SCIENCE BASED TARGETS

DRIVING AMBITIOUS CORPORATE CLIMATE ACTION

Science-based Target Setting for the Maritime Transport Sector

DRAFT Guidance Document for Public Consultation

V0.0 | March 2021

ACKNOWLEDGEMENTS

This guidance was developed by World Wide Fund for Nature (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 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.

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. This makes UMAS world-leading on two key areas; using big data to understand drivers of shipping energy demand and emissions and using models to explore shipping's transition to a low or zero-carbon future.

PRIMARY AUTHORS

To be included prior to final publication.

TECHINCAL WORKING GROUP

A technical working group of dedicated experts from industry and nongovernmental organizations provided detailed input during the planning phase and on various drafts of the guidance and tool. Representatives from the following organizations participated as technical working group members:

To be included prior to final publication

Contents

Foreword

To be included prior to final publication.

Part 1: Background

About this Guidance

This guidance document provides guidelines on emissions target setting and accounting for the maritime 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.

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 document also briefly addresses topics that are described in detail in other SBTi publications, like the *Sectoral Decarbonization Approach Report*, *Science Based Target Setting Manual*, and *Foundations of Science-based Target Setting*.

Taken together, this guidance and SBTi's other publications provide a comprehensive suite of information for companies interested in setting science-based targets for transport activities.

Science-Based Targets

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.

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) have established global carbon budgets for scenarios likely to achieve 1.5°C and 2°C increases in global average temperature above pre-industrial levels (IPCC 2018) (IEA 2017). Under the SDA, the carbon in these budgets is allocated to industry sectors.

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. In addition to taking a sector-level approach, the SDA takes a global least-cost mitigation perspective.

Another key aspect of the SDA is that SDA targets for homogenous sectors (i.e., sectors with a uniform measure of production across companies, such as tonne-nautical miles for maritime transport) 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. 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 aggressive intensity reduction targets, 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 that project growth in market share over the target setting period will have more aggressive 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 Sector

The maritime sector serves as a critical link in many global supply chains and as the foundation of intercontinental trade. In its 2020 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 (United Nations 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 hard to abate. Energy Transitions Commission notes in their 2018 sectoral focus that shipping is the most difficult transport mode to decarbonize (Energy Transitions Commission 2018). Adapting low-carbon energy and propulsion systems to shipping involves high costs per tonne of CO_2 abated. Ships have long asset replacement cycles, meaning that the emission performance of ships built now may be locked in for decades to come. Furthermore, the diverse nature of the sector makes universally applicable abatement solutions impracticable.

Part 2: Decarbonization Pathways

Emission Budgets and Scenarios

1.5°C Scenario

A 2018 IPCC Special Report (IPCC 2018) defines a global carbon budget to satisfy a 1.5°C scenario (1.5DS), a scenario in which global average temperatures remain 1.5°C below pre-industrial levels. The IPCC 1.5DS is based on the projections from several climate models.

The SBTi maritime tool 1.5DS carbon budget is based on the budget described in the IPCC 2018 Special Report. As shown in Figure 1, under this IPCC 1.5DS budget, carbon emissions are assumed to decline linearly between 2018 and 2030. Carbon emissions are then assumed to decline at a shallower linear trajectory to 2050.

Because the 1.5DS budget is not allocated to sectors by IPCC, the SBTi maritime tool calculations are based on the overall absolute emission reduction required by the 1.5DS budget. While the tool does not account for the higher marginal cost of emissions reductions in the maritime sector as compared to other industry sectors, SBTi is currently not aware of a maritime sector-specific budget aligned with a broadly accepted global 1.5DS that can be applied in the maritime tool.

Well Below 2°C Scenario

The IEA Energy Technology Perspectives (IEA 2017) defines a global carbon budget to satisfy a well below 2°C scenario (WB2DS), a scenario in which global average temperatures remain 2°C below pre-industrial levels.

The SBTi maritime tool WB2DS carbon budget is based on the budget described in the 2017 IEA Energy Technology Perspective (ETP) report[1]. See Figure 1.

[1] The IEA issued an update to the ETP in 2020 (IEA 2020). The 2020 ETP is based on different assumptions and a different structure than the 2017 ETP. Some of the assumptions of the 2020 ETP, like a shift away from temperature aligned goals to less well-defined “Sustainable Development” and “Stated Policies” scenarios, do not have clear parallels to the Paris Agreement climate goals. The 2020 ETP 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 supporting the 2020 ETP is not currently available, SBTi decided to rely on the 2017 ETP instead of the 2020 ETP for the maritime tool.

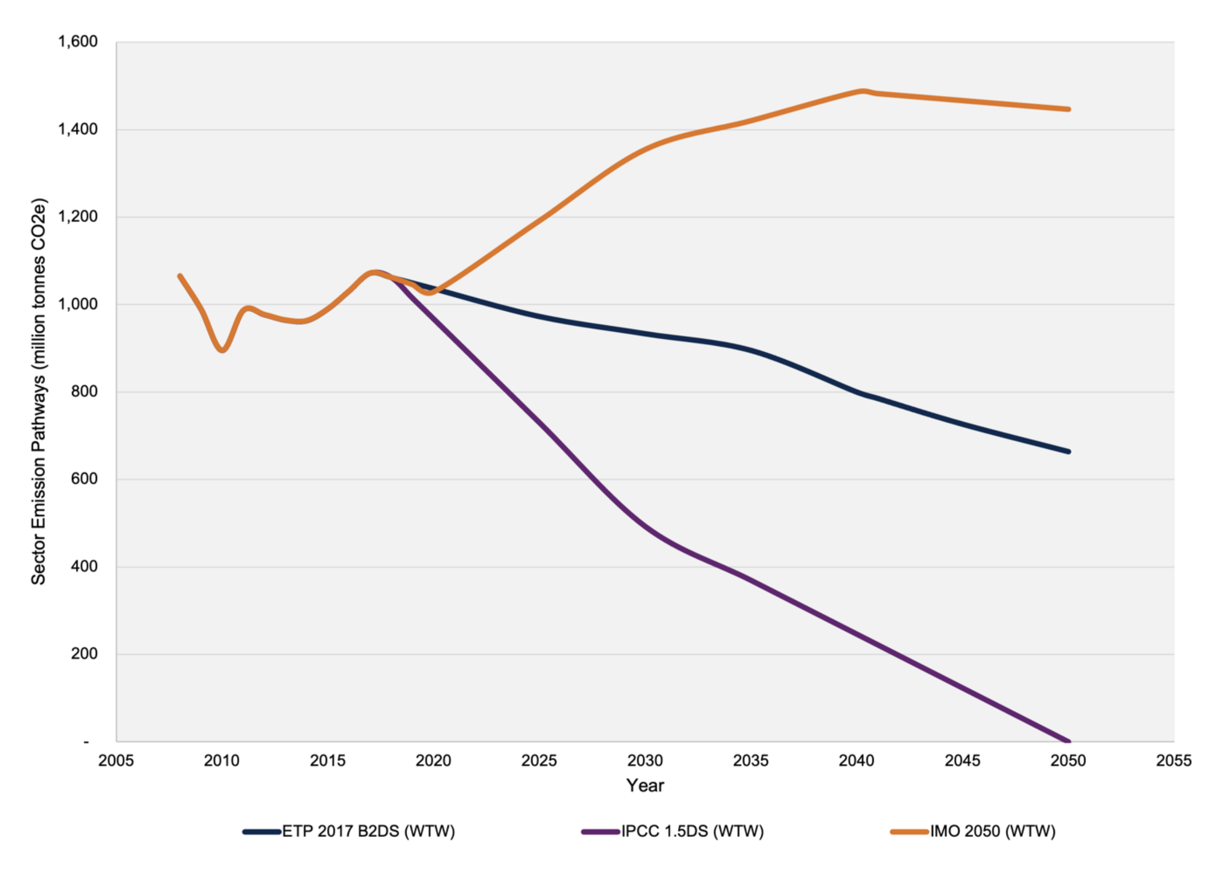

Figure 1: Maritime sector Well-to-Wake (WTW) emission pathways for IEA WB2DS, IPCC 1.5DS, and International Maritime Organization (IMO) 2050[2].

[2] 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" (Marine Environment Protection Committee 2018). The carbon budget associated with meeting this minimum absolute reduction ambition is reflected here for comparison with the WB2DS and 1.5DS budgets. Please note that the IMO targets only address Tank-to-Wake (TTW) emissions, not Well-to-Wake (WTW) emissions.

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 into 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 forecasts in scenario RCP 2.6 SSP2 (Logistics) from the Fourth IMO GHG study (Faber, et al. 2020)[3]. See Figure 2. SBTi 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[4].

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 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 segment-specific demand projections – preclude the use of segment-specific demand projections at this time.

[3] 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.

[4] Faber et al (2020) describe two methods to project transport work related to non-energy products transportation, a "Logistics Model" and a "Gravity 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 Gravity Model. While Faber et al do not state a preference for one model over the other, the transport demand projection in the SBTi maritime tool are based on the Logistics Model. The Logistics Model projections were used in the maritime tool because the Gravity Model's future long term trade growth assumptions are low by historical standards and in comparison with other forecasts. The justification for these lower growth assumptions is not clear. Similarly, relying on the Logistics Model's higher growth assumptions yields a more conservative output from the maritime tool.

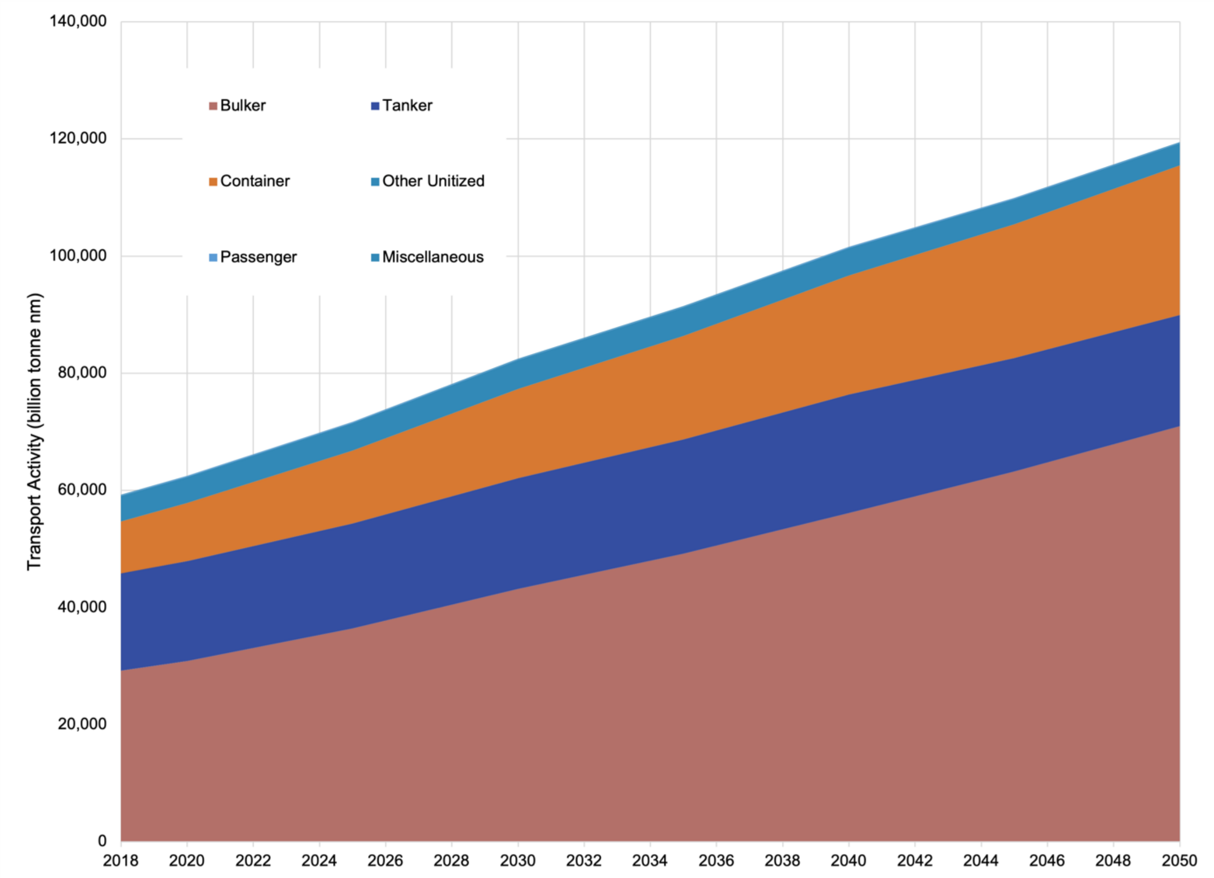

Figure 2: Transport activity projections.

Sector Carbon Intensity Pathways

The SBTi maritime tool relies on the 2018 IPCC 1.5DS and the 2017 IEA WB2DS carbon budgets and the IMO scenario RCP 2.6 SSP21 transport demand forecasts between 2018 and 2050 to calculate carbon intensity trajectories for the maritime sector. As noted in the previous section, because the tool uses overall transport demand forecasts 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, the quotient of the IPCC 1.5DS and IEA WB2DS carbon budgets and the Faber et al sector transport demand forecasts, are shown in Figure 3.

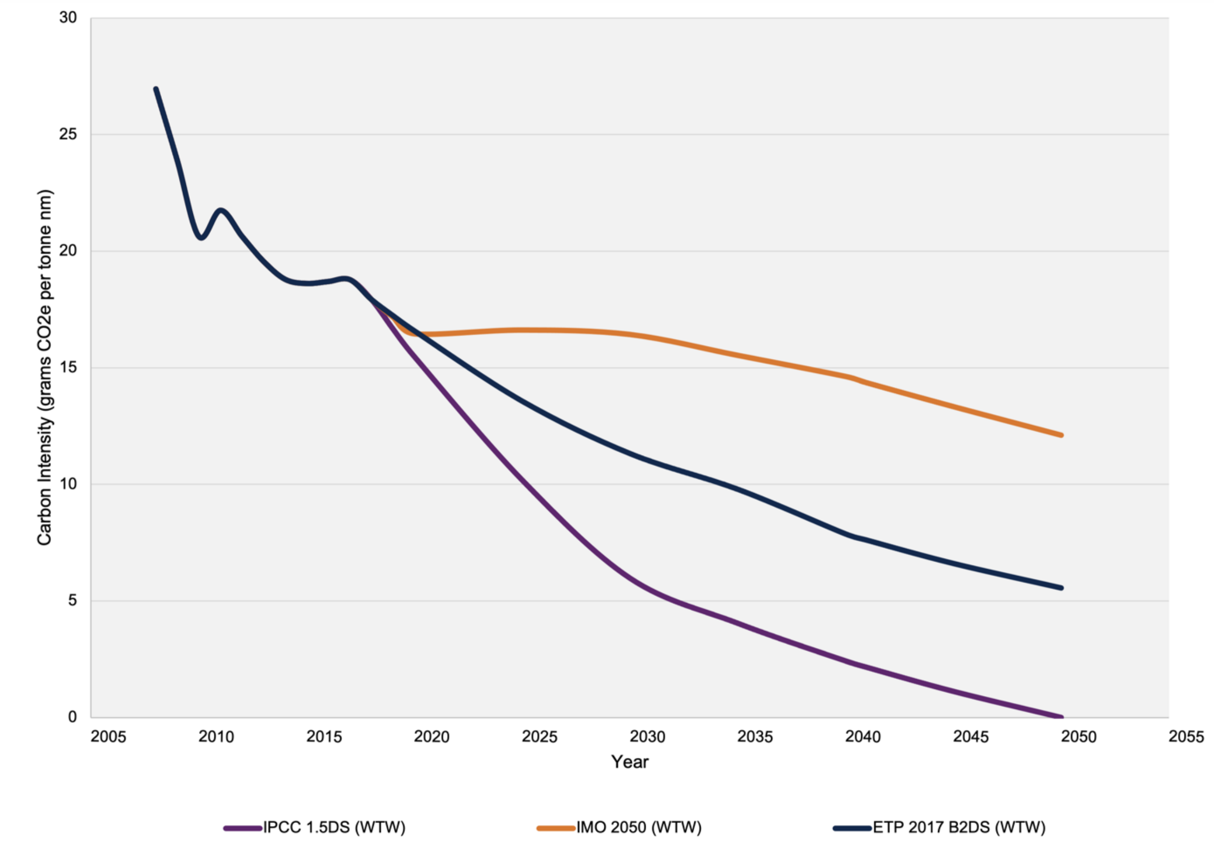

Figure 3[567]: Maritime transportation CO_2e emission intensity trajectories.

[5] The 2008-2018 carbon intensity values shown in this figure are based on data in the Third and Fourth IMO GHG Studies (Smith, Jalkanen, et al. 2014) (Faber, et al. 2020).
[6] Because IEA provides carbon budget data at five-year intervals, for the WB2DS, total carbon emissions for 2020 and 2041 in this figure were linearly interpolated.
[7] 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

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 (2015) vessel type and size category-specific operational intensities are taken from Fourth IMO GHG Study (Faber et al, 2020). See Appendix 1 for a list of vessel types and size categories used in the SBTi maritime tool.

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.

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 accurate.

50% by 2050 compared to 2008" (Marine Environment Protection Committee 2018). The sector emissions intensity associated with meeting this minimum absolute reduction ambition is reflected here for comparison with the WB2DS and 1.5DS intensities. Please note that the IMO targets only address TTW emissions, not WTW emissions.

Part 3: Setting Targets

Overview of the Target Setting Tool and the Importance of Quality Data

The SBTi maritime transport tool is a workbook that calculates emission reduction targets to meet both the IEA WB2DS and IPCC 1.5DS, 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. Tool inputs are described in detail in the next section.

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, program or 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.

User Inputs for the SBTi Maritime Tool

Vessel Type

Users must select from one of thirteen vessel types.

The vessel types 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
13. Vehicle Carrier

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[8] of the tool.

[8] The SBT Aggregator tab generates 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.

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 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 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 target setting.

The target year can be no sooner than five years from the current year and no further than fifteen years from the current year to be eligible for validation by SBTi. 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. Shippers and 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)[9].
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

Shippers and Logistics Service Providers (LSP) 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 emission intensity factor for that transport activity. Default emission intensity factors for maritime transportation are included in the GLEC Framework (Smart Freight Centre 2019)[10].

[9] 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 and UMAS 2019).

[10] 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 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. Shippers and 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).

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 (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 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 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 emission reduction measures that the company must implement to meet the sector emissions intensity trajectory.

Part 4: Submitting, Communicating, and Updating Targets

Introduction

The information included here in Part 4 summarizes the SBTi target submission, communication, and maintenance process as described on the SBTi website at https://sciencebasedtargets.org/set-a-target. For current information on and a step-by-step guide to the target submission, communication, and disclosure process, please refer directly to this website.

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

Companies participating in the SBTi must complete and submit a target submission form to SBTi.

The form, available on the SBTi website, requires disclosure of emissions (by scope) in the base year, activity figures, and related data that SBTi will use to assess the proposed target. 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.

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.*

Updating Targets

Targets must be recalculated if there are any changes to a company or its operations that would impact the relevance or rigor 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

SBTs are Ambitious and Achievable

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 even 1.5DS carbon budget requirements (Bullock, et al. 2020) (Traut, et al. 2018) (Lloyd's Register and UMAS 2019).

The maritime sector needs to decarbonize by 2050 to meet a 1.5DS, even if doing so will be difficult. As noted in Part 1, maritime is a hard to abate sector. In addition to the factors described in Part 1, a number of market barriers and failures impede maritime sector transport activity emission intensity reductions (Fitzpatrick, et al. 2019). And committed emissions – emissions "locked in" from existing and long-lived fossil fuel infrastructure – already account for a significant percentage of the 1.5DS 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) (Smith, et al. 2019) (Lloyd's Register and UMAS 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 (Smith, et al. 2019) (DNV-GL 2020) (Energy Transitions Commission 2018).

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.

Conclusion

The challenges are clear. An industry sector that provides a critical service for society and that also generates difficult 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.

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
Liquefied Gas Tanker	0-49999	CBM
	50000-99999	CBM
	100000-199999	CBM
	200000-+	CBM

VESSEL TYPE	SIZE CATEGORIES	UNITS
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
	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	
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)	

<table>
<tr><th>VESSEL KIND</th><th>VESSEL TYPE</th></tr>
<tr><td>Barge Carrier</td><td rowspan="18">General Cargo</td></tr>
<tr><td>Deck Cargo Ship</td></tr>
<tr><td>General Cargo Ship</td></tr>
<tr><td>General Cargo Ship (with Ro-Ro facility)</td></tr>
<tr><td>General Cargo Ship, Self-discharging</td></tr>
<tr><td>General Cargo, Inland Waterways</td></tr>
<tr><td>General Cargo/Passenger Ship</td></tr>
<tr><td>General Cargo/Passenger Ship, Inland Waterways</td></tr>
<tr><td>General Cargo/Tanker</td></tr>
<tr><td>Heavy Load Carrier</td></tr>
<tr><td>Heavy Load Carrier, Semi-Submersible</td></tr>
<tr><td>Livestock Carrier</td></tr>
<tr><td>Munitions Carrier</td></tr>
<tr><td>Nuclear Fuel Carrier</td></tr>
<tr><td>Nuclear Fuel Carrier (with Ro-Ro facility)</td></tr>
<tr><td>Open Hatch Cargo Ship</td></tr>
<tr><td>Palletised Cargo Ship</td></tr>
<tr><td>Yacht Carrier, Semi-Submersible</td></tr>
<tr><td>CO_2 Tanker</td><td rowspan="6">Liquified Gas Tanker</td></tr>
<tr><td>Combination Gas Tanker (LNG/LPG)</td></tr>
<tr><td>LNG Tanker</td></tr>
<tr><td>LPG Tanker</td></tr>
<tr><td>LPG Tanker, Inland Waterways</td></tr>
<tr><td>LPG/Chemical Tanker</td></tr>
<tr><td>Asphalt/Bitumen Tanker</td><td rowspan="8">Oil Tanker</td></tr>
<tr><td>Coal/Oil Mixture Tanker</td></tr>
<tr><td>Crude Oil Tanker</td></tr>
<tr><td>Crude/Oil Products Tanker</td></tr>
<tr><td>Oil Tanker, Inland Waterways</td></tr>
<tr><td>Products Tanker</td></tr>
<tr><td>Shuttle Tanker</td></tr>
<tr><td>Tanker (Unspecified)</td></tr>
</table>

VESSEL KIND	VESSEL TYPE
Alcohol Tanker	Other Liquids Tanker
Caprolactam Tanker	Other Liquids Tanker
Effluent carrier	Other Liquids Tanker
Fruit Juice Carrier, Refrigerated	Other Liquids Tanker
Molasses Tanker	Other Liquids Tanker
Water Tanker	Other Liquids Tanker
Water Tanker, Inland Waterways	Other Liquids Tanker
Passenger Ship	Ferry (Passenger Only)
Passenger Ship, Inland Waterways	Ferry (Passenger Only)
Cruise Ship, Inland Waterways	Cruise
Passenger/Cruise	Cruise
Air Cushion Vehicle Passenger	Ferry (Roll On/Off and Passenger)
Air Cushion Vehicle Passenger/Ro-Ro (Vehicles)	Ferry (Roll On/Off and Passenger)
Passenger/Container Ship	Ferry (Roll On/Off and Passenger)
Passenger/Landing Craft	Ferry (Roll On/Off and Passenger)
Passenger/Ro-Ro Ship (Vehicles)	Ferry (Roll On/Off and Passenger)
Passenger/Ro-Ro Ship (Vehicles), Inland Waterways	Ferry (Roll On/Off and Passenger)
Passenger/Ro-Ro Ship (Vehicles/Rail)	Ferry (Roll On/Off and Passenger)
Refrigerated Cargo Ship	Refrigerated Cargo
Container/Ro-Ro Cargo Ship	Roll On/Off
Infantry Landing Craft	Roll On/Off
Landing Craft	Roll On/Off
Landing Ship (Dock Type)	Roll On/Off
Rail Vehicles Carrier	Roll On/Off
Ro-Ro Cargo Ship	Roll On/Off
Ro-Ro Cargo Ship, Inland Waterways	Roll On/Off
Car Park	Vehicle Carrier
Vehicles Carrier	Vehicle Carrier

Appendix 3: Acronyms

1.5DS	1.5° Celsius Scenario
CBM	Cubic Meter
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
RoPax	Roll on/off and Passenger
SDA	Sectoral Decarbonization Approach
TEU	Twenty Foot Equivalent Unit
TTW	Tank-to-Wake
WB2DS	Well Below 2° Celsius Scenario
WTT	Well-to-Tank
WTW	Well-to-Wake

Appendix 4: References

Bullock, Simon, James Mason, John Broderick, and Alice Larkin. 2020. "Shipping and the Paris climate agreement: a focus on committed emissions." *BMC Energy.*

DNV-GL. 2020. "Maritime Forecast to 2050 Energy Transition Outlook 2020."

Energy Transitions Commission. 2018. "Mission Possible: Reaching Net-Zero Carbon Emissions from Harder-to-Abate Sectors by Mid-Century."

Energy Transitions Commission. 2018. "Mission Possible: Sectoral Focus Shipping."

Faber, Jasper, Shinichi Hanayama, Shuang Zhang, Paula Pereda, Bryan Comer, Elena Hauerhof, Wendela Schim van der Loeff, et al. 2020. "Fourth IMO GHG Study Final Report."

Fitzpatrick, Nick, Nishatabbas Rehmatulla, Chester Lewis, and Kat Deyes. 2019. "Reducing the Maritime Sector's Contribution to Climate Change and Air Pollution - Identification of Market Failures and other Barriers to the Commercial Deployment of Emission Reduction Options."

IEA. 2020. "Energy Technology Perspectives."

IEA. 2017. "Energy Technology Perspectives 2017 - Catalysing Energy Technology Transformations."

IPCC. 2018. "Global Warming of 1.5°C An IPCC Special Report on the Impacts of Global Warming of 1.5°C above Pre-Industrial Levels and Related Global Greenhouse Gas Emission Pathways, in the Context of Strengthening the Global Response to the Threat of Climate Change."

Lloyd's Register and UMAS. 2019. "Zero-Emission Vessels: Transition Pathways."

Marine Environment Protection Committee. 2018. "Resolution MEPC.304(72): Initial IMO Strategy on Reduction of GHG from Ships."

Smart Freight Centre. 2019. "Global Logistics Emission Council Framework for Logistics Emissions Accounting and Reporting."

Smith, Tristan, Eoin O'Keeffe, Elena Hauerhof, Carlo Raucci, Matthew Bell, Kat Deyes, Jasper Faber, and Maarten 't Hoen. 2019. "Reducing the Maritime Sector's Contribution to Climate Change and Air Pollution - Scenario Analysis: Take-up of Emissions Reduction Options and their Impacts on Emissions and Costs."

Smith, Tristan, Jukka-Pekka Jalkanen, Bruce Anderson, James Corbett, Jasper Faber, Shinichi Hanayama, Eoin O'Keeffe, et al. 2014. "Third IMO Greenhouse Gas Study."

Traut, Michael, Alice Larkin, Kevin Anderson, Christophe McGlade, Maria Sharmina, and Tristan Smith. 2018. "CO2 abatement goals for international shipping." *Climate Policy.*

United Nations. 2020. "Review of Maritime Transport, United Nations Conference on Trade and Development."