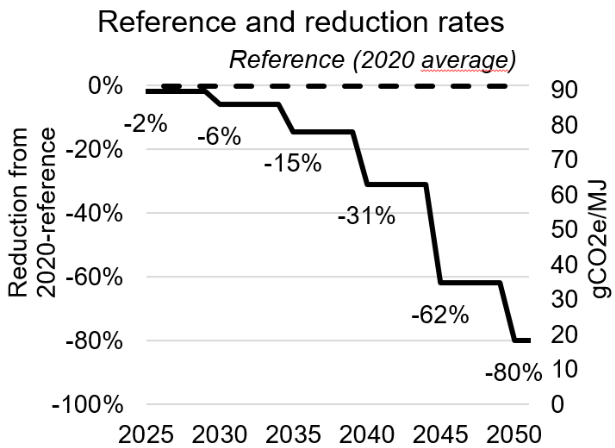

Figure 5 – GHG intensity reduction in FuelEU

[8] See https://climate.ec.europa.eu/eu-action/climate-strategies-targets/2040-climate-target_en

DNV modelling shows, as depicted in Figure 6, that the most cost-effective pathway to reaching these goals in practice, is a combination of reducing energy demand and of introducing new fuels with low or zero carbon emissions.

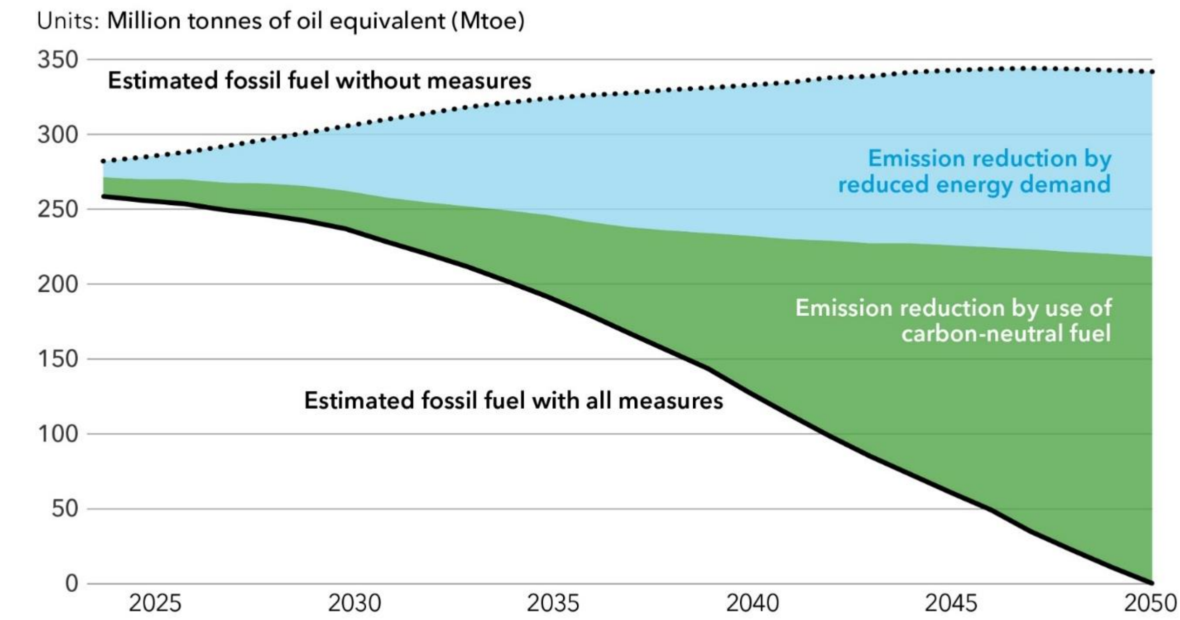

Figure 6 – Pathways to reduce emissions to zero 2050 (DNV, 2023)

To enable this transition, stakeholders are increasingly collaborating more across the value chain. For example, collaboration between shipping company and cargo owner such as the RSI members. In this project we have been concerned with small bulkers and general cargo vessels. Before a discussion on how to reduce emissions with these vessels can take place, it is worthwhile to give an overview of this ship segment.

3.1 The general dry cargo segment

These kinds of vessels ships operate mostly in Europe and in Southeast Asia, as seen in Figure 7.

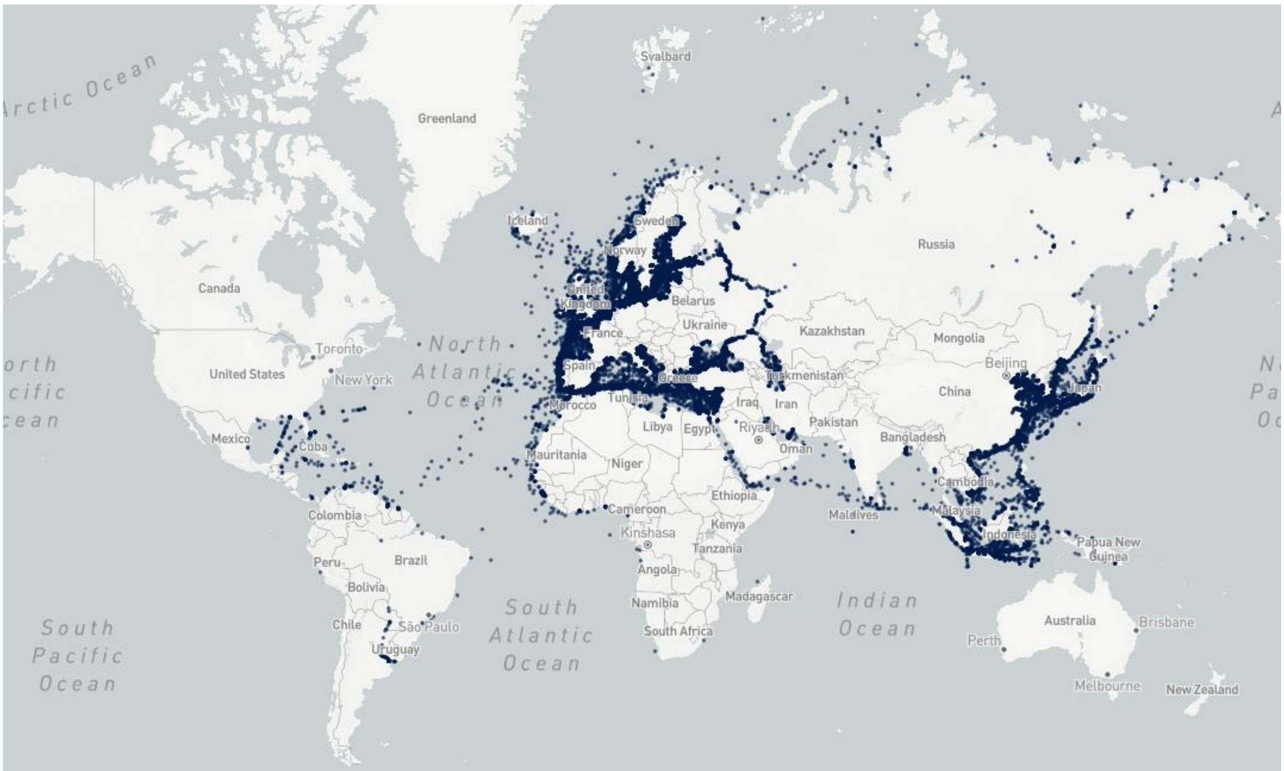

Figure 7 - Positions of general dry cargo vessels, 4000-8000 DWT, January 2024 (DNV analysis based on AIS data)

The vessels are designed to sail at slower speeds, on average 9-10 knots, as shown in Figure 8.

Vessel speed in knots

Vessel draught in meters	-	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Total
	1	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
	2	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	**1%**
	3	0%	0%	0%	0%	0%	1%	1%	1%	1%	1%	0%	0%	0%	0%	**6%**
	4	1%	1%	0%	1%	1%	1%	2%	3%	4%	4%	4%	2%	1%	0%	**24%**
	5	1%	0%	0%	0%	0%	1%	1%	3%	4%	4%	3%	2%	1%	0%	**20%**
	6	1%	0%	0%	0%	1%	1%	2%	5%	7%	8%	5%	2%	1%	0%	**34%**
	7	0%	0%	0%	0%	0%	0%	1%	2%	3%	3%	2%	1%	0%	0%	**15%**
	8	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	**1%**
	Total	**3%**	**2%**	**1%**	**2%**	**3%**	**4%**	**8%**	**14%**	**19%**	**20%**	**14%**	**7%**	**3%**	**1%**	**100%**

Figure 8 - Speeds and draughts of general dry cargo ships January 2024 (DNV analysis based on AIS data)

Typically, they spend about half the time in port or waiting, and half of their time sailing, as shown in Figure 9.

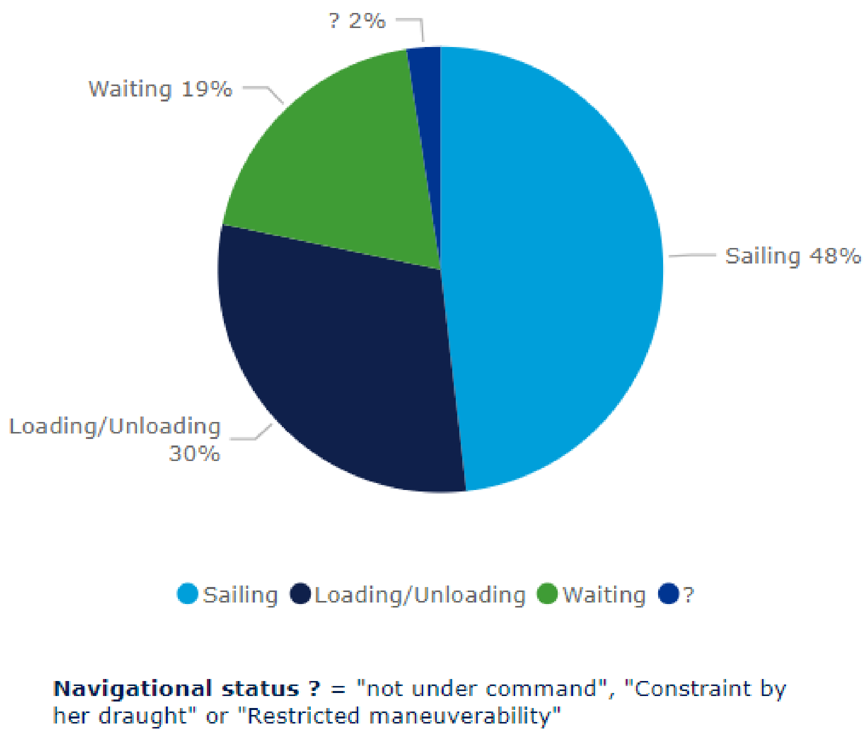

Figure 9 - Operational profile of general dry cargo vessels, January 2024

On average the ships are quite old – globally, the average is 27 years - with a very small share of the total fleet in the orderbook. In March 2024, IHS Markit data showed that looking at all vessels in operations and in construction over all sizes, just 3.8% of the fleet was in the order book. This is considered a very slow replacement pace. In DNV experience, the economic life span of these vessels is up to 30 years on average. This means that a significant part of this fleet needs to be replaced in the coming years.

Many of the vessels have been designed and built in the late 90s / early 2000s, when the price of fuel was much lower than today (even adjusting for inflation). There was little incentive to design ships that were more expensive and fuel-efficient. There were also a lot of orders leading up to the financial crisis in 2008, as in all ship segments. As a result, new vessels that are being designed and constructed now are able to achieve substantial improvements over the old ones. Even though some new vessels have been ordered with battery-hybrid support systems, which further improves energy efficiency, they are almost all ordered with mono-fuel diesel engines that will require further investments in their lifetime if they are to switch to alternative fuels.

3.2 How to reduce emissions in the segment

In the discussions leading up to this project in 2021, DNV suggested three potential actions by which RSI members can work proactively with decarbonisation. These different actions are shown in Table 1 below. Beyond a renewal of the fleet, DNV also recommended to reduce emissions in the existing fleet.

Table 1 – Suggested actions for RSI to address decarbonisation, from early discussions in 2021

What	How	Timeframe	Effort	Impact

1. Improve GHG emissions from existing	Establish rating regime that address, follow up on and reward energy consumption improvements	**Short** Regime in place 2021 Effect in 2022	Limited Develop regime and start follow up, investments needed for shipping company	Improve GHG efficiency in sailing fleet by 5 -20%
2. Improve GHG emissions in the newbuilding phase	Establish requirements, and reward scheme, for new build vessels to accelerate transition to improved environmental performance.	**Medium** Regime in place 2021 Effect in 2024	**Limited** Develop regime and start follow up, investments needed for shipping company)	Improved GHG efficiency by up to 40%
3. Collaborate to improve environmental impact	In joint cooperation with authorities and shipping companies establish regime to cooperate to find optimal ships for the cargoes and trade routes.	**Long** Regime in place 2022 Effect in 2026	**Significant** Many stakeholders to join forces as well as political alignment needed.	Aim for zero emission vessels.

In the discussions that followed between DNV and RSI members, it was decided to focus on actions 2 and 3. An important reason was the too slow renewal of the fleet, and the perceived risk that the fleet would be renewed without focusing on decarbonization trajectories. However, as will be evident in the conclusion section, having a robust emission reporting scheme is essential to monitoring achievements and is a main recommendation.

3.3 Goal and scope

The overall goal of the project is to mitigate the described barriers to enable RSI members to work effectively with fleet renewal along their climate ambitions. Two main case studies were decided on in the project.

First, a description of a “EcoBulk” concept, by which substantial improvements of at least 50% in GHG performance can be made. Also, these vessels should be possible to realize for the RSI members within current business models (e.g. typical charter lengths and rates), together potentially with public investment support such as Klimatklivet for any innovative technologies such as batteries.

As will be discussed in later sections, vessels which such great improvements in efficiency have now started to appear in yard orderbooks and even delivered during the timeline of the project. It turned out that large step changes could be made without needing new fuels, batteries or sails; just better hull lines, engines etc.

Second, a description of a “ZeroBulk” concept. This would have very low or zero GHG emissions, but expected to require new forms of collaboration and new business models with shipowners, bunker companies. At the time of planning the project, in 2021, such concepts were being developed in Norway through the Green Shipping Program.[9] However, despite offering very long-term charter agreements from the cargo owner side, these vessels have still not been ordered. Costs rose dramatically due to inflation, raw material prices and lack of yard capacity.

These concepts would be built on a detailed understanding and analysis of each RSI member’s ship transport needs and align with their climate targets.

[9] See e.g. https://grontskipsfartsprogram.no/flatefornyelse/berge-rederi-as-og-omya-hustadsmarmor-as/ (in Norwegian)

DNV

4 METHODS

This project was set up in three work packages, each designed to build knowledge in each company about emissions and the potential for improvement: using the two main concepts as case studies throughout.

4.1 WP1 “Opportunity identification”

The goal of this WP was to identify transport routes, cargo movements and employed vessels with largest potential for green fleet renewal with each participating company.

Table 2 - WP 1 overview

WP	Overview	Activities
1.1	Kick-off workshop at Stockholm Exergi	Kick of workshop with all participating companies detailing planning and work activities.
1.2	Data collection	DNV visits each company to understand (via interviews and data review) current vessel operations, expected future operations, transport agreements, connections to broader sustainability strategies and R&D plans, preferences for energy carriers (fuels) etc. Mapping current transport agreements for each company.
1.3	AIS and transport analysis	DNV performs desktop analysis and of each company’s current routes, cargo volumes, used vessels and ports. AIS analysis investigating transport routes and cargo movements for selected ports and vessel types. Establish baseline emissions for participating companies and identified routes.
1.4	Presentations	Presentation of analysis in each company. What routes and cargoes should be prioritised in the next work package to make most impact and are there potential synergies to be explored for each participating company.

Deliverables

- Reports with overview of routes, volumes and ports, including what routes have the greatest potential for each company. These identified needs provide input for capabilities of new vessels in WP2.

4.2 Method details

DNV visited all project partners to do interviews and initiate data collection. No partners had primary emissions data from their shipping companies that could be used as baseline and prioritise among routes. For that reason, emissions are estimated based on actual vessel movements. To do this, each RSI member submitted their lists of shipments to DNV, in a specified format that included the following parameters:

- IMO number of the vessel
- Port of departure and arrival
- Time of departure and arrival
- Amount of cargo loaded

DNV has proprietary tools to automatically withdraw AIS data from its database that match the shipments as specified by the RSI members, as shown in Figure 10. The “voyage tables” that come as a result include detailed information on each voyage performed for each RSI member, including time in port, speed profiles and estimates of fuel consumption.

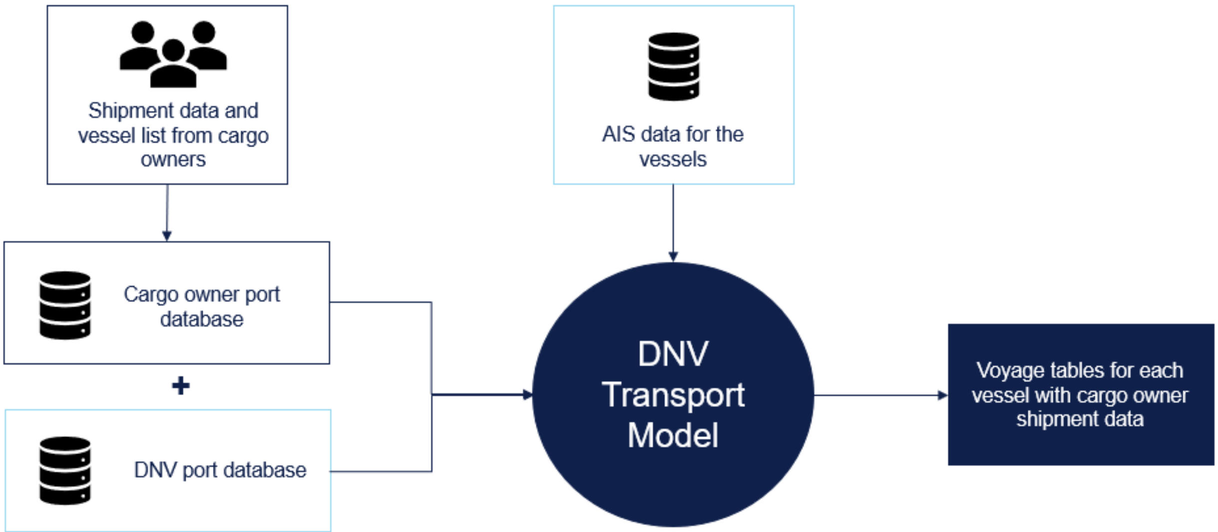

Figure 10 - DNV Transport Model

Voyages can be automatically identified by matching the ship position with certain port geographies, such as when the vessel is reported as being still in a port geography, a port call is registered. There can be a challenge to identify voyages when the time information does not match between that reported from the RSI member and the actual arrival or departure time. For example, a shipment list may only reflect voyage planning and not actual time of departure and arrival. To mitigate this, the process included looking both ahead and backwards in time.

Sometimes, there can also be a lack of AIS data in certain geographies, like depicted in Figure 11.

Figure 11 - Loss of AIS signal in the Baltic

In those cases, or in the case of not being able to match shipment lists with AIS data, emissions were estimated based on scaling from other voyages.

The fuel consumption estimates are a result of DNVs MASTER (Mapping of Ship Tracks, Emissions and Reduction potentials) model (Mjelde et al., 2014.). This model is under constant development, where the latest version can take into account also wind and waves (Guo et al., 2022), as shown in Figure 12 below.

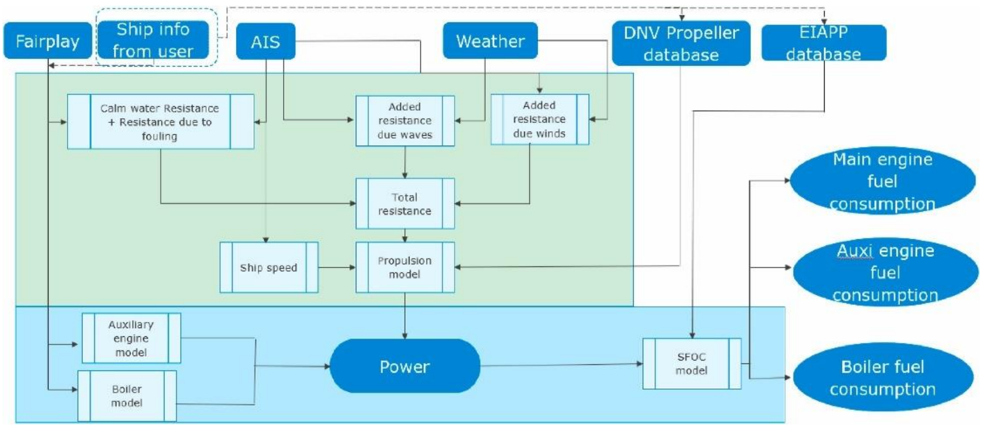

Figure 12 - Flowchart for calculation of ship power and fuel consumption (from Guo, 2022)

Only the loaded voyage was used as basis for the emission estimates, and not the preceding voyage. This is a simplification and means the emission levels are lower than what could be reasonably attributed to each company. In the Sea Cargo Charter regime, for example, in which charterers can gather emission data from ships, it is required that also the preceding ballast voyage is included.

4.3 WP2 "Solution development"

The goal of this WP was to identify the most suitable transport solutions and technologies for new green vessels that satisfy transport needs of participating companies, building on the knowledge developed in WP1. Environmental benefits and additional costs of alternatives compared to current vessels would also be assessed.

Table 3 - WP2 overview

WP	Overview	Activities
1.1	Determine logistics parameters for new vessel concepts	Map use-cases for each company for new vessels. Discuss most suitable capacity, speed and other overall parameters that suits the needs identified in WP1.
1.2	Initial lunch-to-lunch workshop	Present results and decide on vessel parameters for needs in the project.
1.3	Map technical solutions and performance	Map and assess possible technologies for green vessel(s): at least one vessel possible to realise within existing business model (ECO-Bulk), and one with zero emissions requiring new charterer-shipowner collaboration (ZERO-Bulk). Includes rough sketch of new ship concepts with assessments of cost impact (OPEX/CAPEX).
1.4	Value chain workshop	Organise workshop with shipping companies and fuel providers.
2.5	Analysis	Route cost assessments for different ships and tech solutions. Comparisons of environmental performance and cost impact for new solutions compared to current fleet. Including anticipated GHG costs due to regulatory action (e.g. EU ETS).
2.6	Workshop	Presentation of WP results

Deliverables

- Establishment of ship concept: assessment of possible technologies, assessment of current GHG emissions, resulting of route calculations.

4.3.1 Initial workshop agenda

The agenda for the initial workshop was to discuss the prerequisites of realising an EcoBulk and ZeroBulk concept within the different transport systems of the RSI members. Again, improved energy and transport efficiency is essential to mitigate increased CAPEX and FuelEX of new green vessels. Other than that, a regulatory update and a market update on zero emission general cargo vessel concepts were given to provide practical perspectives to the discussions.

In a discussion session on the EcoBulk concept, the following topics were put on the agenda:

- Perceived barriers for realising larger and/or slower vessels (to lower transport costs)
- Associated extra costs for quey storage etc
- Co-loading of cargo on larger vessels together with many cargo owners
- General specifications of vessels

On the second day, there was a discussion session organised on realising zero emission vessels, with the following topics on the agenda.

- Presentations on perceived constraints and inefficiencies in the transport networks by each RSI member
- High-level presentation of logistical overlaps between members as identified in WP2 by DNV
- Smaller group exercises on designing concepts for synergy transport systems, that would for example minimise ballasting by considering imports and exports to the same geographical areas by the different RSI members
- Presentations by the smaller groups and round-table feedback

4.3.2 Route cost and emission performance model

A cost model was built to be able to calculate costs of sailing new vessels along specific routes for each company, as prioritised in WP1, following the process in Figure 13 below.

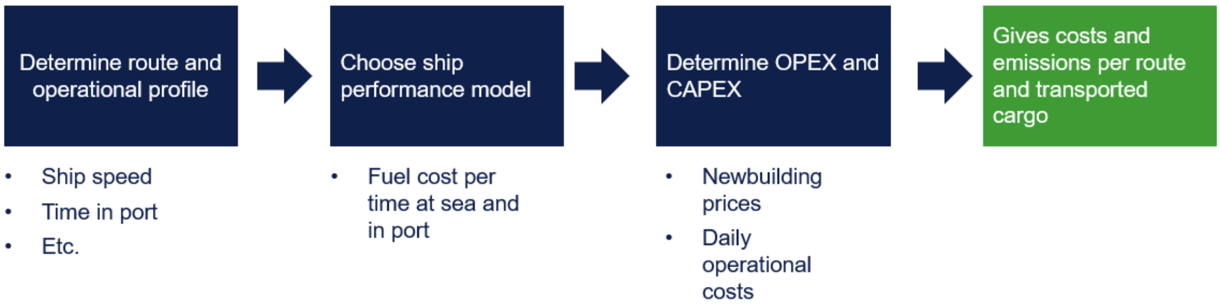

Figure 13 - process to determine costs and emissions for a given route

All in all, three different ship sizes were explored to suite the individual preferences of the RSI members: a 5000 DWT vessel, a 9000 DWT vessel and finally a 22000 DWT vessel. For each ship size, a speed-power curve was defined, drawing from other project were DNV had been involved. A sample of a curve for a 5000 DWT vessel is shown in Figure 14. Based then on assumptions on main engine efficiency, the fuel type, and speed, fuel consumption for vessels can be calculated for a given route. Auxiliary power needs were similarly estimated based on other DNV engagements in newbuilding projects.

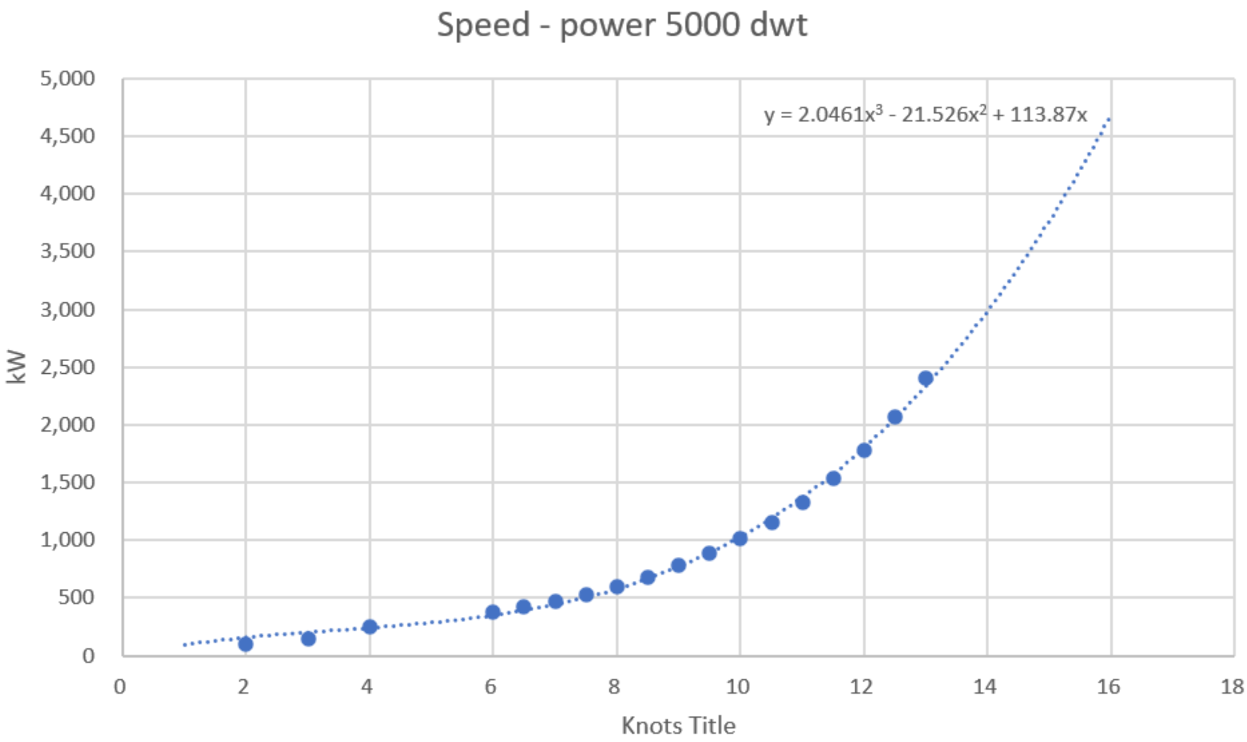

Figure 14 - Speed-power curve for a new 5000 DWT vessel

Prices for newbuilds, including additional costs for alternative fuel systems, were drawn from other DNV engagements with yards, brokers and shipping companies, for example in the Norwegian Green Shipping Program. CAPEX was calculated in a simplified way with constant payments over 20 years and a constant rate of 7.5% resulting in a yearly CAPEX of 10% of the total investment.

Operational costs for these ship types – manning, insurance etc. costs – were based on industry reports (Drewry, 2023), which details these costs for vessels of these categories.

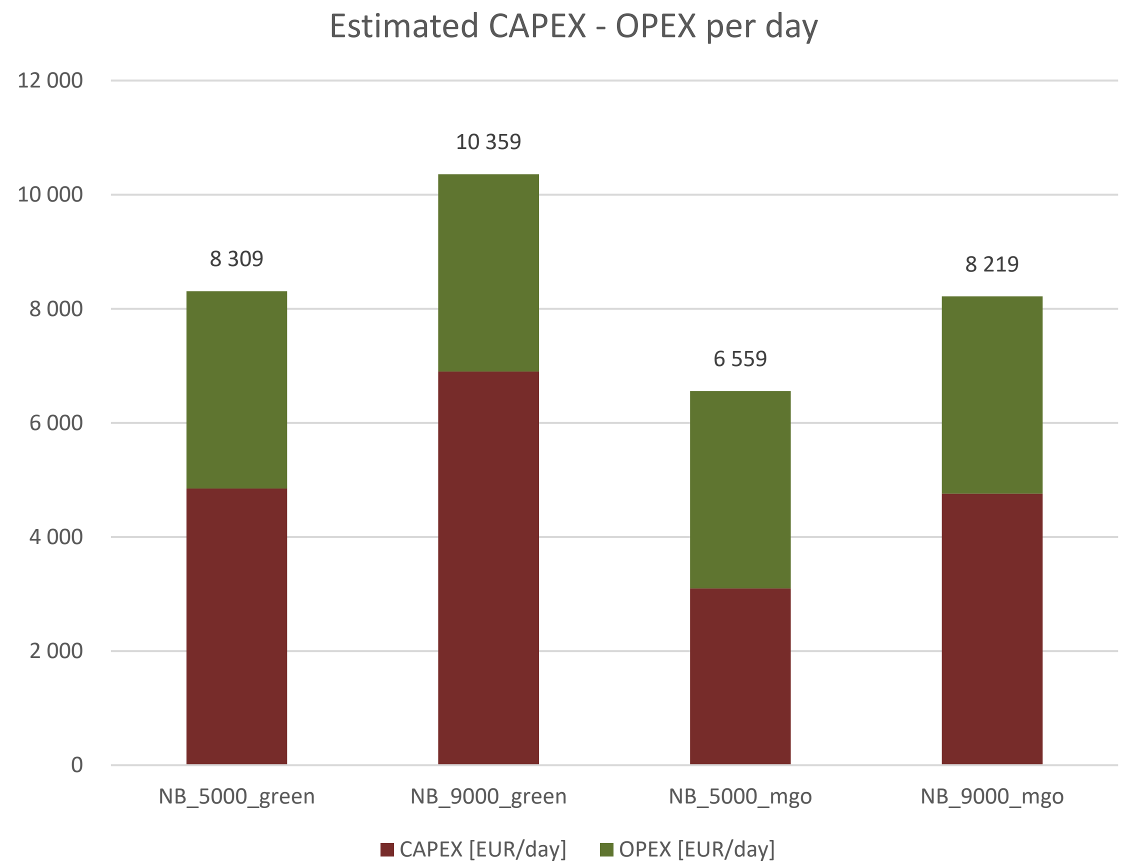

Figure 15 - Example of estimated costs per day, for newbuilds of 5000 and 9000 DWT that are either monofuel (MGO), or "green" (dual-fuel methanol)

The summed CAPEX and OPEX can be seen as a minimum time charter rate for these vessels, as the charterer pays fuel under this contractual format. In discussions with RSI members, it was found that these estimates were slightly lower than current reported market charter rates (about 7500 € per day for a 5000 DWT vessel, during Fall 2023), to some extent validating the model. A lower estimate should be expected as there is for example no profit margin included in the calculations.

The premium daily cost for the "green" version of these vessels are in the above example about 25%, excluding fuel costs. As such, even if the greener vessels were to be bunkered with fossil fuels, they would still be 25% more expensive to operate. In the calculations that follow, and in the individual reports to the RSI members, various alternative assumptions are explored, such as allowing for a lower interest rate for a green vessel, or a green state subsidy (e.g. "Klimatklivet" in Sweden).

For the fuel expenditure (FuelEX) calculations, cost estimates were based on current fuel price data from the publicly available DNV Alternative Fuel Infrastructure (AFI) database[10] and from proprietary DNV internal research on projections of future fuel production cost.

To be able to compare the fuel consumption of these new vessels to existing vessels along the different routes, nominal fuel consumption per 24 hrs at service speed for existing representative vessels of these sizes as reported in the IHS database (IHS, 2023) was used. These consumption

[10] See https://afi.dnv.com/

figures were consistent with those figures being reported to RSI members in various commercial contracts.

To calculate the impact of EU ETS, standard emission factors were used for fossil fuels and green fuels assigned zero emissions as per the ETS regulation.

4.3.3 Value chain workshop

Four shipowners from Sweden, Finland and Netherlands, two bunker fuel providers and a fuel trader from Sweden and Finland were invited to a workshop with the RSI members at Lantmännen offices in Stockholm. The following points were put on the agenda.

- Presentation of work so far in the project to the shipping companies and bunker fuel providers, to gain feedback on the process and results
- Round-table viewpoints on expectations regarding fleet renewal from the different stakeholders
    - What are our stakeholders saying (customers owners etc.)
    - What are the main drivers and barriers for a green fleet renewal from our perspective?
    - What are our top current priorities for a green fleet renewal?
    - What is THE critical issue to solve?
    - In addition, the RSI members were asked to cover what are their sustainability goals and how do they cover shipping; the energy companies were asked to present what are their goals when it comes to supplying new green fuels to the maritime sector; and the shipping companies their fleet renewal goals.

Representatives were divided into smaller groups to discuss presented issues one at a time, along the following points.

1. What do we not know or understand about each other – what are misconceptions?
2. How can we support each other?
3. What are the most pressing barriers to support and collaboration?

Finally, on the agenda was a simplified back-casting exercise. This is a method for strategy development suitable when the current trajectory and ways of working are part of the problem, and new perspectives are needed. Back-casting exercises starts with an end-goal – like zero emission 2050, or 50% reduction 2030 – and then moves backwards step-by-step in time to today. For example, if we need to have reduced emissions by 50% 2030, where do we need to be by 2028?

The participants were divided into three different groups to explore three different end states, corresponding to the three main target years for the IMO climate strategy: 2030, 2040 and 2050, as depicted in Figure 16.

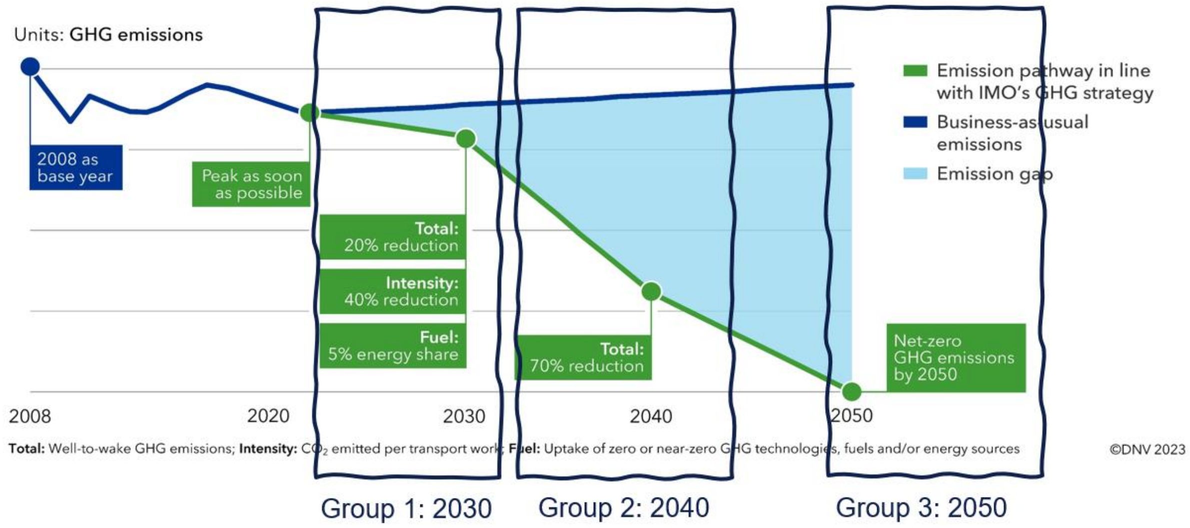

Figure 16 – Groups and strategy periods for back-casting exercise

All groups presented their solutions to each other, which wrapped up the workshop. The goal of this exercise was to get the different stakeholders to start envisioning how to work together.

4.4 WP3 “Practical realisation”

The third work package was changed at the end of WP2 to accommodate the evolved needs of the RSI members given changes in the market. It became apparent that shipowners were starting to order vessels seemingly meeting the “EcoBulk” requirement of a 50% improvement. As such, no special intervention would be required from the cargo owner side on the specifics of the vessels. More important to the RSI members now was to better understand the pace of fleet renewal needed to meet their emission targets.

With the above in mind, WP3 was designed in four main phases.

Table 4 - WP3 overview

WP	Overview	Activities
3.1	Establish analytical framework	DNV to develop framework in Excel to calculate fleet renewal scenarios
3.2	Workshop @Södra in Växjö	Explore the framework for cost-effective decarbonization of a generic shipping setting over time. Discuss implications in the group and revise framework.
1.3	Individual workshops	DNV to hold individual workshops with each RSI member using a revised framework and also looking at a shipping setting specific to the member. Discuss implications for coming renewals of charter agreements.
1.4	Final workshop	Final workshop to discuss common denominators between the members decarbonization trajectories, the lessons learnt from this WP and what RSI should communicate as main results of the project.

4.4.1 Fleet model

A fleet renewal model was built in Excel that would take as input a transport situation: vessel size; voyage length; operational days per year; annual fuel consumption; number of vessels in the fleet; cargo capacity; and average capacity utilization (share of laden/ballast). With this as input the total number of roundtrips, total tonnes transported, and fuel consumption can be calculated.

The model would then work with set time periods, for example five years, in which certain actions can be taken such as replacing vessels in the fleet and implementing energy efficiency measures. Actions are defined with an investment cost, OPEX and fuel saving impact. For simplicity, no costs are discounted in the model. The fleet is divided into a number of groups such that different actions can be taken for different groups during the period. For each period, the blend of fuels in the fleet would also need to be defined, for example a certain percentage biofuels and the rest LSFO.

The model would then output total emissions, CAPEX, OPEX and FUELEX per period. The actions and fuel blends are defined to meet certain targets for the fleet for each period, for example to match an emissions trajectory towards a set time goal (e.g. 50% reduction 2030 or zero 2040).

4.4.2 First workshop agenda and subsequent analytical work

In this first workshop of the WP3, the goal was to come to a mutual understanding of what it would take to decarbonise a generic fleet for a generic transport situation, similar to that of the RSI members. The chosen decarbonisation trajectory was that of the IMO strategy, net zero by 2050.

After the workshop, DNV amended the model as per discussions and performed analysis for each of the project partners following their specific trajectories.

4.4.3 Final workshop agenda

Leading up to the final workshop, DNV did individual analysis using the fleet replacement model for each RSI member, picking a transport case with reference to the actual situation in terms of moved volumes, and following the individual trajectory.

For the final workshop, DNV identified the common denominators and differences between the different members and suggested ways forward.

4.4.4 Summary of WP3 methodology

In this final WP, the goal was to anchor the previous detailed results on individual routes into the actual total transport situation of each member. How fast would fleet renewal have to be just to follow own climate targets. Most RSI members had goals for their shipping emissions ahead of the international regulation, so their actions as individual companies would be very important.

5 RESULTS

5.1 WP1

The work started with a kick-off at Stockholm Exergi premises, followed by site visits by DNV to all RSI members in Växjö (Södra), Malmö (Lantmännen), Raahe (SSAB), Stockholm (EFO and Stockholm Exergi) and Karlshamn (Billerud). This was to set up data collection and perform interviews with representatives from different parts of each organisation, for example sustainability, procurement, production and logistics.

Most of the results of the work in this WP contains commercially sensitive information on trade volumes, utilised ships and shipping companies, loading and discharging ports etc. The detailed results have only been disclosed individually to each RSI member and not the group due to competition law restrictions. A key output was a ranking of the most important routes for each company in terms of emissions, cargo volumes, number of shipments etc., to be used as basis for subsequent work packages.

However, some overall data can be extracted and used as basis for a general discussion.

As described in the methods section above, shipment lists from each RSI member were used to establish what ships were travelling between which ports with cargo. The different RSI members use slightly different sizes of vessels; some smaller around 3000 DWT while others prefer larger ones, as shown in Figure 17. The average DWT was around 5600 tonnes.

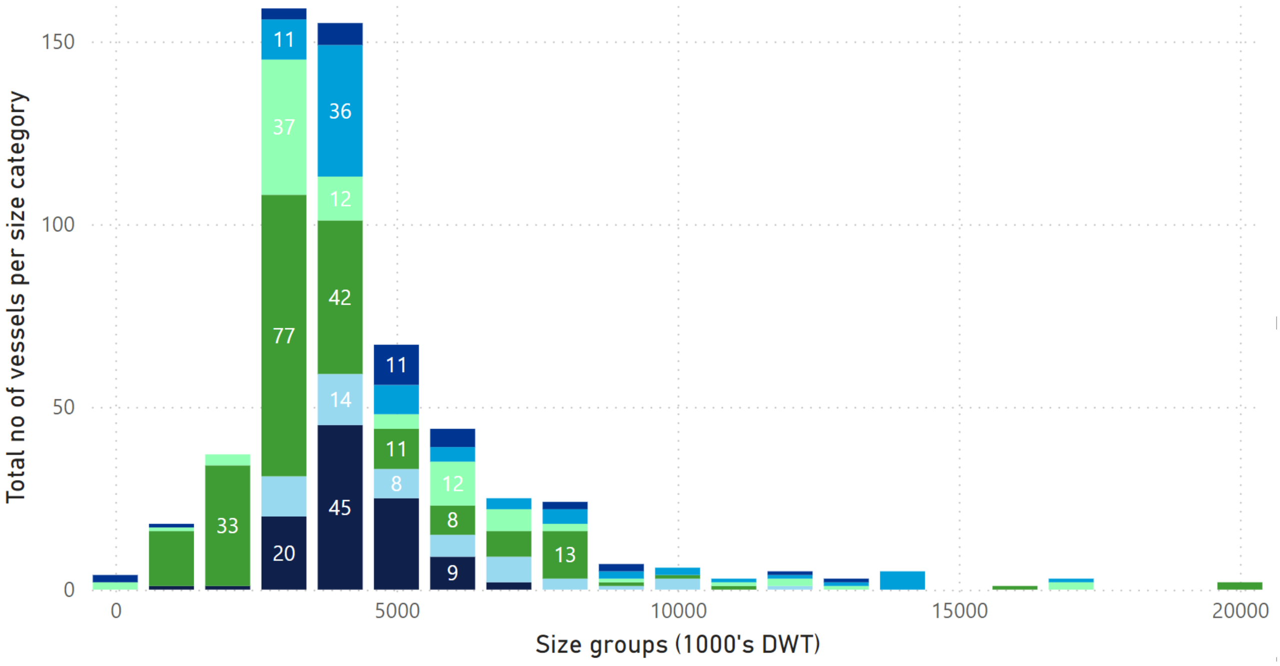

Figure 17 - Histogram of sizes of employed vessels, each colour representing one individual cargo owner

The interviews revealed that the preference for size is connected to production planning and the onshore storage facilities. A short planning horizon and little means to store the cargo, for example, would favour using smaller vessels. But the force of habit was also recognized.

Most vessels were below 5000 GT, though with differences between the RSI members. As described above, this is an important cut off for international and EU climate regulation.

Similarly to the global picture shown in 3.1, the average age of the employed vessels is quite high, with some vessels even above 40 years, as seen in Figure 18.

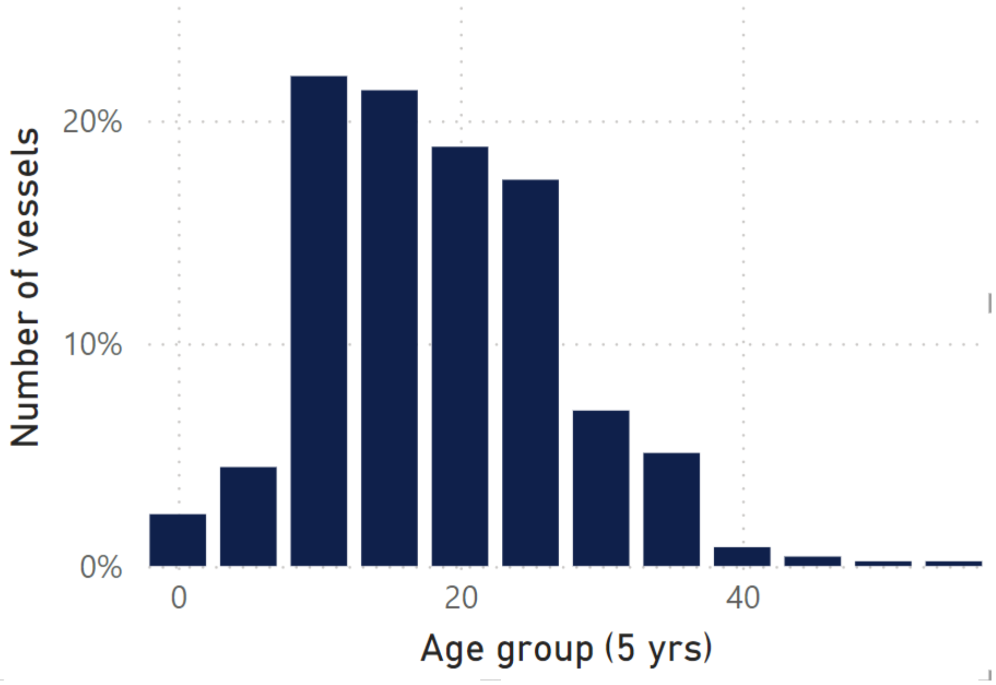

Figure 18 - Age distribution of vessels employed by RSI

Through the AIS analysis, also the ship operational profile can be seen: whether the ships are in transit, manoeuvring or waiting outside a port area, or laying still in port. The average operational profile for all RSI member voyages is shown in Figure 19. It is clear these kinds of ships spend a large portion of their time in port.

Time in port can be a significant barrier to cost-effective operations of vessels, especially for future greener vessels. It is very expensive to have vessels with higher CAPEX unproductive. Reducing time in port becomes a crucial measure to reduce total costs. Increased port productivity including opening hours is then an important component. Previous research as shown that port times can also be reduced with more efficient voyage planning on the shipping company side (Johnson and Styre, 2015).

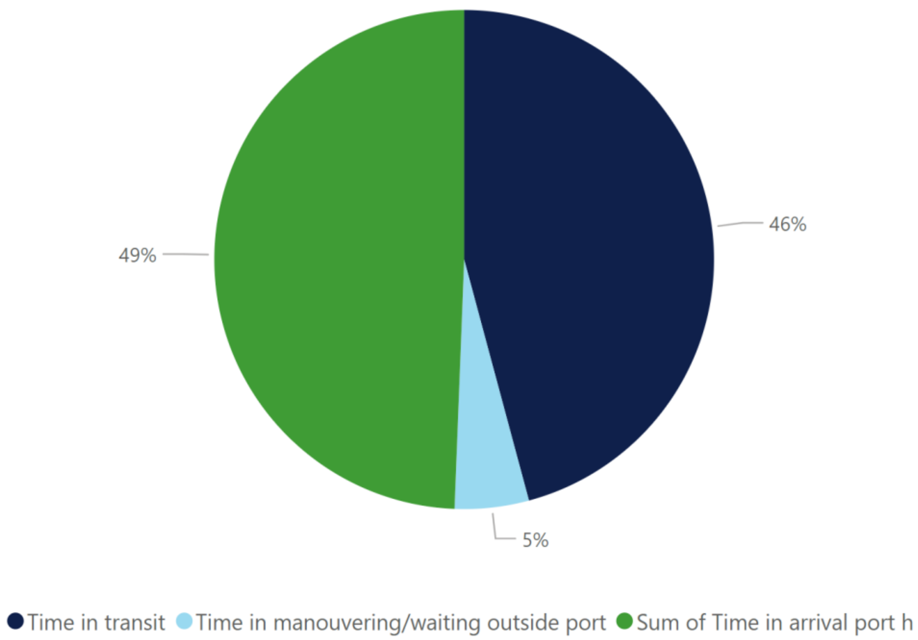

Figure 19 - Operational profile

Ship speeds outside port stays are also easily withdrawn from the AIS data and shown below in Figure 20. There is quite a wide spread of speeds. This could possibly indicate presence of “hurry-up-and-wait” behaviour, where ships sail too fast in the beginning of a voyage to slow down later as arrival times become more certain. Such behaviours can easily be discovered in detailed analysis using these datasets.

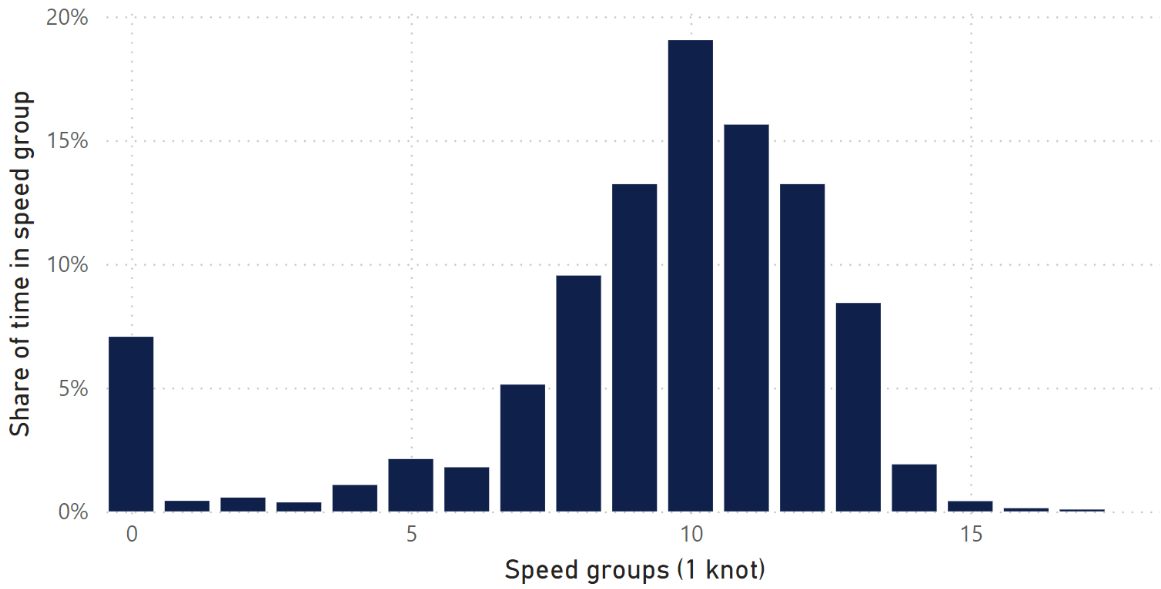

Figure 20 - Speed profile when in transit (includes waiting outside port area)

Finally, the utilisation of these vessels by RSI members was analysed. Since all voyages for all ships used by RSI members were extracted from AIS data, and the voyages made specifically for each member was identified from that material, the share of voyages done for RSI compared to the total number of voyages done by these vessels could be determined (it could also be distance for RSI as a share of total distance covered). This can be seen as a measure of the control the members would have over these vessels: a high utilisation would indicate that the members are a substantial customer to the shipowners of these vessels and could arguably then enforce standards in an efficient way. The utilisation of the vessels was found to be around, as displayed in Figure 21. Again, any ballast or repositioning voyages were excluded for simplicity.

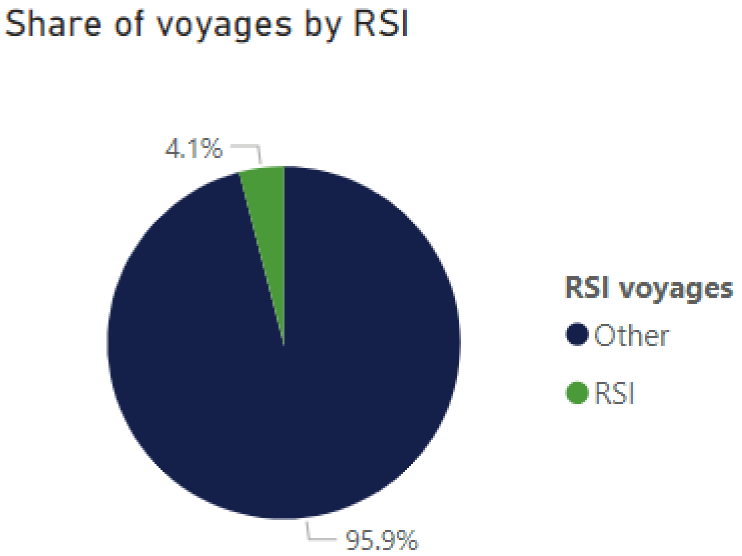

Figure 21 - Utilisation of vessels: for all voyages of all ships utilised at least once by RSI member during the year, the share of voyages done with RSI cargo onboard

5.1.1 Summary of WP1 results

5.2 WP2

5.2.1 Internal workshop results

The discussions were structured in two different sessions, “EcoBulk” and “ZeroBulk”. The purpose was to understand the prerequisites for improving the transport efficiencies in the different RSI member’s sea transport systems. Any improvements in transport efficiency would translate to lower total costs, which in turn would bring down costs for renewing the fleet with greener, more expensive vessels. The “EcoBulk” session covered minor structural changes while the ZeroBulk covered more extensive changes, such as logistical collaboration between RSI members.

Table 5 - Results of WP2 internal workshop on improving transport efficiencies

EcoBulk workshop (minor structural changes)	Size	○ The trend is generally bigger vessels. Smaller vessels are increasingly being moved away from the Swedish/Baltic market. Some RSI members note however they have gone up in size "unintendedly" because of shipping company actions. ○ Market habits may limit drive towards larger vessels, because you ask for what you are already using (e.g. x positions for a 3800 DWT vessel) ○ There are limits in some ports in Baltic, and in UK due to locks, tides etc. ○ Crucially there is a lack of storage capacity in terminals and with producer or consumer, so difficult to absorb larger volumes.
	Co-loading	○ Some RSI members were already co-loading due to initiatives from shipping companies ○ Would require more extensive collaboration with brokers and shipping companies
	Speed	○ Lower speeds not discussed too much. Some RSI members had tested Virtual Arrival, or had received questions from a shipping company to do this ○ Discussed inclusively how to share savings.
	Combine inbound and outbound	○ "Easy on paper" but would require internal collaboration to empty storages at the same time.
ZeroBulk workshop (larger structural changes)	Realising logistical synergies	○ Discussion covered detailed transport situations which are not possible to disclose in the report for commercial reasons ○ In general, everyone is a bit sceptical if synergies can really be realised. Concerns are if there may be extra delays if ships are shared and the different companies cannot collaborate their production/import/export ○ One major synergy situation was defined for imports/exports between Sweden and UK with two RSI members, which was used for further analytical work in the project

5.2.2 Main analytical results

One to three transport cases were defined for each of the RSI members to give representative results based on the data on trade patterns and volumes collected and analysed in WP1. Typically, different ship sizes and trip lengths (e.g. short voyage with smaller ships, longer voyages with larger ships) were tried for each partner.

Each transport case was then modelled in Excel so that vessels of different configurations "sailed" along the different routes at a given speed, time in port etc. The main outputs were the cost structure of the vessel (OPEX, CAPEX, FuelEX) and the emissions over a year. The “green premium” for a vessel fitted with an alternative fuel system could be calculated, and various levers to minimise the premium could be assessed. Such levers could be an increased carbon price, state investment support, increased port productivity etc.

The detailed calculations that were performed for each member cannot be disclosed for commercial reasons. In general, the results were quite similar regardless of port pairs and ship size. In this report, a case of a synergy between two cargo owners will be used as illustration. The main point of the synergy case was to showcase the impact of improving vessel utilisation compared to market average.

To establish the synergy case, DNV identified in WP1 that there were similar volumes being transported in opposite directions in some cases; for example, import for one company and export for another. With assumptions on time in port taken from actual port times as assessed in WP1, ship capacity and total volumes per year, a route was designed. For this roundtrip, the vessel is at sea 9.2 days (68%) and in port 4.4 days (32%). The vessel would sail with cargo onboard 82% of the sailing time, and in ballast 18%.

There is little public information available about the actual utilisation – that is, the ballast-to-laden ratio – of these vessels in this area. It is often assumed to be between 30-40% ballast. The case here represented a significant improvement in vessel utilisation. That is, the ship sailing on this route can have much higher earnings compared to average operation at essentially no extra costs. In practice, this implies that two cargo owners collaborating to reach this improvement in utilisation and then offering up the volumes in a joint tender or contract should be able to negotiate savings compared to market benchmarks (or reach lower emissions through a more expensive vessel at a smaller premium).

For this case, a newbuilt 5000 DWT vessel fitted with a dual-fuel methanol engine is compared with a newbuilt MGO-driven vessel in terms of costs and emissions. The results of the calculations are visualised in Figure 22. CO2 emissions for an existing older vessel sailing the same route is also included. It can be seen that CO2 emissions are reduced by 90% for a vessel running on e-methanol, and by 70% with MGO. In other words, substantial improvements are achievable just with a state-of-the-art hull and engine compared to an existing vessel, without switching fuels.

The green premium calculated here, 2.7€ per tonne cargo in the base case, is the difference between the two new vessels only, and not between today’s older vessels and new vessels. Even though e-methanol is about twice as expensive, the fuel costs are only a smaller part. There is also a slight effect due to carbon pricing, assumed at 100 €/ton. The total cost delta between a new vessel running on a zero-emission fuel and a fossil alternative across the scenarios was 2-3€/ton cargo transported on this service.

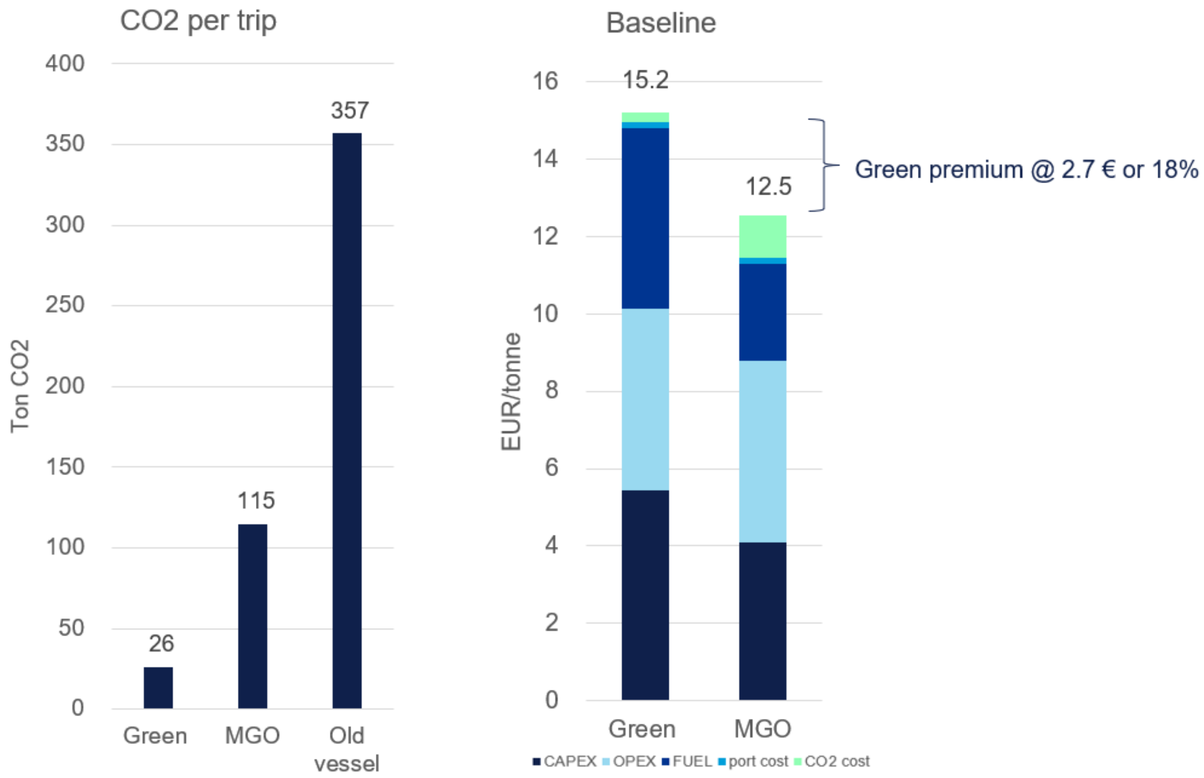

Figure 22 - CO2 per roundtrip for different ship alternatives (right); total cost structure in EUR/tonne transported (right)

The effects of various green levers on the relative cost between the alternatives were also investigated: a doubled CO2 cost; a green investment support; and, a reduction in port time by 5 hours (about 20% reduction). Results are displayed in Figure 22 below.

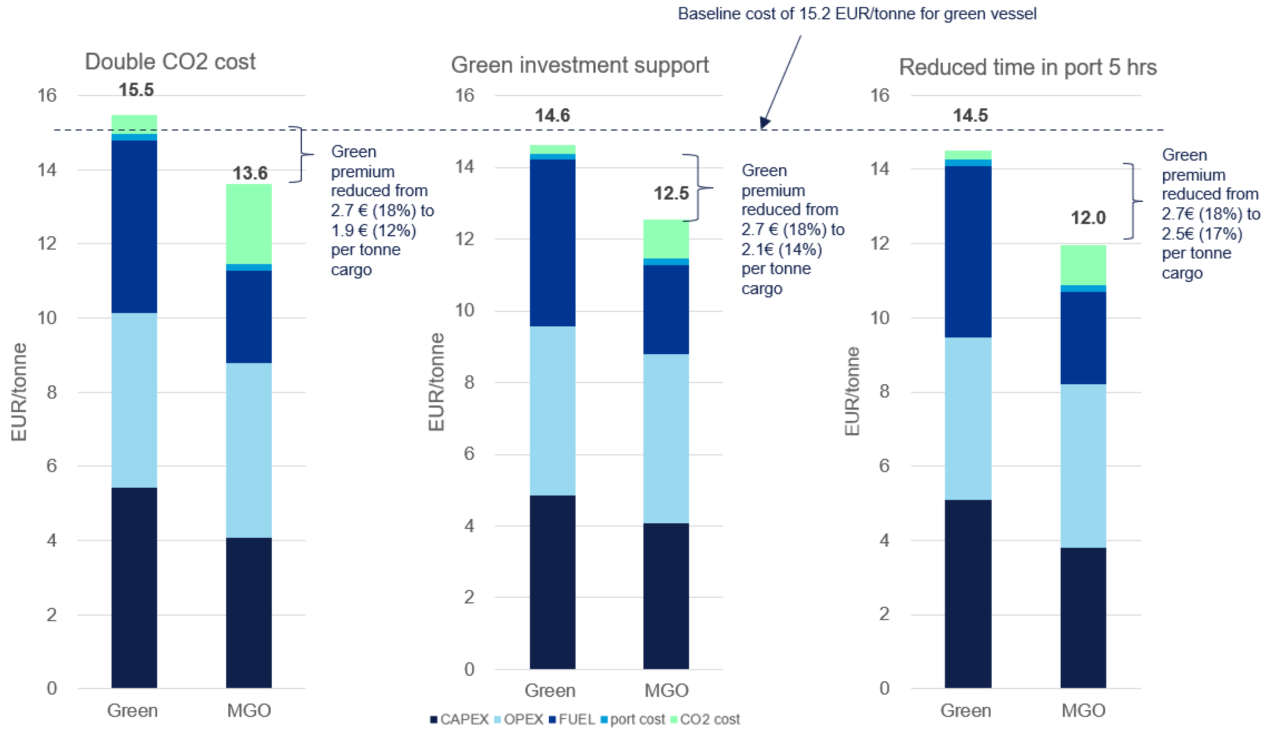

Figure 23 - Effects of various green levers to reduce the green premium: double CO2 cost, 50% green investment support, 5hrs reduced time in port

A combination of green investment support and reduced time in port is applied and displayed in the Figure 24 below.

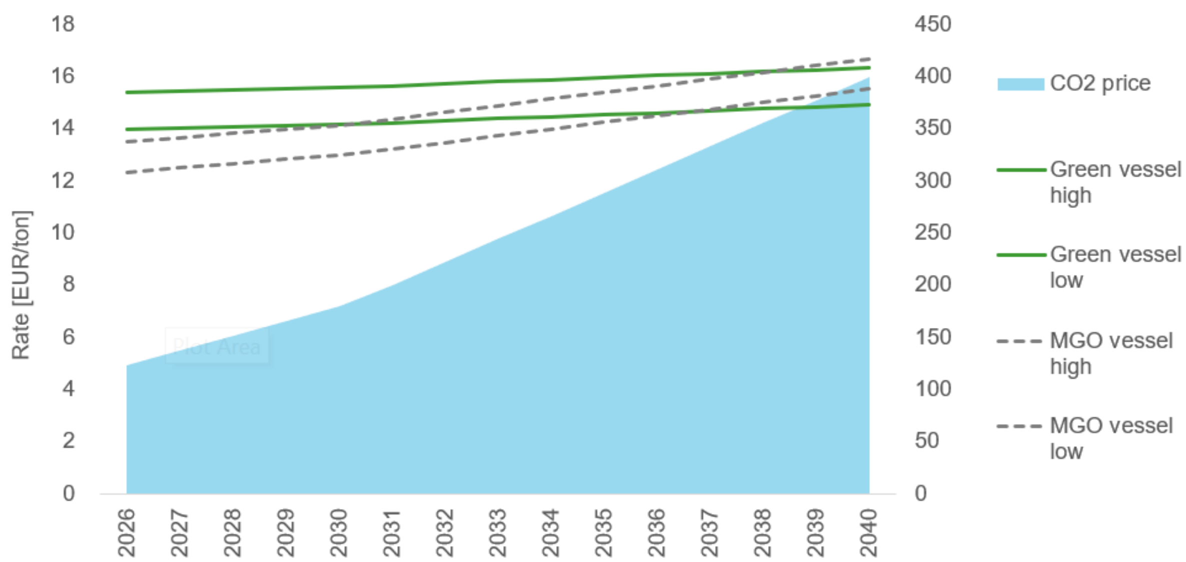

Figure 24 - Combined improved port efficiency with green investment support, projecting increased CO2 cost over time. Two lines are drawn per vessel, representing

This combined green lever scenario shows that within just a few years of operation (or when the carbon price reaches € 200), the lines representing +/- 5% uncertainty in costs start to overlap). After around 10 years of operation, the options are equivalent.

A number of mechanisms are not captured by this kind of scenario analysis, as per below points.

- Reduction in cost of green fuels has not been considered. A fixed cost was assumed in these scenarios.
- The green vessel is assumed to run 100% on a green fuel (plus a small share of pilot fuel). It could also be considered to take the risk of buying a vessel capable of using green fuels, but only blending in enough green fuel to meet regulatory or customer requirements.
- Regulatory fleet optimisation has not been considered, whereby use of e-fuels in a vessel would buy compliance for other fossil-driven vessels. Within the EU, FuelEU maritime will from 2025 require that GHG intensity of a vessel should be reduced in a stepwise approach. Several mechanisms have been introduced to make compliance easier, one of which is “pooling”. The regulation requires that GHG intensity must be lower on a fleet level, not on individual vessel level. A shipowner who is not able to reduce emissions in their fleet during a year, may instead “buy” compliance by entering into a pool with shipowners who have made larger reductions than necessary for their own fleet. Conversely, if a shipowner has a ship running on e-methanol or some other low-carbon fuel, they may compensate for the compliance of many other vessels. E-fuels are even double-counted in the FuelEU regulation, so that the volume of e-fuels used is doubled, further incentivising use of such fuels.
- An RSI member could equally consider meeting their own environmental goals by purchasing a few low/zero emission services along strategic lines, and then do nothing or very little along other lines. The important indicator is the relative cost of reducing a tonne of CO2 from shipping with a certain action compared to other alternatives.

Finally, only the economics of operating different *new* vessels have been considered here, and not compared to vessels currently sailing. In a market where profits are comparatively high, it could be possible to introduce greener vessels with lower margins rather than higher prices. There are indications from the RSI members that shipowners may be offering contracts with dual-fuel ready newbuilds without requiring substantially higher charter rates. Only actual commercial discussions will yield the true picture.

5.2.3 Value chain workshop results

Three shipowners from Sweden, Finland and Netherlands, and two bunker fuel providers and a trader from Sweden and Finland were invited to a workshop at Lantmännen offices in Stockholm. The notes from the discussions on expectations for green fleet renewal are shown in Table 6

Table 6 - Discussion notes, expectations on green fleet renewal

Cargo owner #1	• Shipowners may need longer contracts back-to-back from us cargo owners for loans for more expensive vessels. However, there are challenges with longer-term contracts for us due to current short-term agreements with our own customers. • When we do COA, we can leave it to the shipping company to optimize operations. On time charter we would have to have more ballast.

	• It is important to mention the role of ports. Only one of our ports are open in the weekends [meaning there are large inefficiencies in the network where vessels are waiting] • We are quite eager to assist in green fleet renewal, because of our climate targets. But we are dependence on others for full utilization of new vessels, so there is a need to understand the bigger picture. • We have been exploring virtual ETA to reduce emissions and costs. However, we have had problems for owners and/or captains to trust a virtual Notice of Readiness. • We have goals for 2035 but no plans for yearly reductions.
Cargo owner #2	• We acknowledge there are [logistical] inefficiencies in the system. We highlight the role of technology in addressing these issues [because it will be difficult to change logistics]. • We have ambitious goals for a net-zero supply chain by 2030 but mindful of costs.
Cargo owner #3	• We have no explicit goals for our shipping, but our general goals for transport is to halve emissions after 2030.
Cargo owner #4	• We are facing significant changes in our operations, with plans for fossil-free shipments of some products by 2027. Our fossil-free requirements thus come quite early, emphasising need for cost-efficient services including these ships taking return cargo. • We would like to coordinate shipments of our imports and exports, but it is difficult even within a single company due to different organisations, different requirements and needs, etc.
Bunker producer	• We focus on providing conventional and alternative marine fuels, including HVO • Now we are looking into our product portfolio due to FuelEU • See challenges in transitioning to sustainable fuels due to huge investment requirements • Highlight importance of mass balancing approach and life cycle emissions in decision-making • Note that everyone has ambitious goals but perhaps a bit far away. This is a problem for refineries due to the huge investments involved
Bunker trader	• The transition involves changing business models and adopting mass balance approaches • Need to address customer needs
Shipping company #1	• We were an early adopter of biofuels, first trials already in 80s/90s • We use mass balance calculations for green voyages • Commercialised biofuel blending in 2019
Shipping company #2	• When considering new vessels, you should also try to optimise its operation. We see many inefficiencies the way ships are operated now. • We emphasize the need for longer contracts for investment in expensive, new vessels. Preferably longer contracts than 3 years.

	• Advocates for step-by-step targets for emissions reductions, because it is difficult to make large jumps. • Need to get fossil-free pilot fuels as well, along the actual fuels [e.g. ammonia needs large shares of pilot fuel to combust well] • New ships are by designed 50% more efficient. But that won't solve it. Everything needs to become more efficient. We cannot wait until 2030 or 2032 [when FuelEU ramps up and a lot of companies have set substantial reduction targets like 50% reduction] - everyone wants biofuel by that year. It will be a problem if production hasn't ramped up by then. o Comment from Fuel company: We need to start small-scale on biofuels and ramp up, make transition step-by-step.
Shipping company, active in energy sector #3	• We are focussing on replacing older vessels with more efficient ones to reduce emissions. • We are interested in new technologies and are working closely with energy companies for sustainable solutions. Not all energy companies in the world are as good as the Nordic ones.
Shipping company #4	• We need customer commitments for adopting the dual fuel vessels

As is evident in the above table, a main theme of the discussion was the need to go from longer term goals on the cargo owner side and translate them to shorter term goals; perhaps even year-by-year. This is necessary for both shipping companies and energy providers to be able to plan and make the necessary investments in the right time.

5.2.4 Summary of WP2 results

The practical use of the route calculations done in WP2 was to demonstrate the cost implications of various fuels on specific trades, such that each cargo owner could assess what the green premium would be per transported product.

An important next task from each cargo owners' perspective would be to see to what extent it is possible to absorb those extra costs onwards in the value chain, and to compare those costs to other initiatives. Compared to other emission-reduction actions that can be taken by a company, what is the relative cost-effectiveness of emission reductions in the shipping side?

Even when considering the improvements in transport efficiency enabled in the case study presented above, it was still cheaper in the short term to invest in a vessel operating only on fossil fuels. This will still lead to substantial improvements in emissions, as the existing fleet is so inefficient. The practical implication is such that there is a risk that investments will be made in a fleet that is energy-efficient, but that may still require investments in retrofitting engines and/or fuel systems during its lifetime. This enforces the need for strong policy framework including also smaller vessels <5000 GT.

5.3 WP3

As described, the work package was changed to better reflect the reality that shipowners were already starting to order vessels that would seemingly meet the "EcoBulk" improvements of 50%. There would be no need for the RSI members to do anything in addition to realise these vessels.

This WP was then designed to put fleet renewal in a full context. How fast would the pace of renewal need to be to meet the different climate targets each company had set. Given the substantial improvements in energy efficiency in new vessels, for example, would it be better to renew the fleet slowly or quickly? Is it worth it now to take the extra costs of an alternative fuel system onboard, so that the vessel could run on hydrogen, methane gas, ammonia or methanol?

5.3.1 Initial analytical work and workshop results

An important goal of this WP was to understand of the scale and pace required for reaching shipping climate targets. One aspect of this is the amount of alternative fuel required to meet a given trajectory. There are currently two regulatory trajectories to consider – the IMO and EU goals – alongside the individual goals each company may have.

In WP1, the summed estimated energy use for the shipping considered at each RSI member was around 60 000 tonnes per year. Consider now this energy use in the form of e-methanol – it would correspond to about 120 000 tonnes of fuel given the lower energy density. Then halve it again due to the 50% improved efficiency of new vessels, and we arrive at the volume of 60 000 tonnes of e-methanol to cover a substantial portion of RSI shipping. This in turn is equivalent to about one e-methanol factory such as is being considered in the Baltic. This signals the scale of collaboration needed to facilitate construction of new fuel production.

For the fleet renewal exercise, a generic transport situation representative for many of the RSI members were used for a case study. Ten 5000 DWT vessels were assumed to operate at 70% utilisation (i.e. 70% loaded, 30% ballast) in 5-day voyages to carry 2.1 Mtons of cargo per year. Drawing from typical port stay data, the ship would spend 57% of their time at sea and 43% in port.

In the fleet renewal model used for this case study, six different scenarios were constructed, as shown in Figure 25. All had the aim of reducing emissions to zero by 2050, but as can be seen in the figure, different strategies were chosen to meet the goal. The trajectory towards 2050 was linear.

	Strategy	**Results**
Scenario 1: "No strategy is best strategy"	Meet trajectory by blending in biofuels without fleet renewal	OK as strategy to 2040 when it is no longer possible to reduce emissions more
Scenario 2: "Kick the can along the road"	Gradual fleet renewal and biofuel along regulatory trajectory	Fine as a strategy until 2045, cheaper than #1, same emissions
Scenario 3: "All-in"	Immediate replacement of all vessels and biofuels along regulatory trajectory	Lowest total costs and emissions compared to scenario #1 and #2, compliant until 2045
Scenario 4: "Gradual green replacement"	Two new green fuel vessels every five years and e-methanol along regulatory trajectory	Compliant towards near-zero emissions 2050 but more expensive than #5
Scenario 5: "Green All-in"	Immediate replacement of all vessels and e-methanol along regulatory trajectory	Lowest cost scenario compliant towards near-zero emissions 2050
Scenario 6: "Minimum replacement"	Replace vessels with green fuel vessels only when regulatory trajectory requires a new vessel	Compliant towards near-zero emissions 2050 but most expensive

Figure 25 - Fleet renewal strategies towards zero 2050

The constructed simplified fleet replacement model then worked with a set of fixed time period (in this case 5-year periods), for which "investments" could be made that reduced emissions at a certain CAPEX and/or OPEX. For simplicity, especially considering the complexity of ship finance, no costs were discounted in the model. Yearly CAPEX in this case is simply the total cost for the investment divided by a set number of years (here 10 years).

Moreover, the fuel mix could be changed, resulting in different costs and emissions using fixed prices over time for different fuels, and WtW emission factors.

The fleet was divided into groups in the model (in this case five groups) so that different actions could be taken to different parts of the fleet during each period. The model then calculated the total cost of operating the fleet and the total emissions, for each year in each period. Some examples are found in **Error! Reference source not found.** to Figure 28 below.

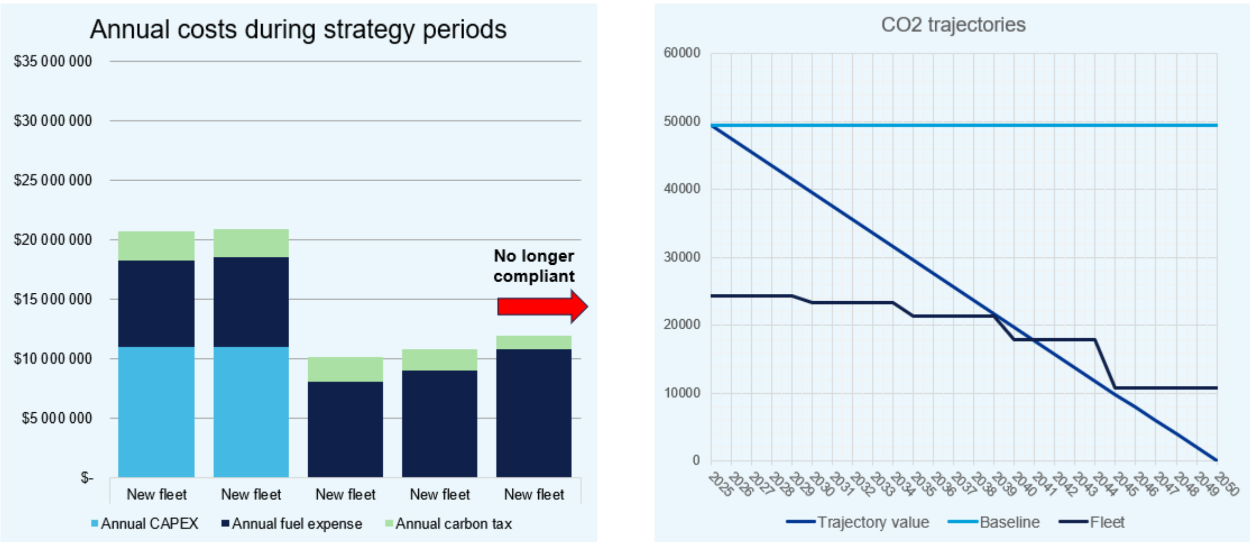

Figure 26 - Scenario 3: Replacing the fleet completely to fossil newbuilds with 50% improved efficiency leads to greatly reduced emissions, and costs once CAPEX has been paid (10 yrs)

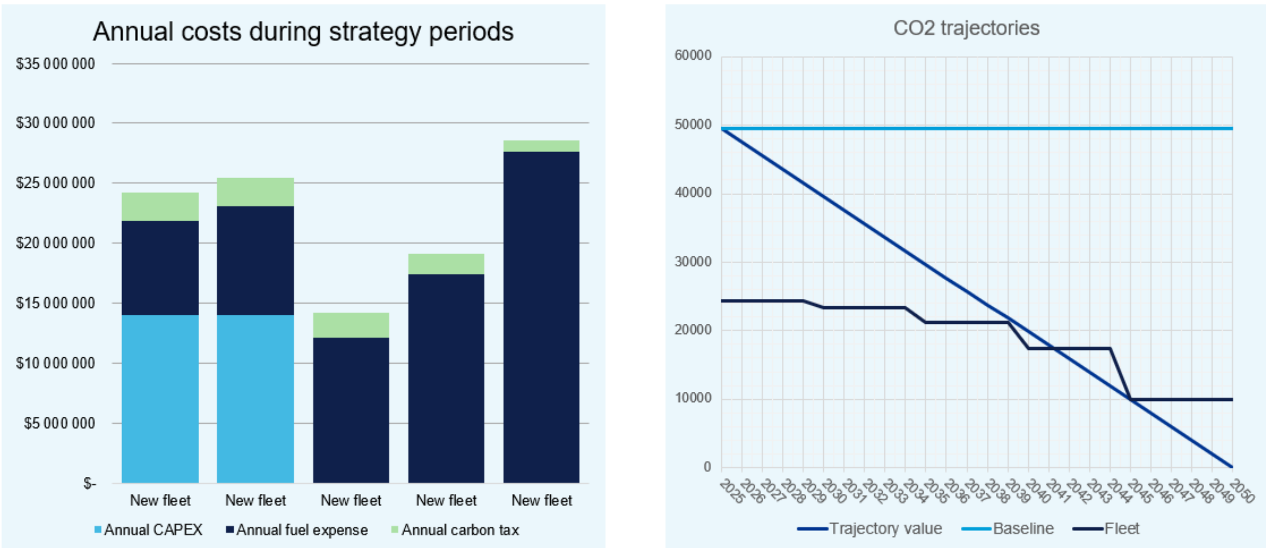

Figure 27 - Scenario 5: Immediate renewal of the fleet with methanol DF vessels can be compliant all the way to 2050

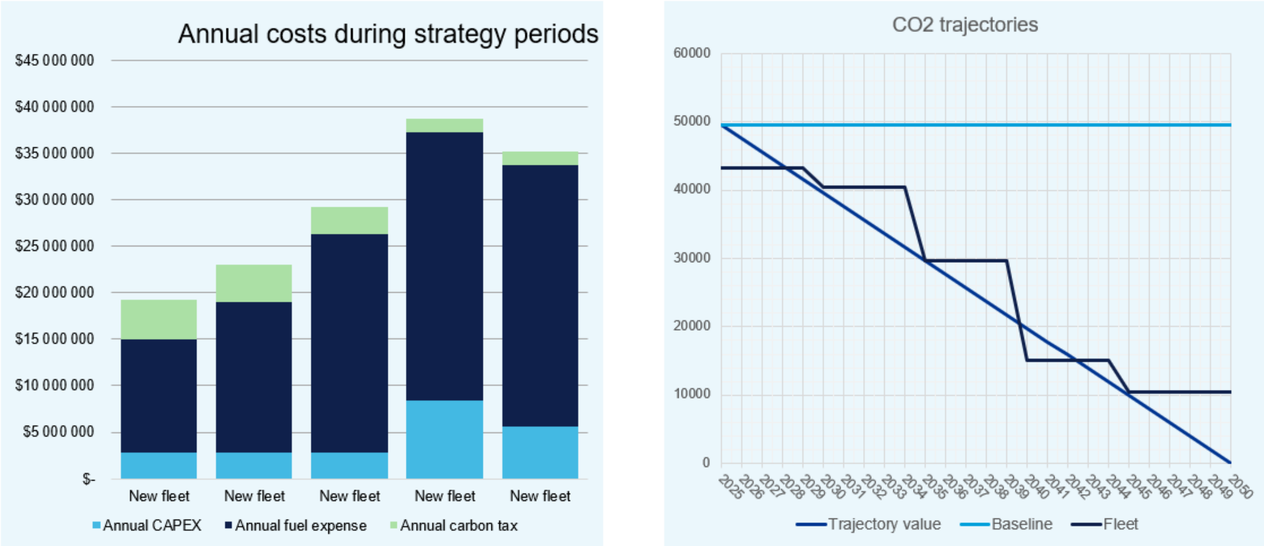

Figure 28 - Scenario 6: Replacement of existing fleet with green newbuilds and filling each of them up with 100% methanol until introducing new ones (in total 8 out of 10 vessels are green NB by 2045)

When put all together, some of the scenarios were of course much more expensive than others, as shown in Figure 29

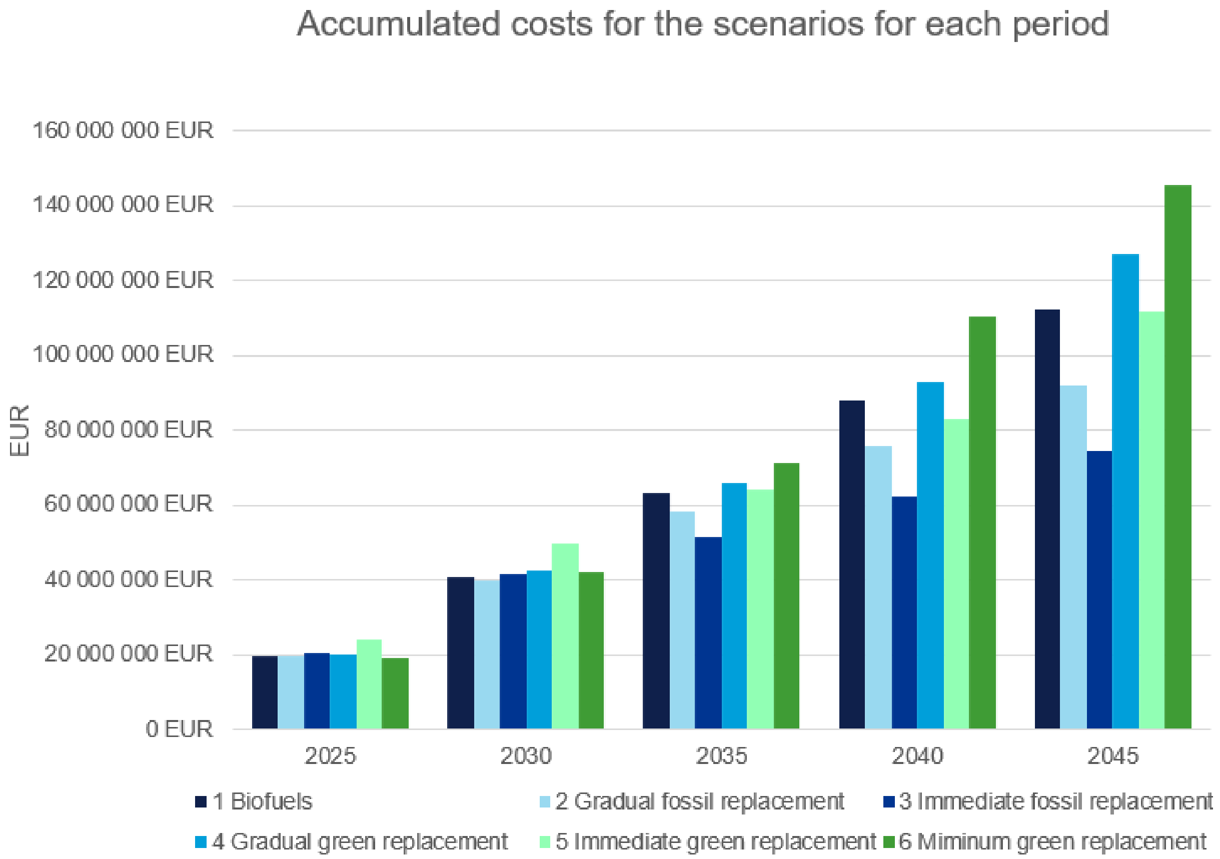

Figure 29 - Accumulated costs per 5-year period

These results were presented and discussed during an onsite workshop at Södra headquarters in Växjö. It was noted also that the actual regulatory ambitions are divergent. While the IMO target goes towards zero 2050, the EU aims at 90% by 2040. Also by 2040, EU aims to have removed the emission allowances in the emission trading scheme, of which all ships >5000 GT are now a part (and the smaller vessels may become part of it). The FuelEU regulation aims not at 90% 2040 but rather 80% reduction in GHG intensity by 2050.

Each of the members were asked before the workshop to discuss internally how they were already or could handle topics such as fleet renewal, shore power, energy efficiency improvements or alternative fuel. However, there were few practical cases. None of the members had had any requirements on fleet renewal in contracting. Shore power had been discussed among at least two of the members, but nothing put in contracting yet. No one had required energy efficiency improvements – but a need for doing so was highlighted in the workshop. Some had tried to use biofuel, but it was not clear what should be required from shipping companies in terms of documentation, especially if it concerned use of biofuels through book and claim.

5.3.2 Final analytical work and final workshop results

DNV followed up the workshop in Växjö by performing modelling exercises with cases aligned more closely with the individual transport situation as mapped in WP1, along with meeting the individual climate target set by the company.

When overlaying all different decarbonization targets, two main categories could be identified:

1. Near-term ambitious reduction in absolute terms. Examples include “fossil free 2030” or “50% reduction by 2030”.
2. Near-term zero emissions on selected routes or in the whole company

Generalising the individual results yielded that **if there is a 50% reduction target**, this could be reached effectively in the short term by either renewing the fleet or aggressively working to improve efficiency in the existing fleet in addition to blending in biofuels. Both could be just as cost-effective in the modelling performed. On the other hand, **if there is a zero-emission goa**l, the only practical option is to engage in a market dialogue to understand the actual options available. This could actually be a reasonable strategy in the cases that there already is a green market premium for the transported good, as in the case for green steel. The results of WP2 indicated green shipping premiums in the order of around 5€ per tonne, whereas the actual green steel is sold at prices that are hundreds of euros above the price of normal steel. It could then be possible to absorb the additional green shipping costs within this larger green premium. These strategies are summarized in Table 7 below.

Table 7 - Decarbonization options

Company decarbonization goal	Best option in theory	Practical implementation
Near-term ambitious reduction in absolute terms	Partly or fully renew the fleet with mono or dual-fuelled vessels, since new vessels greatly improve efficiency.	For a contract up for renewal, engage with one or a selected group of shipping companies to discuss reaching your trajectory. This should include an examination of their potential to improve the efficiency of their existing fleet, together with a

		zero-emission ship renewal - perhaps just one ship. With actual figures, you will know the costs and emissions of renewing the fleet.
	Drastically improving the operational efficiency of the existing vessels and blending in biofuels	Engage with a selection of your shipping companies and see what you can achieve in improved energy efficiency in a quick pilot effort. Use this experience as a benchmark and basis for decision how to move forward. If you are able to achieve substantial savings, this in addition to biofuels could be the best option.
Near-term zero emissions on selected routes or in the whole company	Renew the fleet with zero-emission capable vessels	Tender or market dialogue. Currently it may be a “buyer’s market” for green shipping services. A cargo owner may utilize the interest in providing green shipping services to receive transparent cost calculations of green ships along defined routes.

One result is rather robust: it would be very expensive to reach the goals by doing nothing until 2029 and then requiring biofuels to reduce emissions. In practice, DNV recommended to explore both practical options (top two rows in the rightmost column in Table 7) in a short time frame to gain a better understanding of what is practically feasible given your own organization and your available suppliers.

Based on other engagements and market observations, DNV also recommended to establish a cross-function maritime decarbonization function in the company. An example of a job description is found in Figure 30 below.

Key Responsibilities

- Create transparency on fleet performance towards internal (and external) stakeholders
- Responsible for data structures and data flow related to fleet performance
- Evaluate and analyze energy performance
- Act as a subject matter expert (SME) in close collaboration with internal stakeholders
- Tracking fleet environmental and carbon performance
- Keeping a closer eye on EU ETS and other relevant regulations
- Project managing pilot projects
- Representing the company in industry discussion platforms
- Joining other departments in discussions with ship owners

Key focus areas for strategy follow-up

- Operation of vessels (performance monitoring after contracting)
- Tech. measures installed (before and under contract)
- Type of fuel (before and under contract)
- EU ETS
- CII rating (before and under contract)

Examples of key KPIs to track for benchmarking

- Vessel utilization and speed
- AER/EEOI/EEXI - The best fuel/CO2 performing vessel for the most fuel/CO2 critical trades
- FOC per voyage (per day & nm) incl. EU ETS allowances
- GHG intensity of fuel used

Examples of secondary KPIs to track

- Hull and propeller cleaning frequency
- Type of hull coating applied
- Just-in-time used

Figure 30 - Sample of job description for a Maritime Sustainability Coordinator, from DNV project for large bulk charterer

In addition, it is beneficial to negotiate an internal carbon price so that efforts in shipping to reduce emissions can be compared with efforts elsewhere in the company.

Underpinning execution of all strategies, but in particular for working with reduction of emissions in the existing fleet, is a reliable means of following-up on emissions data. As discussed earlier in the report, vessels <5000GT have not been subject to regulatory requirements for emissions reporting before but are now included in the EU MRV scope from 2025.

A final workshop was held at SSAB offices in Stockholm. A summary of the discussions is found in Table 8 below.

Table 8 - Workshop statements on emission reporting

RSI member #1	We are updating contract clauses to include emissions. We are wondering if we can we have a standard way to get emissions data. Also, how can we verify that it is correct? One thing is to see your own emission figures, one thing to see entire fleet of the shipowner. It might look like it decreased for you but actually increased on a fleet level. Or if they introduce a new vessel in the fleet. The owner needs to be able to show improvement both for your shipments and on their fleet level. Hard to communicate with how to proceed with the smaller owners. We need to monitor, and we need some baseline. If we feel that the realistic level is this. Cheap as possible and as steep as possible. We have talked about this along the way. The better we communicate the better they can compare
RSI member #2	When we started to collect data from spot chartering, we had data from fewer than half of the ships. When the shipment is done, we ask once or twice, but then you forget. Now we get 80-90%, but it takes time. The big owners are advertising that it is verified by DNV or others, but the smaller owners have difficulties. We have all-in-all less than twenty shipping companies to work with.
RSI member #3	We may get emissions data in. We also need to make suppliers have own targets of 50% reduction. There may be no competitive advantages today to have data, but if it gets critical, it becomes a competitive advantage for the shipowner to have this data.

RSI member #4	It seems we need to set our own principles for the emissions. Some companies are sending exact excel sheets for the emissions and costs, and some say it is included in the price. We will report emissions in annual report 2026 emissions for -25.

The workshop ended with a discussion on how to operationalize the recommendations presented in Table 7 above.

Table 9 - Workshop statements on decarbonization: new fuels, energy efficiency, and fleet renewal

RSI member #1	There are a limited number of owners that are licensed to carry our cargo. For us to reach our goals, it will be energy efficiency and then biofuels. Some have built new vessels already. We are in the moment where we need to start discussing. We need to bring up fleet renewal, but we don't have accurate data, which we have to solve now to set a good goal for our shipping. The ambitions may be high but what is the willingness to pay.
RSI member #2	We tried biogas twice. We asked internally if we should use it more often? Top management said thanks but no thanks. Because of extra costs. Biodiesel we tried a couple of times, but the price is too high. One direction was 100% biodiesel. Roughly 10% freight price. Price has changed so many times. Biogas is easier because it correlates with LNG. We are looking to install shore power. We have to invest in the port anyway, and when doing that, have to look at shore power as well.
RSI member #3	Willingness to pay for these ventures is low. A lot has to do with decision on projects internally that reduce Scope 1 emissions. When that has been confirmed for real, then that can move forward with shipping. Roadmap set up for taking bigger steps towards climate neutral transport.
RSI member #5	We are accelerating use of biofuels. We have a concept which we offer to our customers to increase green reductions and get our customers onboard. Biofuels is closest to our hands. We are today asking questions to our current/potential suppliers about their targets, how to get there and emissions per route as part of evaluation when renewing contracts but we need to challenge our suppliers further on energy efficiencies. Our summary is that we have never been so far off reaching our goals. We need to accelerate. Somewhere we need to pay, otherwise we will not reach the goals.

6 CONCLUSIONS AND IMPLICATIONS OF THIS WORK

The necessity for maritime shipping to decarbonize by 2050 is now clear from international and regional regulations. The transition will involve significant changes in ship designs, particularly engines and fuels, to reduce emissions. Operational and transport efficiencies need to be further improved. Technologies such as sails, batteries, and air-lubricated hulls are being implemented to lower energy demand. All these advancements will inevitably increase costs, with projections indicating a rise of around 20% by 2030 and up to 110% by 2050, depending on ship segment. How much this translates to final costs of products remain to be seen.

The work carried out in this project emphasizes the role of transport buyers, such as industrial and energy companies, in this transition. As the increased costs for more climate-efficient ships and fuels will ultimately be passed on to them, their involvement is crucial. This report is in a way a call to action for buyers of maritime transport to engage in the maritime decarbonization process.

The Responsible Shipping Initiative (RSI) – Billerud, EFO AB, Lantmännen, SSAB, Stockholm Exergi, and Södra, is a proactive group working towards green fleet renewal. Many of them have even more ambitious goals than the regulatory trajectory, implying that they need to take extraordinary actions to enable this. The short sea dry bulk or general cargo segment utilised by these kinds of companies is aging and in dire need of replacement. There is a mismatch between the ambitions of these companies and the current regulatory framework which excludes vessels smaller than 5000 GT.

The initial goals of the project were to see how ships that were 1) 50% more energy efficient without changing contractual terms or lengths (EcoBulk), and 2) had close to zero GHG emissions (ZeroBulk), probably requiring longer contractual lengths. During the project shipping companies started to make orders for vessels that seemed to meet or even surpass the first goal. Moreover, the zero emission vessels that was part of the original inspiration for this the project – the projects initiated in the Norwegian Green Shipping Programme – came to a halt and have still not been ordered, even though subsidies have been granted.

The goal was to be met through three major work packages. The first WP would build an understanding of the shipping activities of each cargo owner, including quantification of volumes and emissions. The second WP would calculate the cost of new green shipping services along the most important routes for each cargo owner. The third WP would look at how to implement the results in practical operations.

6.1 Brief summary of the results

This project started out in WP1 with determining an emissions baseline for each RSI member company. None of the companies had any structured means of collecting primary emissions data from their shipping companies, so AIS-based modelling was used to estimate the emissions based on shipment lists. From this exercise, the most important routes for each company in terms of transported volumes and emissions could be determined and used as cases in the subsequent work packages. Also, the different cargo flows from the RSI members could be overlayed to identify cases where combined volumes could form a more transport efficient commercial case than market average (less than 30-40% ballasting).

In WP2, the costs of introducing green vessels along these routes and cases was explored, resulting in approximate costs of choosing a new green-fueled methanol vessel instead of a new fossil-fueled vessel of ~5 EUR per ton cargo. Since these ships spend half their time in port, the relatively higher CAPEX of the vessel becomes important alongside of the more expensive green fuel: even though the fuel is twice as expensive, the total costs of owning and operating the vessels is only 10-20% more expensive per ton cargo. Various levers were explored that could change this, like state investment support, a higher emission costs (e.g. ETS) and also improved transport efficiencies like reduced time in port. In addition to the analytical work, workshops were held within the project and also with external parties such as shipping companies and fuel producers. Here, a key point was that while shipping companies appreciate ambitious long-term goals, they need shorter term goals to take the right commercial decisions.

In WP3, a fleet renewal model was employed to show the effects of taking different strategic choices regarding emission reductions, such as not renewing the fleet and just blending in biofuels to reduce the emissions. While the model was simple, it could illustrate the impact of taking investments in energy efficiency. When considering that many of the RSI members had such ambitious emission goals, the model however gave ambiguous results on short term actions.

The recommendations for practical purposes had to be for each company to go out and try the various options in practice:

- understanding the potential for improved energy efficiency in their operations by engaging with select suppliers to collaborate on identifying and implementing measures.
- and, for companies with near-term zero emission goals, utilize the market interest in providing zero and low-emission services to gather information on costs and emissions of specific routes. WP2 gave an overview of costs but only a market dialogue will give true figures.

Underpinning these recommendations, was a recommendation to assign a special responsible person for coordinating maritime decarbonization actions. Then, a robust system for gathering emissions data from shipping companies. With that as basis, it would be possible to benchmark and track improvements over time. Since voyage charters or contract of affreightments were common, this meant that if a shipowner invested in a more energy efficient fleet, it would not directly or necessarily transfer to emission reductions on the specific cargoes carried for a cargo owner. It would be necessary for a shipowner to display also the average emissions in the fleet over time.

Beyond these recommendations, the following general remarks can be made for project members and any company reliant on chartered vessels.

6.2 Anticipating the costs of a green fleet renewal

The project emphasizes the importance of renewing the aging fleet with more climate-efficient ships. This includes investing in new technologies such as sails, batteries, and air-lubricated hulls to reduce energy demand and emissions. Along with the additional costs of operating on new green fuels, this will undoubtedly raise transport costs. Estimates of the costs have been made for each project partner; in the order of 5-10€ per ton of cargo.

How to absorb or transfer the decarbonization costs further along the supply chain is the key task for transport buyers. One solution may be like already invented by Södra: the Conscious Delivery concept.[11] This applies especially if the company has set a more ambitious targets than decarbonization by 2050 and wants to be ahead of the regulatory pace: this means sea transports may be more expensive than your competitors.

[11] See https://www.sodra.com/en/global/pulp/conscious-delivery/

6.3 Planning for cost-effective regulatory compliance

With the introduction of new regulations such as the EU ETS and FuelEU, companies buying ship transport services must strategically plan compliance with these regulations. At the time of writing, the international regulation decided by countries in the IMO has not yet been concluded but will do so in the near future. A compliance strategy includes understanding the cost implications and potential benefits of different compliance strategies. In WP3, for example it could be seen that emission reductions can take place using different strategies, of which just blending in biofuels in the existing fleet was the most expensive.

6.4 Collaborating across the value chain

The report highlights the need for increased collaboration between shipping companies, cargo owners, and fuel providers. This is to manage the greater risks that need to be taken. In particular, longer-term take-off agreements for fuel and potentially also longer-term charters for ships are discussed. At the same time, it is difficult for cargo owners to take on such longer-term commitments as their contracts with their customers or suppliers are not long.

Better collaboration can also be enabled by translating long term ambitions into short term goals in each contract. This was highlighted in one of the workshops with shipping companies and fuel suppliers: the shipping companies would find it easier to plan their fleet renewal, energy efficiency investments and fuel procurement if the expectations can be set clearly in the commercial and contractual discussions.

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