SCIENCE BASED TARGETS
DRIVING AMBITIOUS CORPORATE CLIMATE ACTION

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SCIENCE BASED TARGET SETTING FOR THE MARITIME TRANSPORT SECTOR

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This guidance was developed by WWF on behalf of the Science Based Targets initiative (SBTi), with support from the Smart Freight Centre (SFC) and University Maritime Advisory Services (UMAS).

SBTi mobilizes companies to set science-based targets and boost their competitive advantage in the transition to the low-carbon economy. SBTi is a collaboration between CDP, the United Nations Global Compact, World Resources Institute, and WWF and is one of the We Mean Business Coalition commitments.

About WWF

WWF is one of the world's largest and most experienced independent conservation organizations, with over 5 million supporters and a global network active in more than 100 countries.

WWF's mission is to stop the degradation of the planet's natural environment and to build a future in which humans live in harmony with nature, by conserving the world's biological diversity, ensuring that the use of renewable natural resources is sustainable, and promoting the reduction of pollution and wasteful consumption.

About UMAS

UMAS delivers consultancy services and undertakes research for a wide range of clients in the public and private sectors using models of the shipping system, shipping big data, and qualitative and social science analysis of the policy and commercial structure of the shipping system. UMAS's work is underpinned by state- of-the-art data supported by rigorous models and research practices, which makes UMAS world-leading on three key areas; using big data to understand drivers of shipping emissions, using models to explore shipping's transition to a zero emissions future and providing interpretation to key decision makers.

About SFC

SFC is a global non-profit organization dedicated to an efficient and zero emissions freight sector. SFC covers all freight and only freight. SFC works with the Global Logistics Emissions Council (GLEC) and other stakeholders to drive transparency and industry action - contributing to Paris Climate Agreement targets and Sustainable Development Goals.

SFC's role is to guide companies on their journey to zero emissions logistics, advocate for supportive policy and programs, and raise awareness. SFC's goal is that 100+ multinationals reduce at least 30% of their logistics emissions by 2030 compared to 2015 and reach net-zero emissions by 2050.

A Technical Working Group (TWG) of dedicated experts from industry and NGOs provided detailed input during the planning phase and on various drafts of the guidance and tool.

TWG member organizations:

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PART 1: BACKGROUND

About this Guidance

This guidance document provides guidelines on emissions target setting and accounting for the maritime transport sector. The document serves as an accompaniment to the SBTi maritime tool, describing how to use the tool, the way the tool is structured, the rationale behind the carbon budget included in the tool, and the way a variety of maritime industry-specific conditions and constraints are addressed in the tool. The document also provides a summary of the SBTi target setting framework, general context on the maritime industry with respect to emissions reduction target setting, and an explanation of how science-based targets are indeed feasible for the maritime industry.

The intended audience for this document is users and providers of marine transportation services. The document and the maritime tool are target setting aids for companies that own and operate oceangoing vessels and companies setting targets for their supply chain emissions associated with maritime trade.

A public consultation was organized from the 29th of March till the 30th of April 2021 to obtain input from stakeholders on this guidance document and accompanying target-setting tool. Feedback from 20 stakeholders was received through an online survey, and public webinars were held on the 29th of March 2021 to launch this consultation period.

SBTi has published several other documents regarding target setting for the transport sector. This guidance complements these existing documents. While this guidance focuses on the maritime industry specifically, SBTi provides direction on aviation target setting in its aviation guidance and provides direction on road and rail sector target setting in its transport guidance. This guidance is consistent with cross-sector methods and frameworks described in detail in Foundations of Science-based Target Setting and Pathways to Net-Zero, and it includes a deepened assessment of mitigation pathways for the maritime sector.

Taken together with the Science Based Target Setting Manual and SBTi Criteria, this guidance and tool provide a comprehensive suite of information for companies to set near-term science-based targets for maritime transport activities. The accounting methods and mitigation pathways described in this guidance must also be followed by companies that wish to set net-zero targets, as described in the SBTi Corporate Net-Zero Standard. The maritime transport sector resources will be reviewed and updated (if needed) on a biannual basis.

Science Based Targets (SBTs)

Science-based targets are greenhouse gas (GHG) emission reduction targets that are consistent with what is necessary, according to current climate science, for society to meet the goals of the United Nations Framework Convention on Climate Change 2016 Paris Agreement. That is, targets that are consistent with limiting the increase in combined surface air and sea surface temperatures averaged over the globe and over a 30-year period to well below 2°C above pre-industrial levels, and to pursue efforts to limit this temperature increase to 1.5°C above pre-industrial levels.

As announced in July 2021, the SBTi made 1.5°C the central ambition in its target setting framework and introduced several changes to its criteria effective July 15, 2022. These include:

- Increasing the minimum scope 1 and 2 ambition temperature classification from well below 2°C to 1.5°C.
- Increasing the minimum scope 3 ambition temperature classification from 2°C to well below 2°C.
- Shortening the timeframe for meeting the temperature targets from 15 to 10 years

Net-Zero Targets

Since the publication of its Net-Zero Standard, the SBTi makes a distinction between near-term and long-term SBTs.

- *A near-term SBT* has a timeframe of 5-10 years.
- *A long-term SBT* is a target to reach the residual emissions level[1] by 2050 at the latest, and commit to neutralizing these residual emissions to reach net-zero.

All companies are encouraged to develop long-term (net-zero) targets in addition to near-term targets (i.e., long-term science-based targets in line with SBTi Net-Zero Criteria). Companies wishing to set a net-zero target must set both near-term and long-term targets. Alternatively, companies may choose to set just a near-term target (but they cannot set only a long-term target).

Important Note: All companies setting near-term science-based targets covering emissions from own operations (e.g. vessel owners or operators) shall also submit long-term science-based targets along with their near-term target submission.

[1] Emissions sources that remain unabated in a specific year of a mitigation scenario. Long-term SBTs are consistent with the level of residual emissions in the year of global or sector net-zero in 1.5°C-aligned mitigation pathways with low or no overshoot.

For maritime transport emissions, a long-term science-based target means reducing emissions to a residual level in line with 1.5°C scenarios by no later than 2040. Companies using this guidance to set near-term science-based targets covering scope 3 emissions from subcontracted maritime transport operations (e.g. cargo owners or shippers) are not required to submit long-term science-based targets.

Companies are invited to familiarize themselves with the SBTi cross-sector resources, the SBTi How-To Guide or Net-Zero Getting Started Guide, followed by reviewing the requirements of target setting in the SBTi Criteria and Recommendations or Net-Zero Standard Criteria. To understand these requirements in more depth, companies should then review the Target Validation Protocol and use the target setting tool, and the net-zero tool to begin developing targets.

The Sectoral Decarbonization Approach

The Sectoral Decarbonization Approach (SDA) is a method for calculating science-based targets. The SBTi maritime tool is based on the SDA.

The Intergovernmental Panel on Climate Change (IPCC) and International Energy Association (IEA) publish mitigation pathways that are categorized across a variety of dimensions, including likely end-of-century warming—a function of the cumulative global carbon budget and non-CO2 GHG emissions. Under the SDA, the carbon in these budgets is allocated first to industry sectors and then to individual companies.

The SDA accounts for inherent differences among sectors, such as sector-specific mitigation potential and expected growth within each sector relative to economic and population growth.

Another key aspect of the SDA is that SDA targets are based on the convergence of company-specific emission intensities to a sector-wide emission intensity. That is, company targets calculated based on SDA methods converge on the sector-specific emission intensity for the target year. For this reason, the SDA is only applicable to homogenous sectors (i.e., sectors with a uniform measure of production across companies, such as tonne-nautical miles for maritime transport). The steepness of different companies' trajectories to this sector-wide intensity target may vary considering:

1. Each company's emission intensity in the base year. A company with a higher emission intensity in its base year will have more significant intensity reduction targets (on a tCO2e per tonne-nautical mile basis), as that company's emission intensity is further from the target year sector intensity than the emission intensity of a company with a lower base year emission intensity.
2. Each company's projected growth over the target setting period. Companies with higher projected growth in market share over the target setting period will have larger intensity reduction targets, as these companies will be responsible for a larger share of the sector-wide activity if they realize their growth ambitions.

For more on the SDA, see SBTi's SDA methods document, Sectoral Decarbonization Approach (SDA): A method for setting corporate emission reduction targets in line with climate science and SBTi's Foundations of Science-based Target Setting.

The Maritime Transport Sector

The maritime sector serves as a critical link in many global supply chains and as the foundation of intercontinental trade. In its 2021 Review of Maritime Transport, United Nations Conference on Trade and Development noted that more than 80% of global trade by volume is carried by sea (UNCTAD, 2021). International shipping contributes to around 3% of global GHG emissions at around 1GT of CO_2 equivalent (CO_2e) and is completely reliant on fossil fuels at the moment (Faber et al., 2020).

The maritime sector is also diverse. Ships engaged in international trade carry everything from refrigerated food products and pharmaceuticals to bulk chemicals to railway locomotives and offshore oil production platforms. Ships vary broadly in size. For example, bulk petroleum tankers alone may range from around 10,000 deadweight tonnes (DWT) to more than 400,000 DWT. Along with this range in cargoes and sizes, vessel routes vary widely. One ship may operate on a weekly liner service between ports in a single region and another on a tramp service that takes the ship around the world over the span of months or years.

Finally, the maritime sector is at an important decision point with regards its future role in global decarbonisation. Ships have long asset replacement cycles, meaning that the emission performance of ships built now may be locked in for decades to come. This makes decisions made in the short term important due to the long-term impact that early commitment to zero emission technologies can have on climate alignment. The SBTi endeavours to provide tools to expedite this transition and be a key part of the effort towards the decarbonisation of maritime transport.

PART 2: DECARBONIZATION PATHWAYS

Carbon Budget and Emissions Scenarios

In order to develop sector-specific emission trajectories for shipping, two elements are to be defined: sectoral carbon budget allocation and projected transport demand for the sector. Both are discussed in the following sections based on scientific literature and reports from the Intergovernmental Panel on Climate Change (IPCC), International Energy Association (IEA) and International Maritime Organisation (IMO). This section outlines the technical background on carbon budget and activity projections on which the carbon intensity trajectories for the maritime transport sector were developed.

Defining a 1.5°C aligned carbon budget

A literature review around sector-specific climate alignment pathways during the development of this guidance for maritime transport was conducted to understand the landscape and pathways available. .

The leading voice in establishing a climate aligned global carbon budget is the 2018 IPCC Special Report (IPCC, 2018). This report estimates carbon budgets (i.e., cumulative net global anthropogenic CO_2 emissions) to satisfy a 1.5°C scenario, a scenario in which global average temperatures remain 1.5°C below pre-industrial levels. The IPCC 1.5°C scenario is based on a summary of the projections from several climate models. The IPCC SR1.5 Summary for Policymakers (IPCC, 2018) highlights the importance of near-term emissions reductions:

> "In model pathways with no or limited overshoot of 1.5°C, global net anthropogenic CO_2 emissions decline by about 45% from 2010 levels by 2030 …, reaching net-zero around 2050 ..."

Relevant work conducted by the Tyndall Centre for Climate Change Research at Manchester University (Bullock et al., 2022; Traut et al., 2018) aligns with the IPCC outlook of sector decarbonisation by 2050 considering shipping to have a relatively stable share of carbon global carbon budget. The IEA NZE 2050 (IEA, 2021) work takes a different tack considering shipping a hard-to-abate sector which should be afforded a larger share going into the future with emissions being reduced from other sectors before. This implies that shipping does not decarbonise as a sector roughly until 2070 and the scenario is not 1.5°C compliant. Furthermore, the IEA modelling has a heavy reliance on biofuels with minimal considerations for change of land use and demand issues as shipping will be competing with other industries that do not have many options for decarbonisation. Furthermore, the modelling does not consider the possibility of low or zero-carbon fuel being retrofitted onto existing tonnage and only available to newbuilds. This goes against several sources that show how retrofitting is essential for timely decarbonisation (Bullock et al., 2020; IMO, 2021)

Thus, for the purposes of this work, the carbon budget allocation for the maritime transport sector was derived from representative industry emissions levels using 2018 as base year and an IPCC-derived emissions trajectory declining linearly between 2018 and 2030 and then at another, less aggressive, linear trajectory down to 2050 in line with IPCC (IPCC, 2018).

The operational carbon inventory for the maritime transport sector in 2018 published in the Fourth IMO Greenhouse Gas Study (Faber et al., 2020) was selected as the reference historic emissions inventory. The IMO's publication is consistent with relevant work in the literature considering a relatively stable share of carbon global carbon budget for the shipping sector with sector emissions levels in 2018 corresponding to 0.94 GT CO_{2e}.

The resulting 1.5C aligned carbon budget (cumulative emissions from 2020 to 2050) amounts to 12.2 GT CO_{2e}, which is below the budget range estimated by the SBTi for this sector in the Pathways to Net-Zero document (i.e. the 2020-2050 CO2 budget used by the SBTi to assess 1.5°C pathways for maritime transport ranges between 12-16 GT CO_2). For comparison, the IEA carbon budget estimate in their NZE scenario between 2020 and 2050 is 15.6 GT CO_2.

Developing a logistic trajectory

While the linear decrease in annual emissions is deemed scientifically robust and was used to inform the total 1.5C aligned cumulative carbon budget for the sector (IPCC, 2018), evidence from existing sector-specific research (Bullock et al., 2022) shows that this is unlikely to happen. This feedback was echoed by industry actors during the public consultation carried out by SBTi in 2021. While the guidance aims to make target setting as ambitious as possible, consideration for the likelihood of technological development and scaling at the rate required for a linear decline in emissions lead to looking at alternative pathways.

To this end the authors utilized the cumulative budget defined by IPCC for 1.5°C alignment to derive an emissions trajectory that accounts for differentiated decarbonisation rates in the coming decades, with a more rapid decarbonisation in the years between 2030 and 2040 (see Figure 1). While this softens short-term targets set up to 2030, targets set beyond 2030 are dramatically more aggressive bringing decarbonisation closer to 2040. This approach is considered by Bullock et al. (2022) and Osterkamp, Smith, and Søgaard (2021) in their work as part of the pathway to decarbonisation of the shipping industry in line with the Paris Climate Accord.

Thus, a logistic curve was proposed as a robust way of taking into account the slow emergence phase which allows costs of switching to low and zero-emission vessels to start decreasing as a steep learning curve is faced. This gives way to a diffusion phase with the rapid adoption of new technology through increased confidence and investment followed by a flattening of the curve to a reconfiguration phase when laggards catch up as the technologies become the norm as per diffusion of innovation theory (Rogers, 2003). More recently, Way et al. (2022) propose a similar trajectory in their research on forecasts for global energy transition based on empirical evidence.

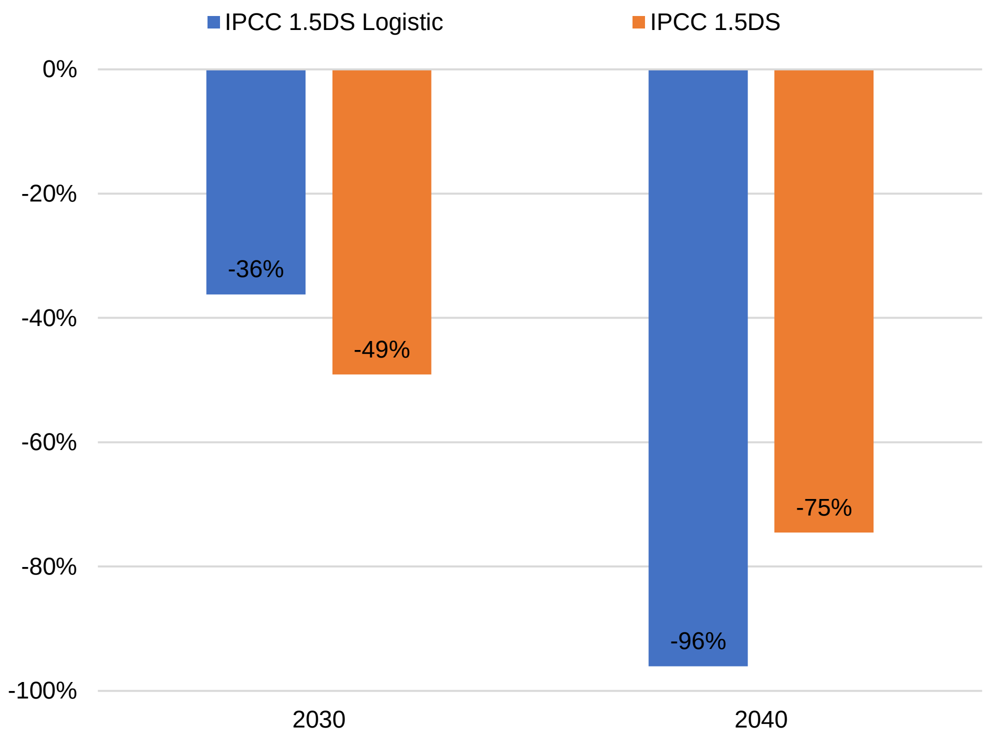

Figure 1: Comparison of required emissions reduction for 1.5°C ambition with reference to 2020 for linear and logistic scenarios

The authors suggest that low and zero-emissions fuels (e.g. hydrogen, ammonia and battery power derived from renewable electricity) need to make up 27% of maritime fuels by 2036 and almost replace fossil fuels completely by 2045. With this rationale, a logistic curve was developed on similar grounds to represent a 1.5°C aligned emissions trajectory.

Adjusting for Well-To-Tank emissions

The sector carbon emissions published in the Fourth IMO GHG Study 2020 (Faber et al., 2020) are Tank-to-Wake (TTW) therefore, a Well-to-Wake (WTW) conversion is required to be consistent with a WTW CO_2e emissions inventory based on an assumed fuel mix.

In order to define upstream Well-to-Tank (WTT) emission factors to complement the TTW 1.5°C emission trajectory, assumptions regarding vessel technologies and fuel mix projections are required. Several studies were consulted which ran different scenarios under a variety of assumptions in order to propose a fuel mix that fit decarbonisation boundaries (DNV-GL, 2020; IEA, 2021; IRENA, 2021; Lloyd's Register & UMAS, 2019b) All studies consider future fuel mixes for shipping as a combination of fuels based on renewable electricity, biogenic sources or fossil fuels. The proportions of each and the production process of different fuels are affected by assumptions considered around production pathways.

Lloyd's Register & UMAS, 2019b work presents three possible scenarios for fuel mix development: renewables dominated, bio-fuel dominated and equal mix. The three pathways stem from varying constraints on the quantitative method used to represent a qualitative narrative that considers global energy trends and implications on the marine sector. The "Equal Mix" scenario was found well suited for target setting as it is not particularly biased towards one outcome given the uncertainty around global energy transition. This scenario assumes equal probability to the uptake of fuels from three energy sources: biogenic, renewable electricity and fossil fuels with carbon capture and storage (CCS). See Figure 2 below. This choice of fuel mix scenario was discussed during the consultation phase and was well-received by companies and other stakeholders as it is not prescriptive giving flexibility on technology choices. Further details regarding the assumptions regarding feedstock and production processes can be found in (Lloyd's Register & UMAS, 2019a).

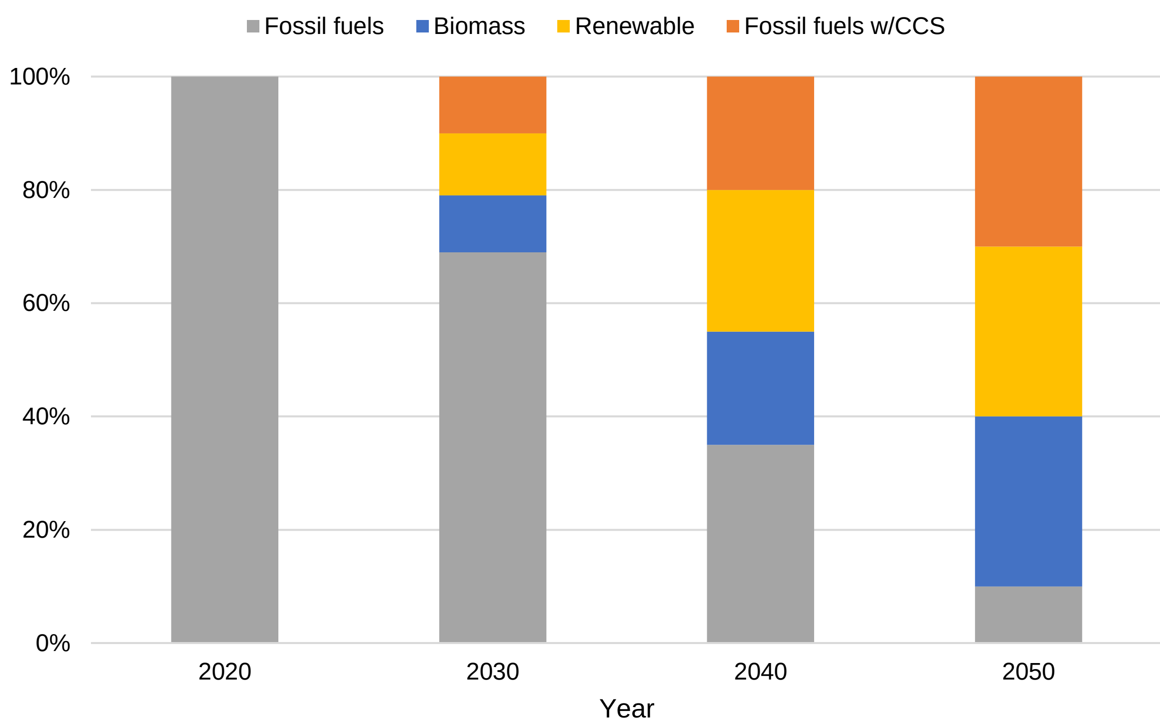

Figure 2: "Equal mix" fuel assumption towards decarbonisation in 2050 (Lloyd's Register & UMAS, 2019b)

This equal mix scenario assumes both a ramp-up of renewable electricity-based marine fuels and bio-based fuels together with a gradual addition of hydrogen and ammonia produced from natural gas with

CCS. A small percentage of fossil fuels are still in the mix even at 2050 mainly due to the assumption that blending with bio-fuels may still be required. This includes an embedded assumption that all maritime sub-sectors will have equal access to emerging fuels, technology, energy sources and feedstock with no geographical or sub-sectoral barriers although it is acknowledged that certain technologies are more applicable to particular trades or vessel types.

The upstream emission factors for the above fuel classes are documented in Table 6 from (Lloyd's Register & UMAS, 2019a) include CO_2, N_2O and CH_4 and translated into CO_2e using GWP100 conversion factors from AR5, consistent with Faber et al. (2020).

Defining a Well Below 2°C aligned carbon budget

The IEA Energy Technology Perspectives (IEA, 2017) Beyond 2C scenario (B2DS) is used to define a well-below 2°C carbon budget for the maritime transport sector, consistent with the assessment of B2DS in Foundations of SBT-setting. The SBTi maritime tool WB-2°C carbon budget and emissions trajectory is based on the WTW sector data included in the 2017 IEA Energy Technology Perspective (ETP) report[2]. See Figure 2 below.

Users of this guidance should note that WB-2°C targets for scope 1 and scope 2 emissions are no longer accepted under V5.0 of the SBTi Criteria, which became mandatory for all new SBT submissions in July 2022. WB-2°C aligned pathways are still usable for informing ambition over relevant Scope 3 emission categories.

Emission Trajectories for Maritime Transport

Figure 2 below illustrates the resulting 1.5°C and WB-2°C emission trajectories on a WTW basis. The trajectory implied by the IMO 2050 Initial Strategy reduction ambition is included for reference. However, it should be noted that this trajectory assumes a WTW budget and a 50% reduction over both upstream (WTT) and operational (TTW) emissions, which deviates from the actual ambition but allows for comparison (IMO, 2018).

[2] The IEA issued an update to the ETP in 2020 (IEA, 2020). The ETP 2020 publication is based on different assumptions, a different structure and emissions boundary than ETP 2017. Some of the assumptions of ETP 2020 shift away from temperature aligned goals to a less defined "Sustainable Development" and "Stated Policies" scenarios, with less clear parallels to the Paris Agreement climate goals. The ETP 2020 also assumes a heavy reliance on biofuels for GHG emissions reductions but does not fully justify whether biofuels will be available at the necessary scale or address potential effects of land use change associated with biofuels. Considering these factors and recognizing that much of the data in the ETP 2020 is not presently available, the authors decided to rely on the ETP 2017 instead of the 2020 ETP for informing the WB-2°C scenario for the maritime sector tool.

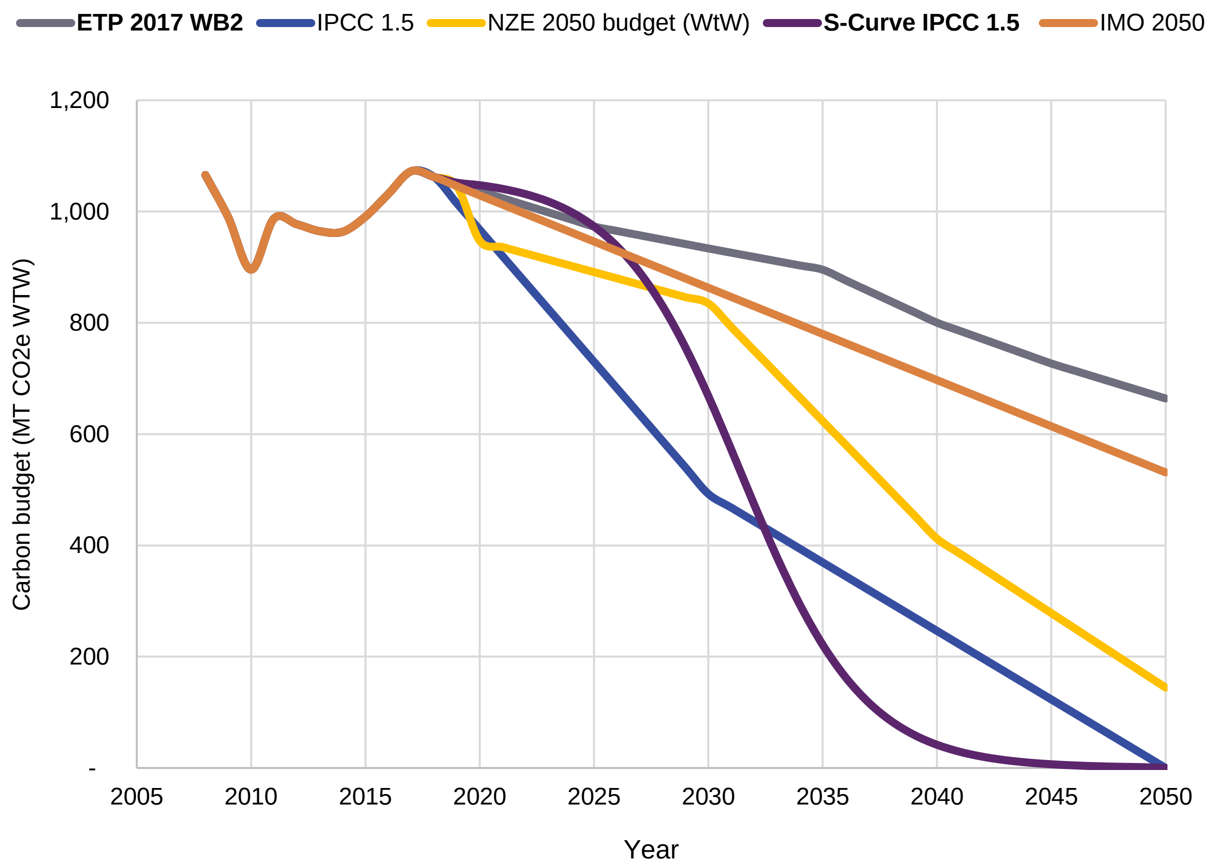

Figure 3: Maritime sector Well-to-Wake (WTW) emission pathways for IEA ETP B2DS, IEA NZE 2050, IPCC 1.5DS, IPCC 1.5DS Logistic, and International Maritime Organization (IMO) 2050[3].

[3] WB-2°C and 1.5°C aligned trajectories are shown in bold in the legend.

Reference	2030	2040	2050
IEA ETP 2017 B2DS	-10%	-23%	-36%
IPCC 1.5DS	-49%	-75%	-100%
IEA NZE 2050	-12%	-56%	-85%
IPCC 1.5DS Logistic	-36%	-96%	-100%
IMO 2050	-16%	-32%	-48%

Table 1: Required WTW carbon emissions reduction rate (relative to 2020 baseline)

Differences with industry climate goals

International Maritime Organization's Marine Environment Protection Committee Resolution 304(72) outlines an ambition to "reduce the total annual GHG emissions [from international shipping] by at least 50% by 2050 compared to 2008" (IMO, 2018). These industry aspirational targets only address Tank-to-Wake (TTW) emissions, not Well-to-Wake (WTW) emissions. In Figure 3 above the IMO 2050 budget shown assumes a TTW 50% reduction (in line with the IMO reduction target) as well as a WTT 50% reduction. This does not suggest that measures or targets are in place to ensure that a 50% WTT reduction will actually occur. Instead, a 50% WTT reduction was used for illustrative purposes to match the 50% TTW reduction targeted by IMO. The carbon budget associated with meeting this minimum absolute reduction ambition is reflected here for comparison with the WB-2°C and 1.5°C budgets calculated on a WTW basis.

Maritime Transport Demand

In addition to determining a sector carbon budget through the SDA, SBTi also incorporated estimates of future transport demand into the maritime tool. Transport demand is an important variable because transport demand can be divided by the sector carbon budget to determine the sector carbon intensities that align with the overall budget.

The SBTi maritime tool relies on the sector growth forecast scenario following representative concentration pathway (RCP) 2.6 as defined by the IPCC and shared socioeconomic pathway (SSP) 2 (Logistics) from the Fourth IMO GHG study (Faber et al., 2020)[4]. See Figure 2. The authors selected this growth scenario for the scenario's alignment with assumptions regarding decarbonization across the global economy, and for the scenario's representation of the rate of Gross Domestic Product growth[5]. Although in theory, this RCP scenario is not aligned with a 1.5ºC, it should be recognised for what it is; a projection based on a certain set of assumptions that were valid at the time of publication. A stricter demand projection would imply a reduced growth scenario making the required decarbonisation trajectory less onerous. The impact of more recent events such as COVID-19 and the war in Ukraine on transport demand are not accounted for. The use of RCP 2.6 is backed by the rigorous review and recognised validity of the Fourth IMO GHG study at the time of publication of this key input assumption. This transport demand projection will be assessed and revised if required during the next update cycle of this technical guidance.

The SBTi recognizes that different segments of the maritime industry (see more below on sector segmentation) may grow at different rates. For example, decarbonization across the entire global economy may be associated with reduced demand for oil transportation at the same time that increased global populations may be associated with increased demand for containerized cargo transportation. Therefore, assuming uniform growth across all segments of the maritime industry may lead to outputs

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[4] While the Fourth IMO GHG Study carbon intensity values are based on international trade as opposed to domestic trade, the operational intensity of a vessel of a specific size and type is not expected to vary significantly based solely on whether the vessel engages on international or domestic voyages. For example, a specific 10,000 DWT bulker is not expected to have a significantly different operating profile if trading between two ports in one country than another 10,0000 DWT bulker on a similar route that happens to involve calls in two countries. For this reason, the intensity targets generated by the tool may be applied to domestic as well as international travel – even though the IMO intensities used in the tool are based on data for international voyages.

[5] Fourth IMO GHG Study describes two methods to project transport work related to non-energy products transportation, a "Logistics Model" and a "Gravitation Model." Both models project future transport work based on the historical relationship between transport work and macroeconomic demand drivers and on long-term projections of these drivers developed either by the IPCC or by economic institutions. However, the variables in the two models are different. The Logistics Model forecasts higher transport demand than the Gravitation Model. While Faber et al do not state a preference for one model over the other, the transport demand projections in the SBTi maritime tool are based on the Logistics Model. The Logistics Model projections were used in the maritime tool because the Gravitation Model's future long term trade growth assumptions are low by historical standards and in comparison with other forecasts. Similarly, relying on the Logistics Model's higher growth assumptions yields a more conservative output (i.e. lower intensity targets) from the maritime tool.

from the maritime tool that are biased for or against certain segments of the maritime sector. While projecting transport demand at a segment-specific level could address this issue, the resources required to calculate these projections – and the host of assumptions that would need to be made to create robust and credible segment-specific demand projections – preclude the use of segment-specific demand projections at this time.

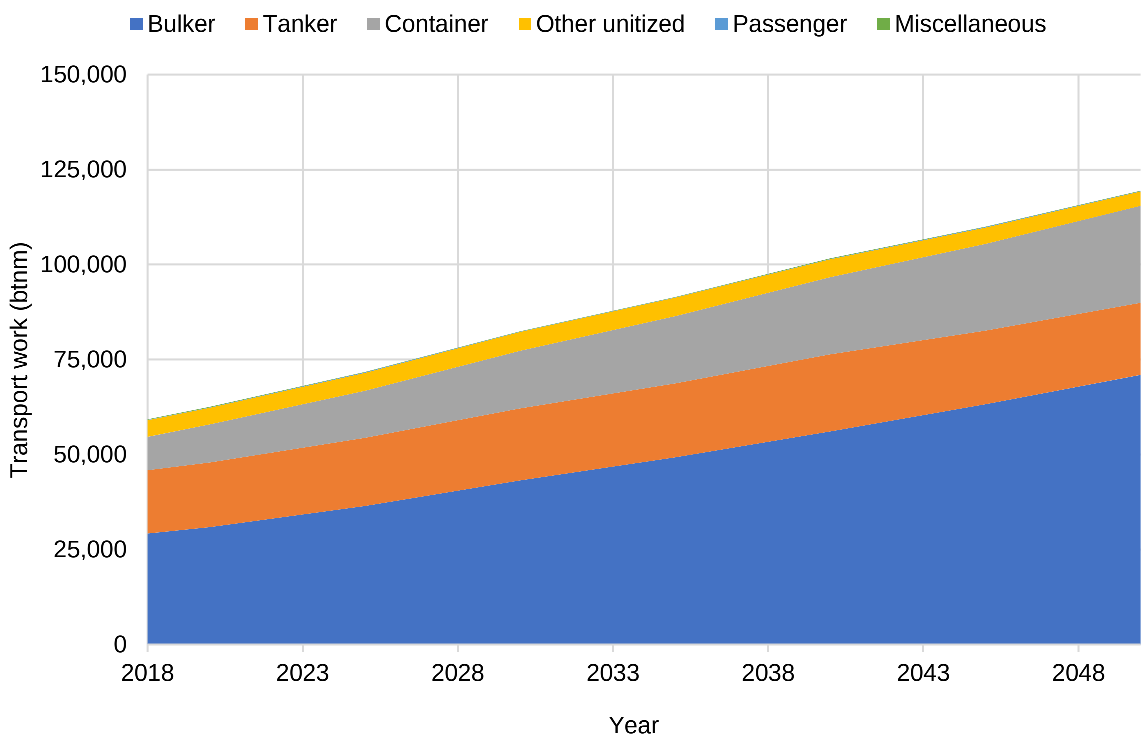

Figure 4: Transport demand projection scenario (SSP2_RCP2.6_L) from Faber et al. (2020)

Sector Carbon Intensity Pathways

The SBTi maritime tool relies on the logistics trajectory cumulative sector budget derived from 2018 IPCC 1.5°C and the 2017 IEA WB-2°C carbon budgets and the IMO scenario RCP 2.6 SSP2 transport demand forecasts between 2018 and 2050 to calculate carbon intensity trajectories for the maritime sector in grams of CO_2 equivalent per tonne nautical mile (gCO_2e/tnm). This metric is also known in shipping as the Energy Efficiency Operational Index (EEOI) put in place on a voluntary basis by the IMO.

As noted in the previous section, because the tool uses overall transport demand pathways in its intensity calculations, it operates on the assumption that all segments in the maritime sector will grow at the same rate. The carbon intensity trajectories (before sector segmentation), the quotient of the IPCC 1.5°C and

IEA WB-2°C carbon budgets and the Faber et al. (2020)sector transport demand forecasts, are shown in Figure 5.

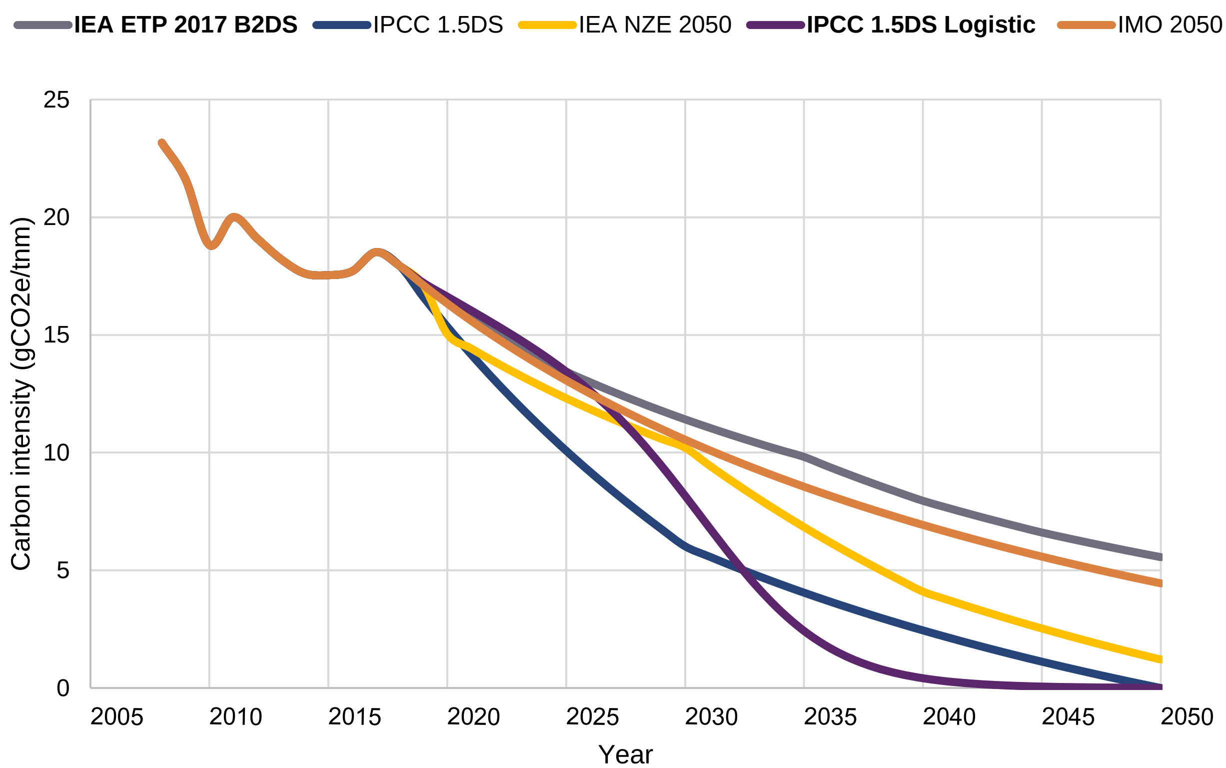

Figure 5: Maritime sector WB-2°C and 1.5°C CO_2e emission intensity trajectories [6][7][8]

[6] Historic carbon intensity values between 2008 and 2018 shown in this figure are based on data from IMO GHG Studies (Faber et al., 2020; Smith et al., 2014).

[7] Because IEA provides carbon budget data at five-year intervals, for the WB-2°C, total carbon emissions for 2020 and 2050 in this figure were linearly interpolated.

[8] (IMO, 2018) The sector emissions intensity associated with meeting this minimum absolute reduction ambition is reflected here or comparison with the WB-2°C and 1.5°C intensities. Please note that the IMO targets only address TTW emissions, not WTW emissions.

Source	2030	2040	2050
IEA ETP 2017 B2DS	-31%	-52%	-66%
IPCC 1.5DS	-61%	-84%	-100%
IEA NZE 2050	-32%	-73%	-92%
IPCC 1.5DS Logistic	-51%	-98%	-100%
IMO 2050	-35%	-58%	-73%

Table 2: Required carbon intensity reduction rate (relative to 2020 baseline)

Sector Segmentation

As described in the introduction, the maritime industry is comprised of a diverse mix of different ship types and sizes. Therefore, the SBTi maritime tool breaks down the carbon intensity targets for the maritime sector by vessel type and size. Vessel type and size categories and base year vessel type and size category-specific operational intensities, as well as definitions of activity metrics, are taken from Fourth IMO GHG Study (Faber et al., 2020). See Appendix 1 and 2 for a list of vessel types, vessel kind and size categories covered by the SBTi maritime tool. The Fourth IMO GHG Study provides median values for carbon intensity for each vessel size and type which provides an activity-specific baseline at 2018 for each segment.

SBTi recognizes that different vessel types and sizes may operate in significantly different carbon intensity ranges. For example, all other things being equal, a fully loaded 1,000 twenty-foot equivalent unit (TEU) containership is likely to generate more carbon emissions per tonne-nautical mile of transport activity than a fully loaded 20,000 TEU containership. A granular pathway segmentation is provided to support users of this guidance with decision making in order to seek optimization of the entire fleet concerned with their maritime transport activities rather than optimizing any any specific vessel category. Segmentation allows users to identify which set of vessel types and sizes can be prioritized based on carbon intensity, operational limitations and customer requirements.

These differences in vessel carbon intensity ranges are particularly meaningful with respect to the SBTi maritime tool because the SDA approach relies in part on vessel base year intensity values (see the discussion of the SDA and the convergence approach above). As such, the tool outputs will be more accurate if the base year intensity inputs are calculated from company specific activity and fuel consumption data.

PART 3: SETTING TARGETS

Overview of the Target Setting Tool

The SBTi maritime transport tool is a workbook that calculates emission reduction targets to meet both a WB-2°C and a 1.5°C temperature goals, according to the methods described above. The tool requires users to input vessel type, vessel size category, base year emissions, and base and target year activity data to generate targets. Data inputs are described in detail in the next section.

Type of shipping related emissions		WTW base year GHG emissions	Base year activity data
Vessel owners / operators	Passenger	Scope 1 Scope 3	tonne-nautical mile
	Freight	Scope 1 Scope 3	tonne-nautical mile
Cargo shippers / Logistics Service Providers	Passenger	Scope 3 category 5 or 6	tonne-nautical mile
	Freight	Scope 3 Category 4 or 9	tonne-nautical mile

While the tool requires a limited number of user inputs, it is critical that the data input into the tool is as accurate as possible. Inaccurate data inputs will yield inaccurate modelling results and targets.

As such, users of the SBTi maritime tool must use primary data from their own operations or from their suppliers wherever possible. If primary data is not available, modelled data may be used to calculate inputs to the maritime tool. Default data may only be used to calculate inputs to the tool when primary, program, or modelled data is not available (or as otherwise noted below). The GLEC Framework for Logistics Emissions Accounting and Reporting (Smart Freight Centre, 2019) includes additional information on data types and on the importance of using primary data for target setting.

Sector Specific Requirements

The below table lists the sector-specific criteria that apply in addition to the SBTi general and Net-Zero criteria.

Topic	Criteria	Description
Target year eligibility	**Shipping-C1**	For all companies using this guidance the choice of near-term target year must be no earlier than 2030
Target requirement	**Shipping-C2**	All companies setting near-term science-based targets covering emissions from own operations (e.g. vessel owners or operators) shall also submit long-term science-based targets along with their near-term target submission. For maritime transport emissions, a long-term science-based target means reducing emissions to a residual level in line with 1.5°C scenarios by no later than 2040. Companies using this guidance to set near-term science-based targets covering scope 3 emissions from subcontracted maritime transport operations (e.g. cargo owners or shippers) are not required to submit long-term science-based targets.

Considerations for biogenic based fuels

Required carbon intensity reduction rates can be achieved by reducing demand for energy, including through energy efficiency improvements, and reducing GHG intensity of fuel including the use of biofuels (see the SBTi Criteria and Recommendations (SBTi, 2021)[9] document for bioenergy emissions reporting and target setting). Biofuels are eligible for achieving GHG reduction, as long as Well-to-Wake emission factors are used , and if in-line with EU Directive (EU, 2018) , crop-based biofuels are avoided. If user is not bound by the EU Directive, it is recommended that these guidelines are still followed. Alternatively

[9] Within SBTi Criteria and Recommendations Version 5: C10 – "Bioenergy accounting: CO2 emissions from the combustion, processing and distribution phase of bioenergy and the land use emissions and removals associated with bioenergy feedstocks, shall be reported alongside a company's GHG inventory. Furthermore, CO2 emissions from the combustion, processing and distribution phase of bioenergy and the land use emissions and removals associated with bioenergy feedstocks shall be included in the target boundary when setting a science-based target (in scopes 1, 2, and/or 3, as relevant) and when reporting progress against that target."

interim guidance provided by GLEC is to be used as a source for upstream assumptions. The IMO MEPC is currently developing sector specific LCA guidelines to provide default values and framework for the definition of emission factors for expected maritime fuels. Pending the review of these guidelines they may be specified for use in due course.

Interaction with other sector decarbonization initiatives

There are several other initiatives related to maritime transport decarbonization which have been developed to measure and disclose climate performance or alignment against a decarbonisation benchmark. The most widely used are the Poseidon Principles for Finance, the Poseidon Principles for Marine Insurance and the Sea Cargo Charter, which have been set up by the maritime financing, insurance and chartering community respectively. While all these initiatives share the long-term purpose of supporting net-zero transition, their intended users, mode of operation and implementation is intrinsically different. While the SBTi maritime transport guidance aims to support near and long-term corporate target-setting, the above initiatives focus on disclosure of climate alignment of shipping portfolios for various types of financial institutions. That is, science-based targets are GHG emissions reductions that companies must achieve within a specific timeframe to meet the decarbonization goals of the Paris Agreement, whereas climate alignment is the degree to which a vessel, product, or investors portfolio's annual carbon intensity is in line with a decarbonization trajectory. In spite of this distinction, the complementary nature of all these frameworks is crucial for engagement and mobilization of different stakeholder groups towards a common outcome of measuring, disclosing and reducing sector emissions.

Usability limitations arising from the SBTi Fossil Fuel Policy

In March 2022, the SBTi published the SBTi Fossil Fuel Policy which affects the extent to which companies engaging in fossil fuel businesses can commit to climate aligned targets. The combustion of fossil fuels represents the single largest source of carbon dioxide emissions. In addition, the oil and gas industry is one of the largest contributors of methane emissions. To meet the goals of the Paris Agreement and avoid catastrophic irreversible climate change, the sector must radically transform.

At the time of publication of this guidance, the SBTi is unable to accept commitments or validate targets for companies in the oil and gas or fossil fuels sectors. This includes companies with any level of direct involvement in exploration, extraction, mining and/or production of oil, natural gas, coal or other fossil fuels, irrespective of percentage revenue generated by these activities, i.e. including, but not limited to, integrated oil and gas companies, integrated gas companies, exploration and production pure players, refining and marketing pure players, oil products distributors, gas distributors and retailers and traditional oil and gas service companies.

Users of the SBTi maritime tool wishing to submit targets covering activities related to transportation of fossil fuel products are advised to review the current status of the Fossil Fuel Policy as well as sector specific requirements stated in the latest version of the SBTi Criteria.

For more information regarding the Fossil Fuel Policy and the implications for your company, please consult the policy and contact SBTi for more assistance.

User Inputs for the SBTi Maritime Tool

Vessel type

Users must select from one of fourteen vessel types.

The vessel types[10] included in the tool are the same vessel types described in the Fourth IMO GHG Study:

1. Bulk Carrier
2. Chemical Tanker
3. Container
4. Cruise
5. Ferry Passenger Only
6. Ferry Roll-On/Off and Passenger
7. General Cargo
8. Liquefied Gas Tanker
9. Oil Tanker
10. Other Liquids Tanker
11. Refrigerated Bulk Carrier
12. Roll On/Roll Off (RoRo)
13. Vehicle Carrier
14. Offshore

[10] Chemical, oil and liquefied gas tankers as well as offshore vessels are subject to the SBTi Fossil Fuel Policy.

See Appendix 2 for examples of the kinds of vessels included in each of these vessel type categories. Please note that the vessel classification scheme described here covers vessels that may trade both domestically and internationally. As such, the tool can be used to address both domestic and international vessel operations.

Users that operate or transport cargo on vessels of more than one type can generate targets for multiple types of vessel by entering their vessel type data on the SBT Aggregator Tab[11] of the tool.

Vessel size category

Users must select from a variety of vessel size categories for each type of vessel.

Units of measure for vessel size categories vary by vessel type according to the units presented in the Fourth IMO GHG Study. For example, bulk carrier units are measured in DWT, containership units are measured in TEU, gas tanker units are measured in cubic meters (CBM), and passenger ferry units are measured in gross tonnes (GT).

Users that operate or transport cargo on vessels in more than one size category can generate combined targets addressing multiple vessel size categories with the SBT Aggregator Tab of the tool.

As described in the section regarding sector segmentation above, the emission intensity of vessels varies not only across vessel types but by vessel size within a vessel type. These variations in intensity are important for modelling targets because the SBTi maritime tool's calculations rely on estimated vessel operational intensities, by size class, as taken from the Fourth IMO GHG study.

Therefore, wherever possible, users are encouraged to input information about the actual size classes of the vessels that they operate or on which their cargo is carried. Provided with accurate vessel size category information, the tool will incorporate size class specific intensity data into its calculations.

In some cases, a user of the tool (e.g. a user of maritime transport services) may not know the size class of the vessels on which its cargo is carried. In these circumstances, the user can select the "Default" size class in the size category dropdown for the tool.

It is important to note, however, that selecting the default size class in the tool means that the tool uses a conservative approach in estimating base year intensity values. Specifically, selecting the default size class means the tool will incorporate base year vessel intensity values using a weighted average of the

[11] The optional SBT Aggregator tab helps generate a combined target for all vessel types and size categories input into the tool. The tool generates combined targets based on the weighted average of each vessel type and size category's share of the total base year activity as input into the tool.

lower quartile of intensities from the Fourth IMO GHG Study for the selected vessel category. These base year intensity values also impact the target year intensities (accounting for sector growth, as described in the transport demand section above). As such, the target year intensity values for the default size class are comparatively difficult to achieve.

Base year

Users must select a base year for target setting. The base year must be no earlier than 2015. However, users are encouraged to select the most recent year for which they have accurate emissions and activity data as their target setting base year. Also, when selecting a base year, it is important to consider how representative base year emissions may be of the user's operations and not to select a base year simply to capture progress already made to date.

Target year

Users must select a target year for near-term target setting. As per sector-specific criteria (Shipping-C1), for all companies using this guidance the choice of target year must be no earlier than 2030.

The target year selection must also be in line with valid SBTi Criteria (i.e., as per SBTi Criteria version 5.0, eligible target years can be no further than ten years from the year of submission). However, the tool does permit users to calculate targets out to 2050 for longer-term planning and strategy development.

Base year Well-to-Wake emissions

Users must input the total Well-to-Wake (WTW) emissions, in metric tonnes of CO_2 equivalents (CO_2e), for the selected base year.

WTW emissions are emissions generated across the life cycle of a fuel. They include both Well-to-Tank (WTT) emissions, generated in the fuel's production and distribution, and Tank-to-Wake (TTW) emissions, generated in the combustion of the fuel.

The following subsections address calculation of base year activity for two general categories of companies that may use the tool:

1. Vessel owners and operators, those companies that own or operate vessels and are setting emission reduction targets for these vessels.

2. Cargo Shippers and Logistics Service Providers (LSPs), those companies that contract marine transportation services from vessel owners and operators and that are setting emission reduction targets for their supply chain emissions. Shippers may include freight shippers and companies that transport people by vessel (e.g., companies with employee commuting or business travel emissions associated with transportation by vessel).

Base year emissions for vessel owners and operators

Vessel owners and operators can calculate base year WTW emissions by:

1. Multiplying the total base year consumption of each type of fuel with the life cycle fuel emission factor for that type of fuel to determine the base year emissions for each fuel type. WTW fuel emission factors for a variety of marine fuels are available in the GLEC Framework (Smart Freight Centre, 2019)[12].

2. Summing the base year emissions for all fuel types to determine the total base year WTW emissions.

Base year emissions for cargo shippers and logistics service providers

Cargo Shippers and LSPs are unlikely to know the amount of fuel consumed by carriers to transport cargo on their behalf. As such, shippers and LSPs will generally need to estimate their base year emissions using default emission intensity factors. Emission intensity factors describe the amount CO_2e emitted per unit of transport activity (e.g., per tonne nautical mile).

Cargo shippers and LSPs can calculate base year emissions by:

1. Determining their transport activity. Instructions for calculating freight transport activity are included in the GLEC Framework (Smart Freight Centre, 2019). Detailed instructions for estimating transport activity on passenger vessels are provided below.

2. Multiplying their transport activity by the appropriate WTW emission factor for that transport activity depending on maritime fuels used. Default emission intensity factors for maritime transportation are included in the GLEC Framework (Smart Freight Centre, 2019)[13].

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[12] Fuel emission factors are also published in the Fourth IMO GHG Study. However, the IMO emission factors only account for the TTW phase of the fuels' life cycles. Because the IMO emission factors do not account for the WTT phase of the fuel life cycles, they cannot be used to calculate WTW emissions without additional WTT data. WTT emission factors for the maritime tool are based on assumptions regarding vessel technologies as described in the Lloyd's Register and UMAS zero-emission vessel transition pathways document (Lloyd's Register & UMAS, 2019a).

[13] The GLEC Framework emission intensity factors are presented in units of gCO_2e per tonne kilometer. The unit of measure for distance used in the SBTi maritime tool is nautical miles. If a user of the maritime tool calculates transport activity in tonne nautical miles, they will need to convert the GLEC Framework default emission intensities from gCO_2e per tonne kilometer to gCO_2e per tonne nautical mile before using those default intensities to estimate base year emissions. Also note that the GLEC Framework emission intensity factors focus on freight transport. Shippers transporting people on passenger only ferries and on cruise ships will need to work with the vessel owner operator to determine appropriate emission intensity factors for these passenger vessels.

Base year activity

Users must input the transport activity for the selected base year.

The following subsections address calculation of base year activity for Vessel owners / Operators and Shippers and LSPs.

Transport activity for vessel owners and operators: Freight

Vessel owners and operators using the tool to set targets for their own vessel operations must input their total transport activity for the base year. Owners and operators of all vessel types, except for passenger-only ferries and cruise ships, must input actual transport activity in tonne nautical miles into the maritime tool.

Transport activity in tonne nautical miles is the product of the actual mass of cargo carried and the distance that each unit of mass of cargo was carried.

The tonne nautical mile transport activity calculation must be conducted on a per tonne of cargo carried basis. Transport activity is in almost all cases **not** the product of the total cargo carried and the total distance sailed across the entire reporting period.

For example, consider these five fictitious voyage legs:

Voyage leg	Distance sailed – laden (NM)	Cargo carried (tonne)	Transport activity
1	1,000	200,000	200,000,000
2	500	300,000	150,000,000
3	1,800	250,000	450,000,000
4	2,000	325,000	650,000,000
5	700	180,000	126,000,000
TOTAL	6,000	1,255,000	1,576,000,000

Based on the voyage profile described here:

- $Total\ Transport\ Activity = 1{,}576{,}000{,}000\ tonne\ nm$
- $Total\ Distance\ Sailed \times Total\ Cargo\ Carried = 7{,}530{,}000{,}000\ tonne\ nm$

- $Total\ Transport\ Activity \neq Total\ Distance\ Sailed \times Total\ Cargo\ Carried$

Further information on calculating transport activity is included in the GLEC Framework (Smart Freight Centre, 2019).

Transport activity for vessel owners and operators: Passengers

Because cruise ships and passenger-only ferries' principal transport activity involves moving people as opposed to freight, the maritime tool uses transport activity in gross ton (GT) nautical miles for these two ship types.

Transport activity in GT nautical miles is the product of the GT of a ship and the distance that that ship travelled during the reporting period.

Vessel owners and operators must conduct the GT nautical mile transport activity calculation on a per vessel basis. That is, a user of the tool must calculate the GT nautical mile transport activity for each vessel and then sum these vessel-specific GT nautical mile transport activities to determine the total transport activity of a group of vessels. Multiplying the total GT of a fleet of vessels with the total distance sailed by that fleet will (in most cases) **not** yield the GT nautical mile transport activity for that fleet.

Transport activity for vessel owners and operators: combined freight and passengers

Owners and operators of combination roll on/off and passenger (RoPax) vessels must input actual or estimated transport activity in tonne nautical miles into the maritime tool.

RoPax vessels carry both passengers and freight. As such, transport activity calculation for these vessels requires conversion of passenger counts into mass to allow for an estimation of the total mass of cargo (combined freight and passenger) carried a given distance.

In most cases, it is not practicable to weigh individual passengers on RoPax vessels. Similarly, it may not be practicable for RoPax vessel operators to determine the actual mass of each vehicle loaded on their vessels. For this reason, default passenger and vehicle masses may be used to estimate RoPax transport activity for input into the maritime tool.

Pending the publication of ISO Standard 14083 (Quantification and reporting of greenhouse gas emissions arising from operations of transport chains), default passenger and vehicle masses from Table B.1 of Standard EN 16258 (Methodology for calculation and declaration of energy consumption and GHG emissions of transport services (freight and passengers)) may be used to determine RoPax vessel cargo masses for RoPax vessel tonne nautical mile transport activity calculations.

To estimate total cargo mass on RoPax vessels:

1. Multiply the passenger count by the default passenger mass to estimate the total passenger mass.
2. If gross vehicle mass data is not available, multiply the vehicle count for each vehicle type by the appropriate vehicle default mass value to estimate the total vehicle mass.
3. Sum up the total mass of freight transported on the vessel (note that the default vehicle masses in Table B.1 of Standard EN 16258 do not include the mass of cargo transported on freight vehicles, the defaults only account for the vehicle masses).
4. Sum the estimated total passenger mass, actual or estimated total vehicle mass, and actual freight mass to determine the total cargo mass.

The total cargo mass can be multiplied by the distance that mass of cargo was carried to determine transport activity. Note that these calculations, like those for pure freight vessels, must be conducted on a per voyage (or per voyage leg, if passengers and vehicles are loaded and offloaded on the leg of a voyage) basis. In almost all cases, multiplying the total estimated cargo mass with the total distance sailed across several vessels or voyages during a reporting period will **not** yield the transport activity.

Transport activity for cargo shippers and logistics service providers: freight

Shippers and LSPs using the tool to set targets for their supply chain transport operations must input only the transport activity for which they are responsible for the base year.

LSPs and shippers of freight must input transport activity into the maritime tool in tonne nautical miles. Transport activity in tonne nautical miles is the product of the actual mass of cargo carried and the distance that each unit of mass of cargo was carried.

See the section “Transport Activity for Vessel Owners and Operators: Freight” above and the GLEC Framework (Smart Freight Centre, 2019) for details on calculating freight transport activity.

Transport activity for shippers: passengers

Passenger only ferries and cruise vessels

Shippers of people on passenger-only ferries and on cruise vessels must input transport activity for which they are responsible into the maritime transport tool in GT nautical miles. These shippers will need to coordinate with the operator of the vessels that provided the transport activity to determine the GT nautical miles for which they as a shipper are responsible.

Specifically, allocation of GT nautical mile shares on passenger-only ferries and cruise vessels can be completed as follows:

1. Determine the GT nautical mile transport activity for the cruise vessels or passenger-only ferries used to transport people for the shipper.
2. Determine the *passenger* nautical mile transport activity for the cruise vessels or passenger-only ferries used to transport people for the shipper.
3. Calculate the shipper-specific share of GT nautical mile transport activity based on the shipper-specific share of passenger nautical mile transport activity.

For example:

- Shipper A's employees travel to and from work on passenger-only ferries operated by Ferry Operator Z. Shipper A is setting an employee commuting emission reduction target using the maritime tool.
- Ferry Operator Z operates five different ferries on the lanes used by Shipper A's employees. Ferry Operator Z calculates its total transport activity during the base year across these vessels to be 100,000,000 GT nautical miles.
- Ferry Operator Z calculates its total base year transport activity in *passenger* nautical miles across these vessels to be 5,000,000 passenger nautical miles. Passenger nautical miles can be calculated using the method described above for calculating tonne nautical miles, except per voyage (or per voyage leg) passenger count is substituted for per voyage (or per voyage leg) tonnes of cargo.
- Shipper A determines that its employees travelled 200,000 passenger nautical miles on Ferry Operator Z vessels during the base year.
- Shipper A's "share" of Ferry Operator Z's base year GT nautical miles transport activity can be calculated based on the ratio of Shipper A's passenger nautical miles transport activity to Ferry Operator Z's total passenger nautical miles transport activity.

That is, the ratio of Ferry Operator Z total base year passenger nautical miles to Shipper A base year passenger nautical miles is 25:

$$\frac{5{,}000{,}000\ passenger\ nm_Z}{200{,}000\ passenger\ nm_A} = 25{:}1$$

Stated differently, Ferry Operator Z conducted 25 units of total transport activity on these vessels for each unit of transport activity it conducted for Shipper A.

Assuming that the same ratio of activity that applied to passenger nautical miles applies to GT nautical miles, Shipper A's share of GT nautical mile transport activity can be calculated as follows:

$$GT\ nm_A = \frac{100{,}000{,}000\ GT\ nm_Z}{25} = 4{,}000{,}000\ GT\ nm$$

RoPaX vessels

Shippers of people on RoPax vessels must input the transport activity for which they are responsible into the maritime transport tool in tonne nautical miles.

In most cases, it is not practical to determine the weight of individual passengers travelling on RoPax vessels. For this reason, default passenger masses may be used to estimate RoPax activity for input into the maritime tool.

Pending the publication of ISO Standard 14083 (Quantification and reporting of greenhouse gas emissions arising from operations of transport chains), default passenger masses from Table B.1 of Standard EN 16258 (Methodology for calculation and declaration of energy consumption and GHG emissions of transport services (freight and passengers)) may be used to determine RoPax vessel cargo masses for RoPax vessel tonne nautical mile transport activity calculations.

To estimate a shipper-specific share of mass on a RoPax vessel, then, the shipper must multiply their passenger count on that vessel with the default passenger mass.

As described above for freight, the passenger mass can be multiplied by the distance that passengers travelled to determine passenger transport activity in tonne nautical miles. Note that these calculations must be conducted on a per passenger nautical mile basis. In almost all cases, multiplying the total estimated passenger mass with the total distance sailed by all passengers during the base year will **not** yield the transport activity.

Transport activity for shippers: Combined Freight and Passengers

Shippers of people and freight on (RoPax) vessels must input actual or estimated transport activity for which they are responsible into the maritime tool in tonne nautical miles.

RoPax vessels carry both passengers and freight. As such, transport activity calculation for these vessels requires conversion of passenger counts into mass to allow for an estimation of a shipper's share of the total cargo (combined freight and passenger) carried a given distance. See the section "Transport Activity for Vessel Owners and Operators: Combined Freight and Passengers" above for calculating combined freight and passenger masses on RoPax vessels.

Expected Target Year Activity

Users must input the expected activity for the selected target year.

As for base year activity data, target year activity data must be input in units of GT nautical miles for passenger-only ferries and cruise vessels, and in units of tonne nautical miles for all other vessel types.

Target year activity may be based on company-specific historical growth rate calculations. Alternatively, a user can calculate target year activity based on future growth rate estimates.

Because the targets generated by the SBTi maritime tool account for a company's projected share of sector activity based on the target year activity provided by the user, it is important that credible target year activity is input into the tool. A user that overestimates target year activity will generate emissions intensity targets that are more difficult to meet than needed to remain within the sector emissions budget. Similarly, a user that underestimates target year activity will generate emission intensity targets that do not serve as accurate indicators of the amount of emission reduction measures that the company must implement to meet the sector emissions intensity trajectory.

PART 4: SUBMITTING, COMMUNICATING, AND UPDATING TARGETS

The information included here in Part 4 summarizes the SBTi target submission, communication, and maintenance process as described on the SBTi website. For current information on and a step-by-step guide to the target submission, communication, and disclosure process, please refer to SBTi resources.

Also note that SBTi may withdraw or adjust its maritime tool at any time. Tool updates may be warranted to address matters such as new information that alters the assumptions inherent in the tool, or new information on the decarbonization pathways necessary to meet global climate goals.

Submitting Targets for Validation by SBTi

To apply for an SBTi-approved target, a company must complete the Target Submission Form and email it to targets@sciencebasedtargets.org. Submissions are validated against the general SBTi Criteria and accompanying SBTi Target Validation Protocol.

The form, available on the SBTi website, requires disclosure of a full GHG emissions inventory (by scope) in the base year, activity figures, and target related data that SBTi will use to assess the proposed targets. All data submitted in the form is treated as confidential and is only used by the SBTi technical experts for validation of a submission against the SBTi science-based criteria.

Users of this maritime transport sector guidance and tool should note that these sector specific SBTi pathways focus exclusively on marine fuel emissions. For target setting methodologies covering non marine fuel -related emissions (e.g. seaport operations, other transport operations, office buildings, etc), please refer to available SBTi guidance. All targets submissions from users of this sector guidance are required to demonstrate compliance to the full list of SBTi Criteria, which may result in additional scope 1, scope 2 or scope 3 emission reduction targets covering non fuel related emissions.

Communicating Targets

To be consistent with SBTi requirements, all targets must include at least five pieces of information:

1. Emissions covered by the target
2. Base year for target setting
3. Target year
4. Percentage reduction in the target year

5. Units of measure for the target

Targets may be expressed either as absolute emissions (tonnes CO_2e) or on an intensity basis (e.g., tonnes CO_2e per tonne nautical mile).

For example, a target may be communicated as follows:

Company A commits to reduce Well-to-Wake GHG emissions 60% per tonne nautical mile from container shipping operations by 2030 from a 2019 base year.

If a company is using biofuels, guidance related to the reporting when using biofuels found in the SBTi Recommendations and Criteria (SBTi, 2021) document has to be followed. Please note criteria C10 requiring the following footnote to be included in target language: **Tthe target boundary includes land-related emissions and removals from bioenergy feedstocks*. For further guidance, companies should refer to the Target Validation Protocol.

Updating Targets

Targets must be recalculated if there are any changes to a company or its operations that would impact the relevance or rigour of an existing target. For example, target recalculation may be warranted following material changes in:

- Company structure (e.g., acquisitions, divestitures, mergers, insourcing or outsourcing).
- Company growth projections.
- Data used or assumptions made in calculating user inputs to the maritime tool (e.g., discovery of significant errors or a number of cumulative errors that are collectively significant).

Companies participating in the SBTi must notify SBTi of any significant changes to targets and report these changes publicly.

In addition to recalculating targets following significant changes, SBTi recommends an annual review of the validity of targets developed using the maritime tool. Targets must be reassessed at least every five years.

PART 5: CONCLUSION

Aiming for Ambitious and Achievable Targets

The targets generated by the maritime tool are achievable. Several researchers conducting analyses of shipping emission intensities and sector demand have concluded that it is possible for the sector to meet a 1.5°C temperature goal (Bullock et al., 2020, 2022; Faber et al., 2020; Smith et al., 2021)

The maritime sector needs to decarbonize by 2050 to meet a 1.5°C aligned target, even if doing so will be difficult. In addition to the high abatement costs, as described in Part 1, a number of market barriers and failures impede maritime sector transport activity emission intensity reductions (Fitzpatrick et al., 2019). Committed emissions – emissions "locked in" from existing and long-lived fossil fuel infrastructure – already account for a significant percentage of the 1.5°C budget for the sector (Traut et al., 2018).

Scenarios for industry decarbonization by 2040-2050 include short term measures, such as slow steaming and technical and operational improvements, as well as a shift towards zero emissions vessels by 2030 (Bullock et al., 2020; Lloyd's Register & UMAS, 2019b; Smith et al., 2019). Ammonia, biofuels, hydrogen, methanol, and synthetic e-fuels will displace fossil fuels in a decarbonized maritime industry, with the uptake of specific alternative fuels varying according to factors like the rate of change of the onshore fuel mix, the price of primary energy sources (e.g., renewable electricity), and regulation (DNV, 2021; Smith et al., 2021).

While the results from scenario analyses can vary based on model inputs and associated assumptions, there is widespread agreement that robust regulation is critical for the maritime sector to achieve science-based emission reduction targets. Regulation is essential to mitigate risks associated with the large capital investments that will be required for decarbonization of the sector and is also essential to remove market barriers to uptake of decarbonization solutions. Indeed, the uptake of alternative fuels can be accelerated by stringent carbon constraints and industry carbon pricing – levers that can only be pulled uniformly by regulatory bodies.

The challenges are clear: an industry sector that provides a critical service for society and that also generates expensive to abate emissions; policy and market barriers to decarbonization; a narrow and rapidly closing window for action to meet global climate goals; no single solution that will work universally across the sector.

These challenges are not insurmountable. But for companies to address the challenges appropriately, they must understand their part in meeting them. The SBTi maritime tool generates emission reduction targets aligned with climate science that allow users of the tool to determine how much they must contribute to achievement of global climate goals.

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APPENDIX 1: VESSEL TYPE AND SIZE CATEGORIES

Vessel type	Size category	Units
Bulk Carrier	0-9999	DWT
	10000-34999	DWT
	35000-59999	DWT
	60000-99999	DWT
	100000-199999	DWT
	200000-+	DWT
Chemical Tanker	0-4999	DWT
	5000-9999	DWT
	10000-19999	DWT
	20000-39999	DWT
	40000-+	DWT
Container	0-999	TEU
	1000-1999	TEU
	2000-2999	TEU
	3000-4999	TEU
	5000-7999	TEU
	8000-11999	TEU
	12000-14499	TEU
	14500-19999	TEU
	20000-+	TEU
General Cargo	0-4999	DWT
	5000-9999	DWT
	10000-19999	DWT
	20000-+	DWT

Vessel type	Size category	Units
Liquefied Gas Tanker	0-49999	CBM
	50000-99999	CBM
	100000-199999	CBM
	200000-+	CBM
Oil Tanker	0-4999	DWT
	5000-9999	DWT
	10000-19999	DWT
	20000-59999	DWT
	60000-79999	DWT
	80000-119999	DWT
	120000-199999	DWT
	200000-+	DWT
Other Liquids Tanker	0-999	DWT
	1000-+	DWT
Ferry (Passenger Only)	0-299	GT
	300-999	GT
	1000-1999	GT
	2000-+	GT
Cruise	0-1999	GT
	2000-9999	GT
	10000-59999	GT
	60000-99999	GT
	100000-149999	GT
	150000-+	GT
Ferry (Roll On/Off and Passenger)	0-1999	GT
	2000-4999	GT

Vessel type	Size category	Units
	5000-9999	GT
	10000-19999	GT
	20000-+	GT
Refrigerated Cargo	0-1999	DWT
	2000-5999	DWT
	6000-9999	DWT
	10000-+	DWT
Roll On/Off	0-4999	DWT
	5000-9999	DWT
	10000-14999	DWT
	15000-+	DWT
Vehicle Carrier	0-29999	GT
	30000-49999	GT
	50000-+	GT

APPENDIX 2: VESSEL KINDS AND TYPES

Vessel kind	Vessel type
Aggregates Carrier	Bulk Carrier
Bulk Carrier	
Bulk Carrier (with Vehicle Decks)	
Bulk Carrier, Laker Only	
Bulk Carrier, Self-discharging	
Bulk Carrier, Self-discharging, Laker	
Bulk/Caustic Soda Carrier (CABU)	
Bulk/Oil Carrier (OBO)	
Cement Carrier	
Limestone Carrier	
Ore Carrier	
Ore/Oil Carrier	
Powder Carrier	
Refined Sugar Carrier	
Stone Carrier	
Urea Carrier	
Wood Chips Carrier	
Bulk/Sulphuric Acid Carrier	Chemical Tanker
Chemical Tanker	
Chemical Tanker, Inland Waterways	
Chemical/Products Tanker	
Chemical/Products Tanker, Inland Waterways	
CNG Tanker	

Vessel kind	Vessel type
Edible Oil Tanker	
Glue Tanker	
Latex Tanker	
Molten Sulphur Tanker	
Vegetable Oil Tanker	
Wine Tanker	
Beer Tanker	
Container Ship (Fully Cellular)	Container
Container Ship (Fully Cellular), Inland Waterways	
Container Ship (Fully Cellular/Ro-Ro Facility)	
Barge Carrier	General Cargo
Deck Cargo Ship	
General Cargo Ship	
General Cargo Ship (with Ro-Ro facility)	
General Cargo Ship, Self-discharging	
General Cargo, Inland Waterways	
General Cargo/Passenger Ship	
General Cargo/Passenger Ship, Inland Waterways	
General Cargo/Tanker	
Heavy Load Carrier	
Heavy Load Carrier, Semi-Submersible	
Livestock Carrier	
Munitions Carrier	
Nuclear Fuel Carrier	
Nuclear Fuel Carrier (with Ro-Ro facility)	

Vessel kind	Vessel type
Open Hatch Cargo Ship	
Palletised Cargo Ship	
Yacht Carrier, Semi-Submersible	
CO_2 Tanker	Liquified Gas Tanker
Combination Gas Tanker (LNG/LPG)	
LNG Tanker	
LPG Tanker	
LPG Tanker, Inland Waterways	
LPG/Chemical Tanker	
Asphalt/Bitumen Tanker	Oil Tanker
Coal/Oil Mixture Tanker	
Crude Oil Tanker	
Crude/Oil Products Tanker	
Oil Tanker, Inland Waterways	
Products Tanker	
Shuttle Tanker	
Tanker (Unspecified)	
Alcohol Tanker	Other Liquids Tanker
Caprolactam Tanker	
Effluent carrier	
Fruit Juice Carrier, Refrigerated	
Molasses Tanker	
Water Tanker	
Water Tanker, Inland Waterways	
Passenger Ship	Ferry (Passenger Only)

Vessel kind	Vessel type
Passenger Ship, Inland Waterways	
Cruise Ship, Inland Waterways	Cruise
Passenger/Cruise	
Air Cushion Vehicle Passenger	Ferry (Roll On/Off and Passenger)
Air Cushion Vehicle Passenger/Ro-Ro (Vehicles)	
Passenger/Container Ship	
Passenger/Landing Craft	
Passenger/Ro-Ro Ship (Vehicles)	
Passenger/Ro-Ro Ship (Vehicles), Inland Waterways	
Passenger/Ro-Ro Ship (Vehicles/Rail)	
Refrigerated Cargo Ship	Refrigerated Cargo
Container/Ro-Ro Cargo Ship	Roll On/Off
Infantry Landing Craft	
Landing Craft	
Landing Ship (Dock Type)	
Rail Vehicles Carrier	
Ro-Ro Cargo Ship	
Ro-Ro Cargo Ship, Inland Waterways	
Car Park	Vehicle Carrier
Vehicles Carrier	

APPENDIX 3: ACRONYMS

1.5DS	1.5° C aligned scenario
CBM	Cubic metre
CO_2e	Carbon dioxide equivalents
DWT	Deadweight tonnes
GHG	Greenhouse gas
GLEC	Global Logistics Emissions Council
GT	Gross tonnes
IEA	International Energy Agency
IMO	International Maritime Organization
IPCC	Intergovernmental Panel on Climate Change
LSP	Logistics service provider
NZE	Net-zero emissions
RCP	Representative concentration pathway
RoPax	Roll on/off and passenger
RoRo	Roll on/off
SDA	Sectoral Decarbonization Approach
SSP	Shared socioeconomic pathway
TEU	Twenty-foot equivalent unit
TTW	Tank-to-wake
B2DS	Well below 2° C aligned scenario
WTT	Well-to-tank
WTW	Well-to-wake