CBI Shipping Criteria – Background Paper

The Shipping Criteria for the Climate Bonds Standard & Certification Scheme

September 2020

The Climate Bonds Initiative gratefully acknowledges the Technical and Industry Working Group members who supported the development of these Criteria. Members are listed in Appendix 1.

Special thanks are given to Tristan Smith, and Sophie Parker from University College London, who acted as the lead specialists coordinating the development of the Criteria through the Technical Working Group, and to Adolf Ng, Mawuli Afenyo and Roozbeh Panahi from the University of Manitoba, who were instrumental to the discussion on adaptation and resilience.

Proposals were agreed by the Technical Working Group, taking into account feedback from the Industry Working Group.

Definitions

Approved verifiers: Organisations approved by the Climate Bonds Initiative to provide assurance services to issuers of Certified Climate Bonds. The duties of approved verifiers include providing assurance that the requirements of the Climate Bonds Standard (including these and other sector specific Criteria) are met.

Climate Bonds Initiative (CBI): An investor-focused not-for-profit organisation, promoting large-scale investments that will deliver a global low carbon and climate resilient economy. The Initiative seeks to develop mechanisms to better align the interests of investors, industry and government so as to catalyse investments at a speed and scale sufficient to avoid dangerous climate change.

Climate Bond: A Climate Bond is a bond used to finance – or re-finance - projects needed to address climate change. They range from wind farms and hydropower plants, to rail transport and building sea walls in cities threatened by rising sea levels. Only a small portion of these bonds have been labelled as green or climate bonds by their issuers.

Certified Climate Bond: A Climate Bond that is certified by the Climate Bonds Standard Board as meeting the requirements of the Climate Bonds Standard, as attested through independent verification.

Climate Bonds Standard (CBS): A screening tool for investors and governments that allows them to identify green bonds where they can be confident that the funds are being used to deliver climate change solutions. This may be through climate mitigation impact and/ or climate adaptation or resilience. The CBS is made up of two parts: the parent standard (Climate Bonds Standard v.3) and a suite of sector specific eligibility Criteria. The parent standard covers the certification process and pre- and post-issuance requirements for all certified bonds, regardless of the nature of the capital projects. The Sector Criteria detail specific requirements for assets identified as falling under that specific sector. The latest version of the CBS is published on the Climate Bonds Initiative website

Climate Bonds Standard Board (CBSB): A board of independent members that collectively represents $34 trillion of assets under management. The CBSB is responsible for approving i) Revisions to the Climate Bonds Standard, including the adoption of additional sector Criteria, ii) Approved verifiers, and iii) Applications for Certification of a bond under the Climate Bonds Standard. The CBSB is constituted, appointed and supported in line with the governance arrangements and processes as published on the Climate Bonds Initiative website.

Climate Bond Certification: allows the issuer to use the Climate Bond Certification Mark in relation to that bond. Climate Bond Certification is provided once the independent Climate Bonds Standard Board is satisfied the bond conforms with the Climate Bonds Standard.

Green Bond: A Green Bond is where proceeds are allocated to environmental projects. The term generally refers to bonds that have been marketed as "Green". In theory, Green Bonds proceeds could be used for a wide variety of environmental projects, but in practice they have mostly been the same as Climate Bonds, with proceeds going to climate change projects.

Technical Working Group (TWG): A group of key experts from academia, international agencies, industry and NGOs convened by the Climate Bonds Initiative. The TWG develops the Sector Criteria - detailed technical criteria for the eligibility of projects and assets as well as guidance on the tracking of eligibility status during the term of the bond. Their draft recommendations are refined through engagement with finance industry experts in convened Industry Working Groups and through public consultation. Final approval of Sector Criteria is given by the CBSB.

Industry Working Group (IWG): A group of key organisations that are potential issuers, verifiers and investors convened by the Climate Bonds Initiative. The IWG provides feedback on the draft sector Criteria developed by the TWG before they are released for public consultation

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1. Introduction

1.1 Overview

This document provides a starting point for the development of Sector Criteria for the shipping industry under the Climate Bonds Standard. The purpose of these Criteria will be to provide a succinct set of decision rules for determining when shipping projects and assets are compatible with a low carbon, climate resilient economy, and therefore should be certified under the Climate Bonds Standard. The document's aim is to give an overview of the issues, which the Criteria's Technical Working Group (TWG) and Industry Working Group (IWG) is likely to meet in developing the Criteria.

The two main tasks of the TWG will be to draw up two sub-sets of Criteria: one for determining the mitigation potential or low carbon status of the project or asset; and one for determining its resilience to climate impacts. These criteria ideally need to provide an optimal balance between rigour, robustness and keeping the burden of assessment low. The main task of the IWG will be to review these Criteria and provide feedback on the efficacy, applicability, and appropriateness of the Criteria.

1.2 Funding needs of a low-carbon and climate resilient economy

The current trajectory of climate change is expected to lead to a global warming of 3.1-3.7°C above pre-industrial levels by 2100[1], posing an enormous threat to the future of the world's nations and economies. The effects of climate change and the risks associated with a greater than 2°C rise in global temperatures by the end of the century are significant: rising sea levels, increased frequency and severity of hurricanes, droughts, wildfires and typhoons, and changes in agricultural patterns and yields. Avoiding such catastrophic climate change requires a dramatic reduction in global greenhouse gas emissions.

Meanwhile, the world is entering an age of unprecedented urbanisation and related infrastructure development. Global infrastructure investment is expected to amount to USD 90 trillion over the next 15 years, which is more than the entire current infrastructure stock.[2]

To ensure sustainable development and slow climate change, this infrastructure needs to be low-carbon and resilient to climate change, without compromising the kind of economic growth needed to improve the livelihoods and wellbeing of the world's most vulnerable citizens. Ensuring that the infrastructure built is low-carbon is estimated to raise annual investment needs by 3–4% to USD 6.2 trillion.[3] Climate adaptation needs add another significant amount of investment, which is estimated at USD 280–500 billion per annum by 2050 for a 2°C scenario.[4]

According to the Task Force on Climate-related Financial Disclosures (TCFD), there are two broad channels through which climate change can present risks to business activities and assets[5]:

Physical risk: the risk of impacts from climate- and weather-related events, such as floods and storms that damage property or disrupt supply chains and trade;
Transition risk: the financial risks that could result from the process of adjustment towards a lower-carbon economy. These include sudden shifts in demand; legal risk due to parties who have suffered loss or damage seeking compensation; and changes in policy favouring lower carbon technologies.

All of these could prompt a reassessment of the value of a large range of assets as costs and opportunities become apparent, and widespread inadequate information on these risks could even threaten the stability of

[1] According to Climate Tracker, under current policies we could expect 3.1-3.7°C: 2018. Temperatures: Addressing global warming. Accessed on 17.05.2018. Available from: http://climateactiontracker.org/global.html

[2] The Global Commission on the Economy and Climate, 2016a. The Sustainable Infrastructure Imperative: Financing for Better Growth and Development The 2016 New Climate Economy Report. (n.d.).

[3] Ibid.

[4] UNEP, 2016

[5] TFCD. 2017. Final Report: Recommendations of the Task Force on Climate-related Financial Disclosures. Accessed on 17.05.2018. Available from: https://www.fsb-tcfd.org/publications/final-recommendations-report/. Accessed on 04.06.2018.

the financial system. Risks to financial stability will be minimised if the transition begins early and follows a predictable path, thereby helping the market anticipate the transition to a 2°C world.

1.3 Role of bonds

Traditional sources of capital for infrastructure investment (governments and commercial banks) are insufficient to meet capital requirement needs to 2030; institutional investors, particularly pension and sovereign wealth funds, are increasingly looked to as viable actors to fill these financing gaps.

Capital markets enable issuers to tap into large pools of private capital from institutional investors. Bonds are appropriate investment vehicles for these investors as they are low-risk investments with long-term maturities (in comparison to equity investments in the same company for example), making them a good fit with institutional investors' liabilities (e.g. pensions to be paid out in several decades).

Bond financing works well for low-carbon and climate-resilient infrastructure projects post-construction, as capital markets also facilitate risk management. Across investors and financial markets, different entities face different types and severities of risks related to climate change, depending on many factors including degree of long-term exposure, likelihood of negative climate impacts, and ability to mitigate impacts or shift positions.

Bonds offer relatively stable and predictable returns and long-term maturities. This makes them a good fit with institutional investors' investment needs. Labelled green bonds are bonds with proceeds used for green projects, mostly climate change mitigation and/or adaptation projects, and labelled accordingly. The rapid growth of the labelled green bond market has shown in practice that the bond markets provide a promising channel to finance climate investments.

The green bond market can reward bond issuers and investors for sustainable investments that accelerate progress toward a low carbon and climate resilient economy. Commonly used as long-term debt instruments, green bonds are issued by governments, companies, municipalities, commercial and development banks to finance or re-finance assets or activities with environmental benefits. Green bonds are in high demand and can help issuers attract new types of investors.

Green bonds are regular bonds with one distinguishing feature: proceeds are earmarked for projects with environmental benefits, primarily climate change mitigation and adaptation. A green label is a discovery mechanism for investors. It enables the identification of climate-aligned investments with limited resources for due diligence. By doings so, a green bond label reduces friction in the markets and facilitates growth in climate-aligned investments.

However, currently green bonds only account for less than 0.2% of all bonds issued globally, whereas the global bond market stands at USD 100 trillion. The potential for scaling up is tremendous. The market now needs to grow much bigger, and quickly.

1.4 Introduction to Climate Bonds Initiative and the Climate Bonds Standard

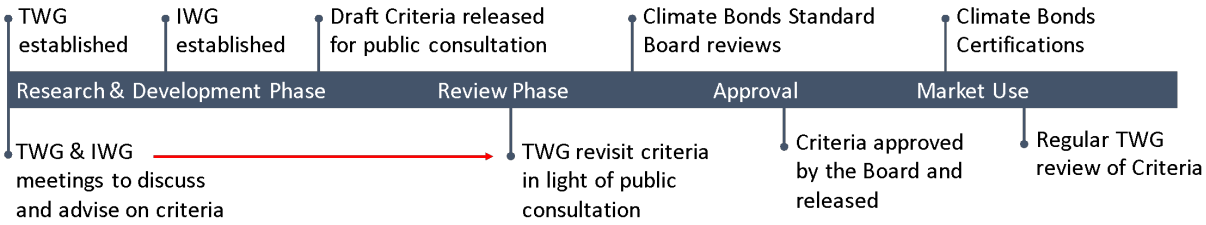
The Climate Bonds Initiative is an investor-focused not-for-profit organisation whose goal is to promote large-scale investments through green bonds and other debt instruments to accelerate a global transition to a low-carbon and climate-resilient economy.

Activating the mainstream debt capital markets to finance and refinance climate-aligned projects and assets is critical to achieving international climate goals, and robust labelling of green bonds is a key requirement for that mainstream participation. Confidence in the climate objectives and the use of funds intended to address climate change is fundamental to the credibility of the role that green bonds play in a low carbon and climate resilient economy. Trust in the green label and transparency to the underlying assets are essential for this market to reach scale but investor capacity to assess green credentials is limited, especially in the fast-paced bond market. Therefore, the Climate Bonds Initiative created the Climate Bonds Standard & Certification Scheme, which aims to provide the green bond market with the trust and assurance that it needs to achieve scale.

The Climate Bonds Standard & Certification Scheme is an easy-to-use tool for investors and issuers to assist them in prioritising investments that truly contribute to addressing climate change, both from a resilience and a mitigation point of view. It is made up of the overarching Climate Bonds Standard detailing management and reporting processes, and a set of Sector Criteria detailing the requirements assets must meet to be eligible for certification. The Sector Criteria covers a range of sectors including solar energy, wind energy, marine renewable energy, geothermal power, low carbon buildings, low carbon transport, forestry and water. The Certification Scheme requires issuers to obtain independent verification, pre- and post-issuance, to ensure the bond meets the requirements of the Climate Bonds Standard.

1.5 Process for Sector Criteria Development

The Climate Bonds Standard has been developed based on public consultation, road testing, review by the assurance roundtable and expert support from experienced green bond market actors. The Standard is revisited and amended on a regular basis in response to the growing green bond market. Sector specific Criteria, or definitions of green, are developed by Technical Working Groups (TWGs), made up of scientists, engineers and technical specialists. Draft Criteria are presented to Industry Working Groups before being released for public comment. Finally, Criteria are presented to the Climate Bonds Standard Board for approval (see diagram below).



To date, Sector Criteria for wind, solar, geothermal, marine renewables, road transport, forestry, water and buildings are available for certification. Sector Criteria for hydropower, bioenergy, fisheries, waste management, agriculture, and shipping are under development. Working groups for energy distribution & management, ICT and industrial energy efficiency will be launched soon.

1.6 Revisions to these Criteria

These Criteria will be reviewed two years after launch, or potentially earlier if the need arises, at which point the TWG will take stock of issuance that arises in the early stages and any developments in improved methodologies and data that can increase the climate integrity of future bond issuances. After the first review, the Criteria will be reviewed again periodically on a needs basis as technology and the market evolves. As a result, the Criteria are likely to be refined over time, as more information becomes available. However, certification will not be withdrawn retroactively from bonds certified under earlier versions of the Criteria.

2. Sector Overview

Shipping is defined as maritime transport of cargo and passengers in international and domestic waters. This does not include military or fishing vessels.[6] International shipping is between ports of different countries, whereas domestic shipping is shipping between ports of the same country. By this definition, the same ship may frequently be engaged in both international and domestic shipping operations. This definition is consistent with the IPCC 2006 Guidelines (Second IMO GHG Study 2009).

Despite significant climate impacts arising from international shipping, domestic shipping is nonetheless important, and the decarbonization of domestic shipping may vary depending on how an individual country's decarbonization plans prioritise this sector. However, overall guidance can still be taken from these criteria.

Global economic activity is the primary driver of international demand for shipping. Maritime transport accounts for approximately 80% of global trade by volume, and 70% by value. In 2017, total volumes transported reached 10.7 billion tons. The UN Conference on Trade and Development (UNCTAD) is forecasting a 3.8 per cent Compound Average Growth Rate (CAGR) for seaborne trade between 2018 and 2023.

The world's global shipping fleet is growing to meet this demand. In 2017, 42 million gross tons were added to global shipping fleet tonnage following an increase in new deliveries and decline in demolition activity.[7] Despite this growth, the UNCTAD also anticipates various political risks and disruptions to the industry including the looming trade tensions between the United States of America and China, Canada, Mexico and the European Union.

The shipping industry is characterized by ship owners, operators, freight forwarders, shipping customers, maritime services, charterers, ports and terminal infrastructure, corporate services, and manufacturers. In terms of market characteristics, the industry is concentrated around a relatively small number of actors, despite its global impact. The top five ship-owning countries (Greece, Japan, China, Germany and Singapore) account for almost 50% of the world fleet in dead-weight tonnage. The top ten cargo carriers hold a combined market share of 68.6% and operate approximately 35% of the world's fleet.[8]

2.1 The Future of Shipping

The future of the maritime industry remains unclear, but industry leaders have an opportunity to define what that future looks like for themselves. The digitization of the shipping sector offers immense growth and innovation potential. Autonomous shipping and blockchain technology are showing considerable promise for application within the shipping industry and the industry is constantly seeking new ways to apply technological advances and adapt to a changing world. In particular, the Global Maritime Issues Monitor 2018 identified 'big data' as having the highest potential impact and likelihood of occurring over the next ten years.[9]

The shipping industry has also recognised that climate change is emerging as a major threat to operations and profitability. More intense storms, rising sea levels and changing shipping routes will force the industry to understand and raise awareness of climate risk and demonstrate the opportunities in taking leadership and action. This will be discussed in more detail in Section 2.4.

2.2 Mitigation Potential and GHG Impacts of Shipping

While shipping is the lowest emitting for of transport, especially for international/trans-continental shipping, decarbonisation of the shipping sector will remain crucial to meeting international commitments to mitigating climate change. According to the International Maritime Organisation (IMO), the shipping industry's governing

[6] International Maritime Organization, 2014. Third IMO GHG Study. Available at: http://www.imo.org/en/OurWork/Environment/PollutionPrevention/AirPollution/Documents/Third%20Greenhouse%20Gas%20Study/GHG3%20Executive%20Summary%20and%20Report.pdf

[7] https://unctad.org/en/PublicationsLibrary/rmt2018_en.pdf

[8] Ibid.

[9] https://www.globalmaritimeforum.org/content/2018/10/Global-Maritime-Issues-Monitor-2018.pdf

body, the sector currently accounts for approximately 2.2% of global emissions. Left unchecked, shipping emissions are expected to grow by 50-250% by 2050.[10]

CO2 is the largest component of greenhouse gas emissions in shipping (98%). The multi-year average estimate for all shipping for 2007–2012 was 1,015 million tonnes CO2 and 1,036 million tonnes CO2e for GHGs combining CO2, CH4 (methane) and N2O (nitrous oxide).[11]

However, methane (CH4) emissions from ships increased over this period (particularly over 2009–2012) due to increased shipping activity associated with the transport of gaseous cargoes by liquefied gas tankers due to methane slip. There is a risk of this trend continuing in the future if shipping moves to LNG-powered ships.

There is however, potential for the sector to make significant GHG reductions. These can be achieved through a combination of:

- Increasing the energy efficiency of shipping
- Reducing the GHG intensity of the energy used by ships

The former can be achieved by technologies and operational interventions. Examples of technologies include equipment which can improve the hull's efficiency, the propulsion efficiency, or the efficiency of the machinery used to convert fuel into propulsive or auxiliary power (e.g. the engine). Operational interventions include reduction or optimisation of speed, maintenance programmes on hull coatings and machinery, trim and draught management, as well as fleet wide strategies enabling just in time arrival at ports.

However, while the potential for significant GHG reduction from efficiency gains is important, it is ultimately limited and will not enable significant decarbonisation in its own right. We also recognise that refrigerated container units (reefers) are used extensively across the shipping sector and present a substantial opportunity to reduce emissions due to increased energy consumption for cooling and leakage of refrigerant. This technology segment intersects with various transport modalities (including road freight and rail). The present criteria do not provide guidance on measuring or certifying the contribution of improvements to reefer performance, but the need for further work in this segment is recognised.

Table 1 outlines for an example ship type (a Medium Range Tanker), the carbon intensity values as a result of varying speed, the use of energy efficiency technologies and the adoption of lower carbon fuels (i.e., a 50% and 75% lower carbon factor than current fuels) relative to the baseline specification.

For example, applying a speed reduction from the baseline of 12.8 knots to 11.3 knots results in an intensity value that is 80% of the baseline value, or a 20% reduction in carbon intensity. Speed reductions and energy efficiency technology in combination with wind propulsion could only reduce carbon intensity by between 30% and 70% relative to the 2010 baseline design and operational specification (shown in yellow).

To achieve such a reduction requires a large reduction in operating speed which could be undesirable for commercial and operational reasons. Significant further reductions beyond 70%, including at higher operating speeds closer to those used today, are only achievable when use of lower carbon factor fuels was explored (shown in green).

[10] International Maritime Organization, 2014. Third IMO GHG Study. Available online.
[11] Ibid.

Table 1: Energy Efficiency Operational Indicator (EEOI)[12] value indexed to the baseline, 2010 specification, taking into account potential impacts due to technology, operation and energy/fuel choices for a Medium Range tanker[13]

	Operating speed (knots)	Baseline	Max. technology but no wind assistance/block	Max. technology and wind assistance/block	Max. technology, wind assistance/block and 50% carbon factor (C_f) reduction	Max. technology, wind assistance /block and 75% carbon factor (C_f) reduction
MR tanker	4.5	46%	49%	34%	17%	9%
	6.0	46%	46%	31%	16%	8%
	8.9	59%	56%	38%	19%	9%
	9.7	66%	61%	42%	21%	10%
	11.3	80%	73%	50%	25%	13%
	11.7	85%	77%	53%	27%	13%
	11.9	87%	79%	55%	27%	14%
	12.0	89%	80%	55%	28%	14%
	12.8	**100%**	89%	61%	31%	15%
	14.3	131%	110%	75%	38%	19%
	15.0	153%	126%	85%	43%	21%

Note: Table 1 serves only to illustrate the impacts of technology, operation and fuel choices on a vessel's EEOI, the reference to a Medium Range tanker is illustrative but does not negate the categorical exclusion of dedicated fossil fuel carriers.

Therefore, in addition to increasing efficiency, the sector will need to switch to energy and fuel which produces lower GHG emissions when used on board. Options include:

- Harvesting of renewable energy on board (wind propulsion, solar, wave)
- Advanced Bioenergy[14]
- Battery energy storage
- Synthetic or e-fuels (sometimes also called power-to-liquid or power-to-gas), made from renewable electricity or fossil fuel sources in combination with CCS

These options are at varying levels of readiness and use. For example, solar has been in use for supplementing auxiliary power for some time. Wind assistance technologies have been in use for some time on several sea going ships, as has battery energy storage and biofuel. Some of these options have yet to be deployed for deep-sea shipping operations (for example bioenergy and synthetic/e-fuels) but are already deployed and in operation for short sea shipping. Their application for deep sea shipping use is the subject of intense Research, Design and Development (RD&D) efforts, and their potential availability is expected over the coming decade.

Figure 1 describes potential scenarios of how the energy demand in shipping could progress from 2010 (the baseline year[15] used to express the performance of the current fleet) to 2050. The predominate fuel mix in 2010 was Heavy Fuel Oil (HFO) and Marine Diesel Oil (MDO), both fossil fuels.

As well as cost-effective use of all available energy efficiency opportunities, the scenarios describe significant growth in biofuel and hydrogen energy use. In both scenarios significant rates of operational GHG emission

[12] EEOI is one of the possible metrics to be used for setting the CBI Criteria. The choice of metric will be discussed in Chapter 4.

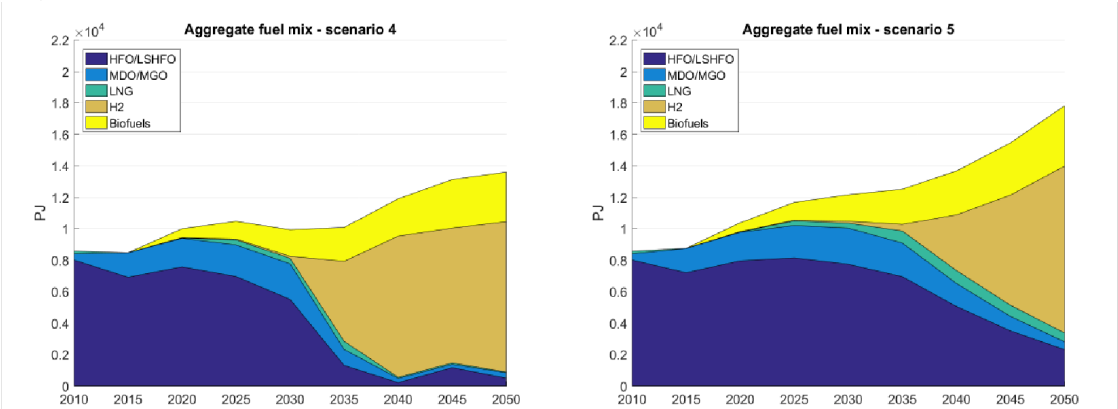
[13] IMO ISWG-GHG-1 INF.2 – A scientific study on possible reduction targets and their associated pathways.

[14] As defined in the EU Renewable Energy Directive Recast II

[15] A standard baseline year of 2010 is used because of historical data available from the Third IMO GHG Study.

reduction, such that scenario 4 (left) achieves nearly 100% emission reduction by 2050, and scenario 5 (right) achieves approximately 50% emission reduction by 2050 (both on 2010 baseline). Other scenarios and analyses see different fuel mixes and different fuels could compete to dominate the future shipping energy demand (e.g. ammonia, e-methanol), but the basic principle remains: that the fleet will need to rapidly move away from fossil fuel use to low and zero GHG emission alternatives.

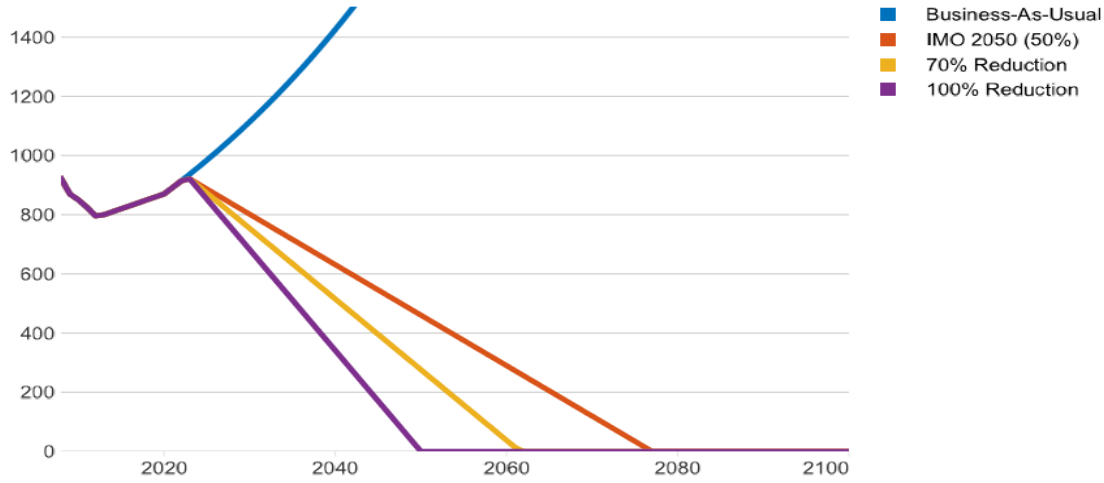
Figure 1: the penetration of different fuels in the aggregated energy demand for international shipping, over the period 2010-2050[16]



In order to drive these changes the IMO, April 2018, committed to reducing emissions generated by shipping activity, which represented a significant shift in climate ambition for a sector that currently accounts for 2-3% of global carbon dioxide emissions. This Initial Strategy by the IMO sets out three objectives.[17] The first objective is specifically related to the design efficiency improvements of newbuild ships. The latter two require emission reduction targets on an absolute and also on a relative basis.

The IMO's absolute reduction target requires GHG emissions from international shipping fleets in aggregate to peak as soon as possible and to reduce by at least 50% by 2050 compared to 2008 whilst pursuing efforts towards phasing them out.[18] This implies that the shape of Figure 2 shows the lower bound (50% reduction), middle reduction scenario (70% reduction) and upper bound (100% reduction).

Figure 2: The Global Shipping fleet's absolute CO2 targets and trajectories



[16] IMO ISWG-GHG-1 INF.2 – A scientific study on possible reduction targets and their associated pathways. http://www.imo.org/en/OurWork/Environment/PollutionPrevention/AirPollution/Documents/ISWG-GHG%201-2.pdf

[17] In April 2018, MEPC 72 adopted resolution MEPC.304(72) on the Initial IMO Strategy on reduction of GHG emissions from ships (the Initial Strategy). This important agreement represents the framework for further action of the Committee, setting out the future vision for international shipping. The Initial Strategy envisages for the first time a reduction in total GHG emissions from international shipping which, it says, should peak as soon as possible and to reduce the total annual GHG emissions by at least 50% by 2050 compared to 2008, while, at the same time, pursuing efforts towards phasing them out entirely. IMO Member States agreed to keep this Strategy under review, including adoption of a Revised Strategy in 2023.

[18] IMO (2018). Resolution MEPC.304 (72) (adopted on 13 April 2018), Initial IMO strategy on reduction of GHG emissions from ships, IMO doc MEPC 72/17/Add. 1, Annex 11.

The IMO's third, relative emissions target, or carbon intensity[19] aims to reduce carbon intensity by at least 40% by 2030 based on 2008 levels but should pursue efforts towards 70% by 2050.[20]

However, the at least 40% and at least 70% intensity targets were set prior to the determination of the at least 50% absolute reduction goal. Depending on future demand for shipping services, the IMO's absolute and relative targets (See: Figure 1 and Figure 2) may or may not align. However, alignment is unlikely. The wording of the Initial Strategy does not state that meeting a 40% reduction in intensity by 2030 and 70% by 2050 ensures compliance with the absolute reduction goal. To address this, it is expected that the IMO will update intensity targets to better align with absolute targets at the forthcoming review process for the IMO's Initial GHG Strategy.

Reduction targets in the Strategy use 2008 as the baseline year because this is the agreed baseline from the IMO. Nations pledged in the 2015 Paris Agreement "to achieve a balance between anthropogenic emissions by sources and removals by sinks of greenhouse gases in the second half of this century". This means getting to "net zero emissions" between 2050 and 2100. 2050 therefore represents a key milestone in the Paris Agreement, which the IMO explicitly references in its Strategy.[21]

The Strategy does not alone secure 1.5°C nor clearly show that efforts have been pursued to achieve this. The Strategy increases the possibility of being able to keep global average temperature increases within this limit. Immediate measures to implement the Strategy will be required to urgently peak and reduce GHG emissions in line with 1.5°C.

Critical to the viability of 1.5°C is whether the Strategy is converted into significant GHG reductions before 2023, and this is dependent on the outcome of future IMO meetings and their ability to agree and then rapidly deploy policy measures.

Figure 3: International Shipping's Share of IEA "Below 2 Degrees" Net Emissions, calculations by UMAS

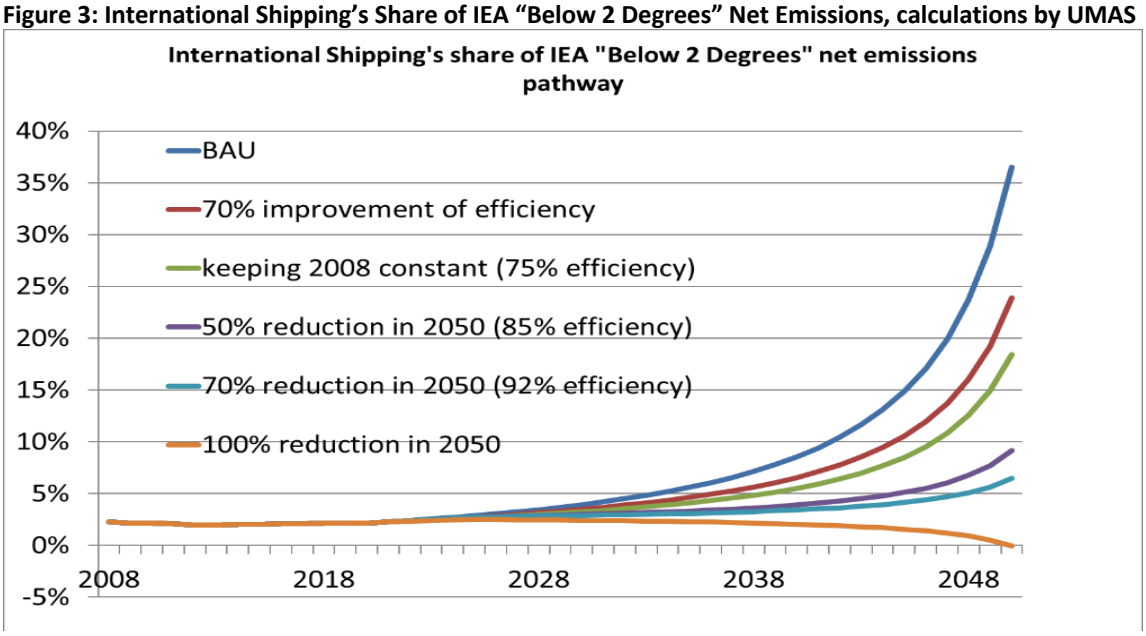


Figure 3 shows International Shipping's share of net emissions in the IEA's "Below 2 Degrees"[22] scenario in different reduction scenarios compared to the Business-As-Usual (BAU) pathway. The IMO Strategy's 50% absolute emissions reduction (the lower bound on reduction ambition) represents a ~10% share of net emissions by 2050 in this scenario, well above international Shipping's historical share of emissions (2-3%).

[19] Carbon intensity is defined as the amount of CO2 emitted to provide 1 unit of transport work (typically measured in tonne-nautical miles).
[20] [Placeholder for IMO Strategy Ref]
[21] IMO, MEPC.304(72), 2018.
[22] The IEA's "Below 2 Degrees" represents a 1.75° pathway.

Moreover, substantial CO2 cuts are needed before 2030 across the transport sector, including shipping, to get the world on track to achieve the IPCC's 1.5°C goal. Short-term measures for shipping must therefore be implemented before 2023. This will require operational energy efficiency measures, such as speed reduction and the implementation of operational efficiency standards. In order to be aligned with 1.5°C, the sector would require 100% GHG reduction by 2050.

2.2.1 General introduction to major policy developments at IMO and the European Union

CBI recognizes that both the EU and the IMO have made significant strides towards developing and standardising the metrics and data necessary to transition the shipping sector towards a low-carbon trajectory. These metrics are briefly outlined in this section but will be discussed in further detail in section 4.2

The Energy Efficiency Design Index (EEDI) was made mandatory for new ships and the Ship Energy Efficiency Management Plan (SEEMP) for all ships at the IMO's Marine Environment Protection Committee (MEPC) 62, on July 2011, with the adoption of amendments to the International Convention for the Prevention of Pollution from Ships (MARPOL) Annex VI (resolution MEPC.203(62)), by Parties to MARPOL Annex VI.

This was the first legally binding climate change treaty to be adopted since the Kyoto Protocol. Since this breakthrough MEPC 63 (March 2012) adopted four important guidelines (resolutions MEPC.212(63), MEPC.213(63), MEPC.214(63) and MEPC.215(63)) aimed at assisting the implementation of the mandatory regulations on Energy Efficiency for Ships in MARPOL Annex VI.[23]

The EEDI for new ships is the most important technical measure and it aims at promoting the use of more energy efficient (less polluting) equipment and engines. The EEDI requires a minimum energy efficiency level per capacity mile (e.g. tonne mile) for different ship type and size segments. From 1 January 2015, following an initial two-year phase zero when new ship design will need to meet the reference level for their ship type, the level is to be tightened incrementally every five years, and so the EEDI is expected to stimulate continued innovation and technical development of all the components influencing the fuel efficiency of a ship from its design phase.

The SEEMP is an operational measure that establishes a mechanism to improve the energy efficiency of a ship in a cost-effective manner. The SEEMP also provides an approach for shipping companies to manage ship and fleet efficiency performance over time using, for example, the Energy Efficiency Operational Indicator (EEOI) as a monitoring tool.

The Data Collection System (DCS) defines the data that the IMO has mandated that all shipowners will be required to report. The DCS is a new policy that entered into force in March 2018. The current specification of the DCS requires shipowners to collect and report to IMO, per calendar year, the following data for any vessels in their fleet which are 5,000 gross tonnage and above:

1. The amount of fuel consumption for each type of fuel
2. Distance travelled
3. Design deadweight used as cargo proxy
4. Hours underway

The first data collection period is for the calendar year 2019. Prior to reporting to the IMO, the data must be verified by a Recognised Organisation (RO). Once data have been verified, a Statement of Compliance (SoC) is generated (by May 2020 for calendar year 2019 data). Verified data need to be transferred to the IMO's database by June 2020. The data reported to the IMO are confidential and it is uncertain how the data will be used, but it could be provided upon consent of the shipowner to a third party such as a lender.

In April 2015, the European Parliament and the European Council adopted the Regulation (EU) 2015/757 on the monitoring, reporting and verification of CO2 emissions from maritime transport ("the EU MRV Regulation"). This EU regulation is an important milestone to collect robust and verified CO2 emission data from ships operating in the European Economic Area (EEA). The Regulation applies to ships above 5,000 gross tonnage in respect of CO2 emissions released during their voyages from their last port of call to a port of call under the jurisdiction of an

[23] https://www.marpol-annex-vi.com/eedi-seemp/

EU Member State and from a port of call under the jurisdiction of a EU Member State to their next port of call, as well as within ports of call under the jurisdiction of an EU Member State.
The data collected includes the CO2 emissions per distance travelled and cargo carried on voyages (or CO2 emissions divided by transport work, which is measured by deadweight tonnage and distance travelled). A document of compliance is issued to a company by a verifier, which confirms that that the ship has complied with the requirements of this Regulation for a specific reporting period.

Both the EU's monitoring, reporting and verification (MRV) regulation and the IMO data collection system (DCS) are based on collecting and analysing fuel consumption data; however, there are important differences in the types of information that is needed, the submission deadlines and the responsible authorities. The key difference is that transport work data is collected under the EU MRV scheme, whereas IMO DCS collects deadweight tonnage (DWT) and total distance travelled, the product of which is a proxy for transport work.

2.3 Impact of Climate Change on Shipping and Adaptation Strategies

The effects of climate change on the shipping industry will be felt at sea and onshore. Changes in sea-level, temperature, humidity, salinity, precipitation, extreme weather, floods, increased fog and other climatic events are likely to affect ports and shipping routes as well as connecting transport infrastructure and the global network of supply-chains. The potential for damages, delays and disruptions across closely linked global supply chains means that addressing the impact of climate change on key transport infrastructure is of strategic economic importance.

Ports are particularly susceptible to climate change risks. There are over 3,700 maritime ports around the world enabling global and local commerce, 60% of the goods loaded and 63% of the goods unloaded at these ports are in developing countries.[24] As sea levels rise, there are obvious risks for coastal areas and coastal infrastructure. Potential investments in these areas are also a focal point for our Adaptation and Resilience Expert Group (AREG). The supporting infrastructure for decarbonising the shipping sector may require additional guidance on adaptation and resilience.

It is uncertain how climate change will impact the environmental conditions encountered by ocean-going vessels. Changes in wave heights and wind speeds and ocean current patterns may impact regulations on ship designs and other structure designs. Structural failure may result in loss of human life, environmental damages and economic disruptions. In addition to changing wave and wind patterns, climate change will contribute to changes in the pH level of oceans and their marine ecosystems which in turn could contribute to changes in hull condition rates of deterioration and potentially also marine growth on ships.[25]

2.4 Investment need/how is shipping currently financed?

Shipping is amongst the most capital-intensive industries. It utilises assets with high commercial value, and debt typically accounts for a large share in the capital structure of a shipping business. Between 2005 and 2017, over $1.5 trillion was invested in newbuild vessels, with contracting reaching $263 billion during the cycle peak of 2007.[26] Meeting this debt requires access to substantial amounts of capital to replace ageing vessels with new, more efficient and environmentally friendly ones. Bank debt remains the shipping industry's primary source of funding, but ship owners are also looking towards other financing sources, including bonds, convertible debt, capital and operating leases and preferred equity structures.[27]

Financial institutions, equity investors and shipowners face the risk of their assets becoming devalued due to either a carbon price and/or a switch to more expensive but lower GHG emitting fuels. Additional capital is

[24] https://unctad.org/en/pages/newsdetails.aspx?OriginalVersionID=1949&Sitemap_x0020_Taxonomy=UNCTAD%20Home;#1721;#Transport;#2197;#Transport,%20Climate%20Change%20Impacts%20and%20Adaptation;#1788;#Transport%20Policy%20and%20Legislation;#2170;#Transport,%20Climate%20Change%20and%20Maritime%20Transport

[25] Bitner-Gregersen, E. (2013). Ship and offshore structure design in climate change perspective (SpringerBriefs in climate studies). Berlin; New York: Springer.

[26] Alexandridis, Kavussanos, Kim, Tsouknidis, & Visvikis. (2018). A survey of shipping finance research: Setting the future research agenda. Transportation Research Part E, 115, 164-212.

[27] http://www.nortonrosefulbright.com/knowledge/publications/158513/trends-in-ship-finance

needed to finance clean tech in the industry, which could be filled by climate bonds which target specific technologies. Figure 4 characterises shipping stakeholders according to their market exposure. Stakeholders include financial institutions, private equity investors, shipowners, operators and charterers. Bank lending (ship mortgage and corporate debt) is the largest source of financing in shipping. The top 40 banks lent around $400bn in 2017. Traditional banks are increasingly providing advice for clients on capital market products and placements with less emphasis on direct bank debt lending, following the financial crisis in 2008. Debt capital markets represent a much smaller portion ($7bn), but the bond market has been growing as shipping companies look for other sources of capital to fund shipping assets.

Figure 4. Stakeholder Exposure Model

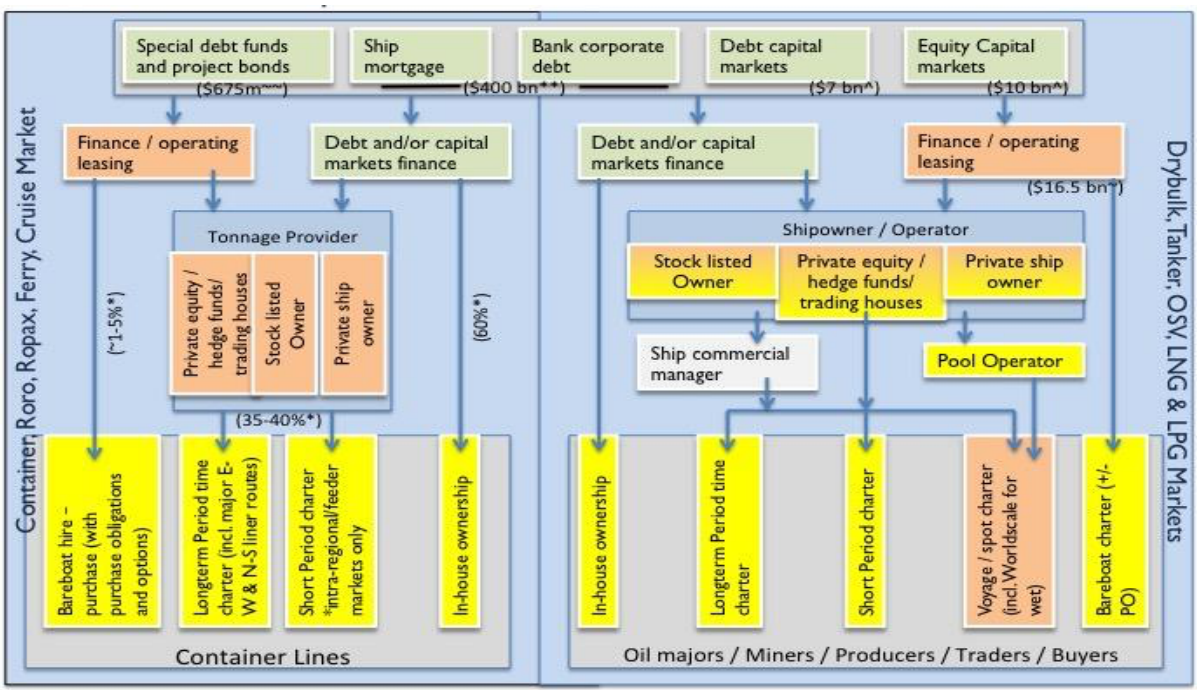


Figure 5: Supplemental description of shipping stakeholders and their respective exposure to bunkering cost and asset value risks for Figure 4 above.

Direct exposure to vessel bunkering costs and highest environmental standards accountability

Direct and indirect exposure to fuel efficiency and cost depending on vessel fixture type and direct exposure to environmental standards accountability

Indirect exposure through charter rates and asset values, with direct exposure to environmental standards accountability

Secondary exposure through asset valuation, debtor cashflow risk and environmental standards accountability

Environmental standards accountability only

*Based on Maersk estimates as an indicative proxy for the industry
** HSBC estimate, February 2017
^ Debt and equity capital markets money, raised 2014, source: Dealogic
~ Based on Chinese leasing companies ONLY, for international maritime assets, source: Comments from Mao Wanyuan, Director Chinese banking regulatory commission, March 17
~~ Norwegian 'Project Finance' market – capital raised in 2016

It is important to characterise different investment needs or risks for stakeholders. Finance and risk can be categorised using the characterisation from Figure 5, under the following headings:

Financial institutions: focused on asset valuation risk and/or cashflow depending on the finance product, asset class, owner credit etc.

Asset heavy (Shipowners and shipping investors): have at least four considerations in their business model – i) Cyclical risk, ii) charter parties and periods, iii) financial leverage, iv) residual values. All ship investors will be somewhere on a scale between having strong asset value focus (asset players) and, at the other end, firmly focused on maximising operational profitability where the asset is seen only as a capital cost (with some residual value risk). Generally speaking, the shorter the investment horizon, the more focused on asset value an investor will be, where someone focused on operating returns will have a longer investment horizon or a blended approach; timing investments with cycles and covering cargo commitments. Short term investors (3-5 yrs) will generally want a positive cashflow and wish to reduce operational risk, so are more likely to fix period deals which provide greater visibility.

Asset light (operators and charterers): will be somewhere on a scale between being focused on generating return through beating 'the market' (for example a trader with a long view might think of taking ships in on long period to cover his cargo position, and mark to market his/her position, benchmarking against the spot market or vice versa) and at the other end of the scale, return through providing a value added service such as the portion of a carrier's fleet that is chartered-in (hired), where ships are chartered to maintain a liner route.

Shipping transportation services are typically either provided directly by the shipowner (known as voyage or spot charter) or on a time-charter. In a time-charter, the cargo owner leases the ship for a period of time – either for a single voyage or a longer period of time. Under this contractual arrangement, the cargo owner pays for the fuel costs while the shipowner retains ownership responsibility (e.g., maintenance, investment in new technologies). Shipowners which operate predominantly in the spot market[28] (e.g., tankers) face direct exposure to the voyage fuel cost and fuel efficiency improvement, while shipowners that operate in markets which are predominantly time-charter (e.g., bulk shipping) are less incentivised to invest in fuel efficiency improvements because they are not always rewarded through a higher time charter rate.

2.5 Bonds in the Sector

Green bonds have begun to debut in the shipping sector. In 2018, green bonds were issued by Nippon Yusen Kaisha (NYK) and Mitsui OSK Lines (MOL). Proceeds from NYK's first green bond will be used to finance and refinance LNG-fuelled ships, LNG-bunkering ships, ballast water management systems and SOx scrubber systems. NYK also took a green loan to support investments in methanol-fuelled ships. The project is positioned as part of the research for future fuel conversion of ships.

As with NYK's first green bond, proceeds from MOL's bond will finance and refinance LNG-fuelled ships, LNG-bunkering ships, ballast water management systems and SOx scrubber systems. Under its Green Bond Framework, NYK and MOL have committed to ensure the financed vessels will not be used to transport products that relate to high fossil-fuel and resource intensive industries including, but not limited to, coal, tar sands and oil shale.

Climate Bonds commented on both issuances stating that switching to LNG-fuelled vessels is not enough to comply with a 2°C decarbonisation trajectory in the long-run. However, the projects financed by the deals are currently the lowest-emission asset option until other renewable fuels become commercially viable. It is nonetheless important to ensure the vessel design is flexible enough to avoid fossil fuel lock-ins in the future. There is a need for clear guidelines defining whether an asset is compatible with the reductions required to meet climate targets over the lifetime of the asset. This paper provides these climate compatibility guidelines.

[28] The spot market is where financial instruments, such as commodities, currencies and securities, are traded for immediate delivery. Delivery is the exchange of cash for the financial instrument.

3. Principles and Boundaries of the Criteria

3.1 Guiding Principles

The Climate Bonds Standard needs to ensure that the Shipping assets and projects included in Certified Climate Bonds deliver on GHG mitigation potential and climate resilience benefits and are in line with best available scientific knowledge and compatible with the goals of the Paris Agreement. At the same time, the Shipping Criteria need to be pragmatic and readily usable by stakeholders in the market, to maximise engagement and use. High transaction costs run the risk of reducing uptake of a Standard in the green bond market. Keeping the costs of assessment down while maintaining robust implementation of the criteria is important. Table 2 sets out the principles guiding the development of the Shipping Sector Criteria to meet and balance between these two goals.

Table 2: Key principles for the design of the Climate Bond Standard Shipping Criteria

Principle	Requirement for the Criteria
Level of ambition	Compatible with meeting the objective of keeping global warming well below 2° C above pre-industrial levels set by the Paris Agreement, and with a rapid transition to a low carbon and climate resilient economy.
Robust system	Scientifically robust to maintain the credibility of the Climate Bond Standard.
"Do not reinvent the wheel"	Harness existing robust, credible tools, methodologies, standards and data to assess the low carbon and climate resilient credentials of any technology, endorsed by multiple stakeholders where possible.
Level playing field	No discrimination against certain groups or geographies.
Multi-stakeholder support	Supported by key stakeholders; those within the relevant industry, the financial community and broader civil society.
Continuous improvement	Subject to an evolving development process with the aim of driving continuous improvement and credibility in the green bond market.

3.2 Scope of the Criteria

The Climate-aligned Shipping Criteria are designed to apply to wide range of ships, provided that issuers are able to provide either the EEOI or Annual Efficiency Ratio (AER) data of the vessels on which the proceeds of a bond will be used or, in the event this is not available (below), evidence that no fossil fuel has been used in the vessel's operation.

With that in mind, it is important to note that only certain types of ships are within the scope of the EEOI and AER data systems. The EU MRV regulation applies to ships above 5000 GT trading on voyages that include ports within the EU Member States (MS). It excludes warships, naval auxiliaries, fish-catching or processing ships, wooden ships of a primitive build, ships not propelled by mechanical means, or government ships use for non-commercial purposes. The IMO DCS applies to ships of 5000 GT or above performing international voyages. Ships smaller than these size limits including those engaged on domestic voyages are only eligible for certification if they do not use fossil fuel in their operation (e.g. they use batteries, hydrogen or other fuels), and so do not need to be monitored for their compliance with a decarbonisation trajectory.

Furthermore, as is consistent with the CBI Standard and Certification Scheme's other sector criteria, assets which are dedicated to supporting the fossil fuel sector are not within scope. This includes dedicated fossil fuel carriers and platforms associated with the extraction of fossil fuels, such as LNG carriers and Crude Carriers. Following the public consultation, this exclusion has also been extended to dry bulk carriers that are transporting fossil fuel. Globally, approximately 1.21 billion metric tons of coal is transported annually, this constitutes approximately 25% of global bulk cargo. We recognise that left unchecked, there is a significant risk that a Certified green bond would be used to finance a dry bulk carrier that is used to transport coal. Thus issuers who include dry bulk

vessels within their green bond frameworks are required to show that the vessel(s), are not primarily transporting fossil fuels during the life of the bond.

This means that for bonds where proceeds will be used for dry bulk carriers, issuers must show that (a) coal did not constitute more than 25% of dry bulk by tons carried by the firm over the previous 3 years, based on the bills of lading, and (b) the volume of coal transported by the vessel does not exceed the declining threshold for allowable coal carried. This threshold follows a geometric decay model starting at 25% in 2020, decreasing at 5.3% per year as consistent with the International Energy Agency's (IEA) Sustainable Development Scenario (SDS), and is based on the bills of lading.

These criteria use 25% of tons loaded as the starting point for the threshold in 2020 because it reflects coal's absolute proportion of tons of cargo moved, and so any firms that are ship proportionally more coal than the overall industry average are logically, harming climate change mitigation efforts. This upper limit is tightened at a pace concomitant with the IEA SDS, which requires that coal-fired generation without CCUS decrease 5.3% per year to 2030.

These criteria also recognize the importance of decarbonizing the luxury travel industry in particular, cruise liners. The TWG/IWG have not taken a view on whether cruise ships should categorically be excluded from the criteria, and the criteria will apply to these assets, but this may be change when the Shipping criteria are reviewed. Certifications awarded against such assets before a decision is made will not be revoked retroactively.

These criteria also recognize the importance of certain shipping sector-related assets which will not be covered by the EEOI or AER data regimes but can still provide a significant contribution to decarbonization of the shipping sector as a whole. In particular, refueling infrastructure that is dedicated to the delivery of electricity and eligible types of fuel are also within the scope of these criteria.

Recognizing that there are assets which can contribute significantly to enabling the decarbonization of the economy, specifically Wind Turbine Installation Vessels (WTIVs) and Jack-up Rigs which are dedicated to the installation and maintenance of offshore electricity production technology.[29] Given that these assets are critical to 'enabling' an activity (production of offshore wind energy) that fully provides a substantial contribution to fulfilling the Paris Agreement, it was determined that such assets should be considered as 'within scope' of the offshore renewable energy criteria. More information about this is available in the marine renewable energy criteria documentation on CBI's website.[30]

3.3 Examples of Use of Proceeds

Table 3 provides an overview of the key assets and technologies which could be considered for evaluation. This is not a prescriptive list - CBI's criteria are technology neutral. Rather, it is intended to provide the reader with examples of technological investments that can be made to bring a ship within the threshold that was developed over the course of the TWG and IWG discussions.

[29] In this particular case, "dedicated" means the asset is to be used only for the purposes of installation and operation of offshore wind energy facilities and nothing else. Assets used in sectors other than marine renewable energy or for purposes other than installation and operation are not eligible.

[30] For Certification of WTIVs or Jack-up Rigs dedicated to the installation and operation of offshore wind energy assets, during pre-Certification, verifiers should ascertain that the vessel will be used solely for the installation, operation, maintenance or decommissioning of renewable energy assets. Those assets that are used in other sectors (e.g. Oil and Gas industry) are not eligible. If this is not available before issuance, then verifiers must ensure on an annual, post-issuance reporting basis, that the asset(s) have only been leased or operated for offshore wind energy installation/operation. This can be done through verification of receipts or accounts payable, against the overall revenue earned attributed to the asset. For more information please see the documentation on the Marine Renewable Energy criteria: https://www.climatebonds.net/standard/marine

Table 3: Overview of key assets and technologies in the shipping sector

Assets	Description
Ships which include technologies that increase a ship's energy efficiency and/or reduce GHG emissions	To include ships featuring one or more of the following technologies: ● Main machinery improvements: e.g. engine derating, hybridisation, waste-heat recovery ● Hull improvements: e.g. air lubrications, coatings, bulbous bow ● Propulsion improvements: e.g. ducts, vane wheels, pods, advanced propellers ● Auxiliary machinery efficiency improvements: e.g. cargo handling equipment, lighting, pumps and fans ● Fuel or cargo storage improvements e.g. to reduce GHG emissions from fuel or cargo
Ships that use technologies that enable a switch from the use of fossil fuel, or the capturing of exhaust emissions	To include ships featuring one or more of the following technologies: ● Main aux. machinery and boilers for use with alternative (non-fossil) fuels e.g. machinery (internal combustion or fuel cell) for use with non-fossil fuel ● Fuel storage and handling e.g. non-fossil fuel storage and handling equipment ● Electrification for use in conjunction with a source of low carbon electricity e.g. propulsion electrification, auxiliary electrification, shore power adaptation, batteries ● Onboard renewable energy e.g. wind assistance technologies, solar power, shaft regeneration ● Ships which feature technologies to capture and store GHG exhaust emissions on board
Infrastructure that enables the supply of non-fossil fuel/energy to a ship, or the transfer and transport of captured emissions from a ship	To include infrastructure which enables one or more of: ● Supply of non-fossil fuel/energy in the port (e.g. local battery storage, grid connection, fuel production technologies, fuel storage facilities), in conjunction with a source of low carbon energy ● Supply of non-fossil fuel/energy from the shore to the ship (e.g. shore power connection infrastructure, bunkering infrastructure including bunker barges), in conjunction with a source of low carbon energy ● Infrastructure to transfer and transport captured emissions from the ship for onwards sequestration
Programmes that enable reductions in carbon-equivalent intensity for an existing ship or fleet of ships	To include: ● Retrofit programmes that reduce the carbon-equivalent intensity of an existing ship or fleet of existing ships, either through significant efficiency improvement or through enabling a switch from the use of fossil fuel ● Programmes to enable an operational or behaviour change that can increase energy efficiency e.g. fleet or port-based initiatives such as speed management, just in time arrival, energy use optimisation, reefer container upgrading

3.4 Emissions out of Scope

The shipping criteria have been developed with an intentional focus on the operational emissions of the shipping industry – those from the exhaust of ships in operation. That is not because non-operational emissions (for example upstream emissions from energy production, or embodied emissions associated with manufacture and disposal) are not considered important. However, for practical reasons it is not deemed feasible for an issuer to manage the upstream or embedded emissions of an asset at point of bond issuance.

As a result, the shipping criteria are based on inclusion in scope of assets that are either ships, or the infrastructure that directly supplies ships with energy/fuel. For reasons of pragmatism, the criteria do not cover:

- Upstream infrastructure associated with the energy used by ships in operation, for example those associated with the production, transport of energy/fuel outside the port.
- Infrastructure associated with the construction and disposal of ships[31]

[31] Values vary between ship types and sizes, but by way of example the embodied CO2 in a large tanker (VLCC) is approximately 90000 t. over its life. The emissions per annum from fuel combustion are approximately 20,000-60,000t depending on how the ship is operated. Smith, T.W.P,

These criteria cannot be used to certify assets associated with the upstream production of fossil-based energy/fuel or the manufacture of ships. Other types of port infrastructure (e.g. those not directly related to the direct supply of net-zero emissions energy/fuel to a ship), are also out of scope.

We also recognise that refrigeration gases on reefers pose a significant challenge to both our ozone layer and global warming, and there are opportunities for the shipping sector to reduce these impacts. However, these assets and emissions were not included within scope of the shipping criteria because their use crosses between different industries across the transportation and logistics sector.

4. Discussion and Eligibility Criteria for the Shipping Sector

4.1 Overarching considerations and requirements for the Shipping Sector

The requirements have been defined for both the shipping sector as a whole, and subsequently (Section 3) for specific shipping assets. We propose to use a top-down approach because the environmental regulation for reducing carbon emissions in shipping has been set at an aggregate level of carbon emissions and evaluation criteria should be consistent across ship types and sizes. Table 5 describes the guiding requirements for the shipping sector. These are divided into two areas, those associated with mitigating the GHG emissions in the sector and those associated with ensuring the sector is resilient and adapted to foreseeable climate changes. Table 6 provides the shipping sector Mitigation Recommendations. The guiding requirements for mitigation set out in Table 5 ensure that overall, the sector is compatible with the level of ambition set in the Climate Bond Standard Shipping Criteria – to keep global warming well below 2°C above pre-industrial levels, making efforts to limit temperature increase to 1.5°C, set by the Paris Agreement. To make this transition, the shipping sector needs to anticipate the challenges of decarbonising the shipping stock by anticipating future financial impacts of decisions made at the time of investment.

Table 5: Guiding requirements for the Shipping Sector

Area	Requirements
Mitigation	• The asset is compatible with transition to low carbon economy and keeping global warming well below 2°C. • The asset is resilient to transitional risks by anticipating future financial impacts
Adaptation	• The asset adapts to adverse climate impacts such as severe storms and sea level rise. • The asset promotes resilience to climate change.

4.1.1 Adaptation and resilience requirements for the Shipping Sector

The guiding requirements for adaptation will be discussed during the TWG/IWG meetings and aligned with other ongoing work at Climate Bonds Initiative, particularly that of the Adaptation and Resilience Expert Group (AREG). With regards to flood defence and surge barrier investments, issuers can refer to existing Water Infrastructure criteria.

4.2 Specification and justification of mitigation requirements for the Shipping Sector

Table 6 provides recommendations for meeting the shipping sector mitigation requirements. The following sections discuss and justify each recommendation.

Parker, S. Rehmatulla, N. On the speed of ships. www.lowcarbonshipping.co.uk, Harish, C. R., Soumya S.K. (2015) Energy Consumption and Conservation in Shipbuilding. International Journal of Innovative Research and Development 4 7/26-31:

Table 6: Guiding recommendations for criteria development

Recommendations
• The shipping sector is compatible if it meets the upper bound of the IMO's Objective 3 for GHG emissions to peak and reduce by 100% by 2050, and for emissions to continuously decline leading up to 2050. This is approaching the ambition of the Paris Agreement (see Section 2.3). • The global fleet's compatibility will be assessed using the global carbon-equivalent intensity required to meet the climate goals over a time horizon to 2050. • Dedicated infrastructure that enables the supply of non-fossil fuel/energy to a ship, or the transfer and transport of captured emissions from a ship are also eligible. • An asset must operate underneath the emissions intensity threshold for its respective class and size for each corresponding year that the bond is outstanding. • An asset should not cause significant harm to climate change mitigation through the activities that it enables.

4.2.1 Sector compatibility with a <2°C level of ambition

Section 2 discussed the inconsistencies between the IMO's second and third objectives – carbon-equivalent intensity and absolute GHG reduction targets. For the reasons stated, it is recommended that the Standard is aligned with the IMO's absolute emissions objective – reducing GHG emissions by "at least" 50% by 2050 compared to 2008 levels. The "at least" terminology leaves open the possibility that the IMO will pursue an upper bound of emissions reductions of 100% by 2050.

The Strategy's upper bound of 100% reduction and requirement for emissions to peak as soon as possible was therefore identified as the sufficient level of ambition for the purposes of the Shipping Criteria and consistent with the Standard's ambition to comply with the Paris Agreement. In addition, as climate change is a result of the cumulative emissions in the atmosphere, absolute emissions must peak as soon as possible and decline over the time horizon been the peak and 2050.

4.2.2 Metrics for assessing whether mitigation requirements are met

Both absolute and intensity-level measurements of GHG emissions are useful for evaluating a sector against a climate goal. Absolute emissions are important, as this is the total emissions figure that ultimately needs to be reduced to mitigate climate change. However, this does not provide sufficient information for a company to understand the carbon (or carbon equivalent) efficiency with which it conducts its business activities, because vessels have different production units and need to be compared on a like-for-like basis.[32] For this reason, a relative intensity-level metric is proposed and will need to be derived in such a way that it is consistent with the absolute emissions targets.[33]

In shipping, carbon intensity represents the total operational emissions generated to satisfy a supply of transport work (gCO2e/tonne-nm). The shipping sector uses multiple metrics to assess the carbon intensity of ships (see Table 6 of Appendix 3 for an overview of the different starting points for different size and class of ships). To provide the most accurate representation of a vessel's climate impact, the carbon intensity of a vessel should be measured from its performance in real operating conditions instead of using a design specification metric (e.g. EEDI). The EEDI is not a reliable estimate of the carbon intensity because it assumes that the ship sails at its design speed (full speed) and is fully loaded which in practice is not common. For newbuild ships, operational data will not be available at the time of bond issuance and therefore the carbon intensity will need to be estimated.

In IMO nomenclature, the carbon intensity is known as the Energy Efficiency Operational Index (EEOI) but the units are gCO2/tonne-nm rather than energy units[34]. An alternative intensity metric is the Annual Efficiency Ratio (AER). AER is reported in unit grams of CO2 per tonne-mile (gCO2/dwt-nm[35]). This metric is calculated using an

[32] CDP, 2018. CDP Technical Note: Measuring emissions intensity of transport movements.

[33] This is also consistent with CBI's approach to on-land freight transport criteria.

[34] Tonne-nm is a measure of useful work done and is calculated as deadweight carried X distance.

[35] Dwt-nm: a measure of a ship's weight carrying capacity (not including the empty weight of the ship) x distance

approximation of the total annual transport work performed by a ship, obtained from its distance travelled and deadweight (in tonne units). It is recognised that AER is less accurate at estimating a vessel's carbon intensity than some other metrics (e.g. EEOI), which use data on the actual mass of cargo carried and the loaded miles rather than total miles. Because there are other important emissions that contribute to climate change which are expected to increase from LNG-powered ships which emit methane, we propose using carbon-equivalent intensity (gCO2-e/tonne-nm[36]) as the metric for assessment of mitigation requirements.

To choose the appropriate metric, we evaluated each metric based on the following criteria:

- Enables comparison of ships with different transport work units
- Can measure GHG emissions of ships in real operating conditions
- Data is available at a global level for all ships
- Can be aligned with IMO's Initial Strategy absolute GHG emissions reduction objective

Table 7 shows that no single metric satisfies all of the criteria. The most useful metrics were EEOI and AER, but each has a trade-off between theoretical accuracy of the measure and data availability. EEOI is the most theoretically correct measure to use because it enables the carbon intensity to be measured on an apples-to-apples basis for ships with different transport work units. However, currently EEOI data is only available for voyages into and out of the EU. This means that ships which sail on voyages between China and the US, a major trade route, would not be captured.

Table 7. Comparison of different metrics for measuring emissions performance.

Metric	Enables comparison of ships with different operational production units	Can measure all GHG emissions of ships in real operating conditions	Data available at global level for all ships	Can be aligned with IMO's Initial Strategy absolute GHG emissions reduction objective
Absolute Emissions		✓	✓	✓
As-designed technical efficiency (EEDI)	✓		✓	
Technical efficiency at a point in time (EVDI)	✓		✓	
Annual Efficiency Ratio (AER)	Via proxy for transport work	✓	✓	Via proxy for actual carbon intensity
Energy efficiency operational index (EEOI)	✓	✓		✓

On the other hand, AER assumes that ships are 100% utilised (i.e., fully loaded on all miles travelled) which is often not the case (e.g., ships are not loaded to 100% of their DWT and ballasts are emptied after unloading, especially in the tanker and dry bulk carrier trades). However, there will be global data coverage of AER starting in 2020 as a result of the IMO DCS regulation. AER can be used assuming 100% cargo utilization, as long as the decarbonisation trajectory is also constructed with the same 100% cargo utilization assumption. Alternatively, AER (and the decarbonisation trajectory) can be calculated with an assumed default value for cargo utilization (e.g. 60%). Data for each ship size/type will be available in Fourth IMO GHG Study up to 2018. The assumed default value for cargo utilization for each ship size/type shall be revisited on a biennial basis, to shift with potential shifts in market dynamics.

[36] In the case of passenger ships (i.e., cruise and ferry), gCO2-e/GT is used. GT is the gross tonnage of the ship, a proxy for number of passengers.

We propose to take forwards both EEOI and AER with estimated utilization from published sources ("**adjusted AER**") metrics. If the vessel is expected to trade 100% of the time on voyages that are within the EU, the issuer must report EEOI data. Otherwise, the issuer needs to report IMO DCS data that enable the AER calculation, or can opt in to being measured on EEOI data, but in that event will need to enable an additional verification step (to validate the cargo mass data required for the EEOI calculation which is not covered in the IMO DCS system). Issuers shall have the right to provide verified data on actual cargo utilization for a specific ship, in an effort to incentivize transparency as well as properly incentivize businesses that have better asset utilization.

4.2.3 VERIFICATION OF DATA FROM IMO DCS AND EU MRV

The EU MRV Regulation requires mandatory third-party verification in order to ensure the accuracy of the data submitted. It uses a specific verification system based on internationally agreed ISO standards and EU specific verification rules. In the IMO DCS there is no specific verification system for this data collection. Instead, flag Administrations shall verify the data according to national rules, taking into account 30 IMO guidelines. Flag States can outsource those tasks to "Recognised Organizations" (RO), subject to verifications and audits under the RO Code. However, ROs do not need to be accredited by National Accreditation Bodies. Note that, in accordance with the EU legislation, EU MS have to use only EU recognised organisations in order to comply with their reporting obligations under IMO DCS.

In order to meet Climate Bonds Certification requirements, issuers are required to submit information reported on an annual basis of their achieved EEOI or AER, alongside evidence that the data was also submitted and verified for EU/IMO purposes.

4.2.4 Port infrastructure compatibility

As discussed in Section 3.2, fuel and energy (i.e., electricity) is required to reduce the carbon-equivalent intensity of the global fleet. This needs to be supported by the availability of bunker fuels and energy to power ships. For example, infrastructure that supports the supply of hydrogen, biofuel, ammonia and renewable electricity is considered compatible. This does not include infrastructure that is used to deliver LNG.

4.3 Criteria for assessing asset eligibility with respect to mitigation requirements

The shipping sector is amongst the sectors labelled "harder-to-abate."[37] In these sectors, the development of technologies required to achieve decarbonisation is in progress but are either not widely available, not used (because of market barriers and failures preventing take-up[38]), or still need to reach commercial viability. As ships and port infrastructure typically have asset lives measured in decades (e.g. many ships are designed for 25-30 years of operation), the technology onboard a ship today could create a "lock-in effect" if there are no cost-effective solutions to meet future targets (e.g., by investing in new technologies that convert the ship to use zero carbon fuels or ensuring availability of fuel at ports). The following sections discuss the recommendations for ensuring a ship can cost-effectively meet future targets.

Table 8 summarises the mitigation screening criteria. This requires that assets are designed and specified to be "best in class" today and also compatible with future regulatory and technological changes that may occur over an asset's lifetime as the sector transitions to a low carbon sector. Ships include both newbuilds and retrofits to existing ships.

[37] [ETC, Mission Possible Report]

[38] Rehmatulla, N. and Smith, T.W.P. (2015) Barriers to energy efficient and low carbon shipping. Ocean Engineering 110:102-112

Table 8: Criteria for establishing eligibility at the point of bond issuance

Asset Category	Criteria
Ships	Demonstrate that the expected carbon-equivalent intensity of ship is aligned with the decarbonisation trajectory of the ship's type/size category ("**the ship's class**") over the lifetime of the bond. Ships must either be specified to be zero-carbon from the year the bond is issued (i.e., a zero-carbon vessel)[39] or if there is insufficient market penetration (see below) of appropriate technology/fuel, have a managed reduction in carbon-equivalent intensity through the lifetime of the bond. In cases where the ship is not already zero carbon emissions, the issuer is required to provide a managed reduction plan to show that it is cost-effective to align the ship(s) expected carbon-equivalent intensity with the required intensity for its class(es) over the lifetime of the asset(s).
Infrastructure	Demonstrate that infrastructure supports the supply of non-fossil fuel/energy in the port (e.g. local battery storage, grid connection, fuel production technologies, fuel storage facilities), supply of non-fossil fuel/energy from the shore to the ship (e.g. shore power connection infrastructure, bunkering infrastructure including bunker barges) or infrastructure to transfer and transport captured emissions from the ship for onwards sequestration.
Programmes	programmes (e.g. retrofit technologies for an existing ship or fleet of ships or fleet/port-based initiatives such as speed management) reduce the carbon-equivalent intensity of an existing ship or fleet of existing ships as specified at issuance. A programme enables a ship(s) to be aligned with the decarbonisation trajectory for the ship or ships' class(es) throughout its lifetime according to the decarbonisation trajectories of those ships' classes. In cases where the ship is not already zero carbon emissions, the issuer is required to provide a managed reduction plan to show that it is cost-effective to align the ship(s) expected carbon-equivalent intensity with the required intensity for its class(es) over the lifetime of the asset(s).

4.3.1 Background on how assets can ensure compatibility with sector mitigation requirements, given current levels of availability of technologies and associated energy/fuel sources.

In many cases, the technologies and energy/fuel sources that are needed to enable operation right away at levels of carbon-equivalent intensity that align with expected future projected levels are not widely available. Of those that are available, many are then not cost-effective or commercially viable. To enable progressive reduction in carbon-equivalent intensity over the lifetime of an asset, which would allow the specification to remain continuously aligned with the requirements defined in Section 4.1, there are several options:

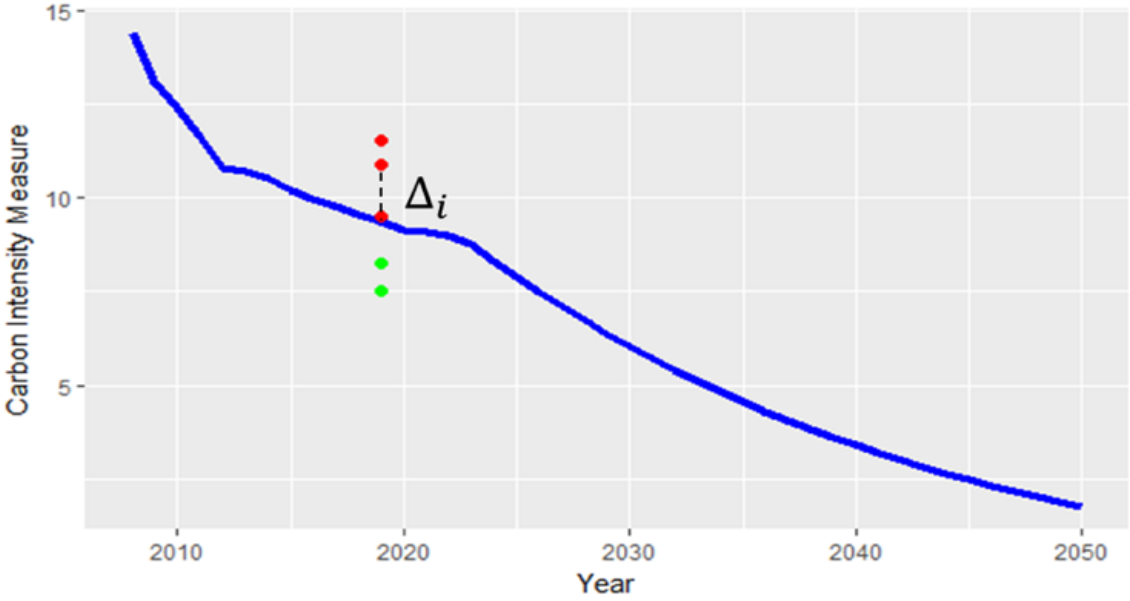
- Ensure that the ship as specified at issuance will operate immediately with some of the lowest levels of carbon-equivalent intensity within its current peer group.
- Fit technologies which produce GHG reductions now and will also enable GHG reductions in the future (e.g. many (but not all) energy efficiency technologies, wind assistance, solar, etc. if they are cost-effective now, will likely continue to be cost-effective after a switch away from fossil fuel use).
- Expect to change the operational regime to enable alignment with future lower carbon intensities (e.g. anticipate future reductions in speed that could be used whilst retaining competitiveness).
- Fit technologies and fuel/energy storage now which is flexible and able to be operated competitively in the future with non-fossil fuels.
- Fit technologies and fuel/energy storage (or put aside space for energy storage) now which for a small additional cost can be modified to be operated competitively in the future with non-fossil fuels.

[39] In the case of a newbuild, the year of bond issuance may not be the same year the ship is operating. In this case, the ship must meet the alignment criteria from the first year the ship is expected to be in operation.

4.3.2 Criteria for establishing eligibility at the point of bond issuance

Table 8 outlines a number of proposed screening criteria and screening metrics for each of the asset categories – ships, infrastructure and equipment/technology. This criteria for ships require that the expected carbon intensity of ships must be no greater than the decarbonisation trajectory for that ship type/size category over the lifetime of the ship. For example, eligible ships with sufficiently low carbon intensity could be represented by the green dots in Figure 6, it illustrates climate alignment for a set of Suezmax vessels using a hypothetical decarbonisation trajectory for the Suezmax fleet.

Figure 6: Example of climate alignment for a set ships



Data points which lie below (above) the decarbonisation trajectory (blue curve) are aligned or misaligned with the decarbonisation trajectory. The delta Δ_i in Figure 5 represents the alignment (the distance between its actual carbon intensity measure and the trajectory) for a vessel at a single point in time (shown here in 2019). Over time, vessels will need to reduce their intensity to stay on or below the curve. In this example, after 2025, if no further action is taken, then both of the aligned vessels (green dots) will become misaligned, and will need to reduce their intensity through speed, technology retrofits and/or change in the fuel type.

Standard decarbonization trajectories have been produced by CBI for each ship type and size category. Appendix 3 describes the method used for establishing the target carbon intensity for a given ship type and size category in a given year. This is carried out by calculating a decarbonization trajectory from 2012 out to 2050. The method is derived from IMO Secretariat commissioned data sources, both the Third IMO GHG Study and IMO MEPC 68 Inf. 24 publication. Assumptions for formulating the trajectory are also taken from the Initial Strategy, including the use of a 2008 baseline. The trajectories currently reflect carbon emissions. This serves as a proxy for GHG emissions, as carbon emissions accounted for 98% of the industry's GHG emissions but will be corrected when the 4th GHG Study is released. Full trajectories will also be provided in the next update to the paper.

For bonds where the proceeds will go towards financing new build ships, data will not be available to validate whether the ship has met the criteria at the point of issuance. Carbon-equivalent intensity is a function of the technical efficiency (e.g. the technologies onboard a ship), operational parameters (e.g. speed, cargo-carried and distance sailed) and the type of fuel used. Specifically, fuel consumption and type of fuel, cargo-carried and the distance sailed to fulfil transport work when loaded needs to be estimated over the lifetime of the ship. Operational parameters are influenced by market conditions and fluctuate year-on-year.

It was recognised that some ships which meet the Shipping Criteria during the life of the bond will exceed the emissions intensity threshold at some point during its operating life (even if this is after the bond has matured). To reduce the risk of CBI certifying a bond where proceeds will be used to finance a ship that would at some

point, fail to provide a significant contribution to meeting CBI's climate ambition, all ships that are not zero emissions must provide a Managed Reduction Plan (MRP) that states the compatibility and plans to add retrofit technologies or a fuel switch to comply. These plans must show how the asset will achieve compliance with carbon-equivalent intensity trajectories through future retrofit or switches in energy source, and that this can be achieved without significant additional costs (whether capital or operating costs) relative to foreseeable future assets, such that the asset should remain competitive.

By way of example, a fossil fuelled ship built in 2025, may plan to undertake a refit after 5 years of operation at which additional fuel tanks (for non-fossil fuel) are installed and an engine conversion undertaken. Efforts taken at design/build can ensure that space for the tanks and access to machinery can minimise the cost of that refit, such that the ship can be competitive against newbuild ships entering the fleet in 2030 and operating on non-fossil fuel.

Given the potential reliance on anticipated future changes (retrofit, energy switch) beyond the period of the bond, to achieve continued compliance with the decarbonisation trajectory, we thus require that the bond issuer present an MRP at the point of investment if the ship is not zero-carbon at the point of bond issuance. This MRP plan can rely on future technologies/fuels that are not available today but are expected to become available and cost-effective in the future, in time for the continued compliance with the decarbonisation trajectory. The list of candidate fuels for use in the reduction plan will be regularly reviewed, but initially includes:[40]

- Hydrogen
- Ammonia
- Advanced Bioenergy[41]
- Methanol (from bio or synthetic feedstock)
- Nuclear
- Wind
- Electric

At present, there is no evidence that synthetic LNG or synthetic diesel will be available at sufficient volumes and so they are not eligible for use in a reduction plan. The MRP should include the following details:

- The time period about which a significant fuel switch will be necessary
- Any modifications required to fuel storage systems onboard (including any additional space required and how this modifies cargo carrying capacity)
- Any modifications required to fuel handling systems (including bunkering systems)
- Any modifications required to machinery
- The estimated total additional cost

During the public consultation period, CBI received useful feedback from various industry stakeholders outlining the various challenges associated with the MRP requirement outlined in these criteria.

Further guidance to support issuers with submission of MRPs:

- The MRP is a novel requirement that currently does not exist in the market. The intention is to encourage issuers to think about future technology pathways and scenarios, and to help them use our Certification tool as a means of communicating this to market.
- We will not withhold Certification on the basis of quality of the MRP. While we encourage best-effort on the part of the issuer in preparing this documentation, we acknowledge that due to the lack of comparable documentation, we cannot currently reference 'best practice'.
- We will accept MRPs, provided that the documents submitted provide the details required above and clarifies the types of fuels/energy sources that the issuer intends to transition towards.
- However, we expect that over time, the ambition and quality of these MRPs will reveal itself. We are hopeful that the shipping industry will draw on existing documentation such as the Ship Energy Efficiency Management Plan (SEEMP), to guide their submissions.

[40] The selection of these fuels is based on research conducted by UMAS/UCL into potential future fuel-technology pathways:

[41] As listed in Part A, Annex IX of the EU Renewable Energy Directive (2018/2001/EU).

The public consultation also brought to our attention the need for more clarity on the role of LNG. The following points are intended to provide more background on CBI's stance on LNG.

- Currently, LNG is not eligible as a candidate fuel under the MRP.
  - While there is some credence to the role of natural gas as a 'transition' fuel, it is not however, given evidence around the extent of methane leakage and the severity of methane global warming potential, we do not currently view natural gas as Paris-aligned energy type.

- Advanced Bioenergy, such as BioLNG is eligible.
  - BioLNG and other biofuels produced from feedstocks listed in Part A, Annex IX of the EU Renewable Energy Directive (2018/2001/EU) are eligible as candidate fuels for the MRP.
  - Combustion of BioLNG presents an opportunity for the shipping sector to reduce its climate impact without making significant modifications to assets. However, we recognize that BioLNG can be produced from primary or secondary feedstocks. The former would create limited climate mitigation benefits due to the climate impacts of producing energy crops.
  - Therefore, in order to encourage transparency, we recommend that issuers who reference BioLNG in their MRPs provide certificates to prove the origin of the fuels.

4.3.3 Procedure for monitoring eligibility over the period of the bond

All certified bonds have to report annually to confirm that assets remain in compliance. The carbon-equivalent intensity of a ship will need to be monitored over time to ensure adherence to its projected values because it can vary as a function of operational choices (e.g. speed and utilisation) and also fuels used. The monitoring process requires that the issuer of a bond reports annually on the actual in-service carbon-equivalent intensity of operations. The metric and the report should be consistent with those used to meet the Shipping Criteria.

The report must be based on data that has been verified by an independent third party. It is proposed that the data used to generate the report should be either those values reported by the asset owner (in this case the ship), to report to the IMO's Data Collection System, or the EU's MRV system, for which minimum verification standards have already been defined. The use of such pre-existing systems also ensures that no additional data collection burden should be required.

5. Adaptation & Resilience Principles

CBI's Climate Adaptation & Resilience Principles are designed to provide a framework for Climate Resilience Criteria requiring Certified Climate Bond issuers to go beyond just assessing climate risks. Specifically, issuers must demonstrate that for the assets and activities (re)financed via the bond they:

- Understand the climate risks faced by the asset, activity or system in question;
- Have addressed those risks by undertaking risk-reduction measures and adopting flexible management plans that take account of inherent uncertainties around climate change, ensuring that the asset, activity or system is robust, flexible and fit-for-purpose in the face of that uncertainty;
- Can deliver resilience benefits over and above addressing identified risks (for system-focused investments); and
- Are undertaking regular (re)evaluation of the asset and/or system's climate resilience performance, adjusting to risk reduction measures over time as needed.

Despite our best efforts to develop criteria on adaptation and resilience for the shipping sector, there are currently no additional mandatory requirements for issuers to meet CBI's Climate Resilience Principles.

This is because vessels are implicitly fit for purpose in changing climates as existing standards and classification society requirements are already capable of ensuring that vessels are able resilient to extreme weather events.

Further-more, it was determined that existing shipping sector regulations, in particular The International Convention for the Prevention of Pollution from Ships (MARPOL) and The International Convention for the Safety of Life at Sea (SOLAS) were found to provide an adequate basis for protecting the marine environment as well as human lives at sea. As such, the shipping sector is currently derogated from the requirements of CBI's Climate Resilience Principles. This will be subject to periodic review.

The resilience of infrastructure that is dedicated to recharging or refuelling zero-emissions ships was found to be outside the specialisation of the Shipping Criteria TWG. Moreover, the Climate Resilience Principles that would be developed for infrastructure on ports would be better developed as separate criteria. As such, assets that are dedicated to recharging or refuelling infrastructure for zero-emissions ships are currently derogated from the requirements of CBI's Climate Resilience Principles. This will be subject to periodic review. Further information about our rationale and the outcomes of the discussions can be found in Appendix 4.

6. Summary of Criteria

Criteria:

- Ships must not be dedicated to transporting fossil fuels (Crude Oil or LNG Carriers)[42] and:
- Ships must either be specified to be zero-carbon from the year the bond is issued or,
- Ships must demonstrate that the expected carbon-equivalent intensity of the ship is aligned with the decarbonisation trajectory (emissions intensity threshold) for that ship's type/size category ("the ship's class") over the lifetime of the bond.[43], [44],
    - Ships that are not net-zero must provide a managed plan that shows how the ship can remain under the emissions intensity threshold during the operational life of the ship.

Metric:

Annual Efficiency Ratio (AER): The ratio of a ship's carbon emissions per actual capacity-distance (e.g., gCo2e/t-nm). The IMO's Data Collection System (DCS) enables AER to be calculated for all ships 5,000 GT and above trading on international voyages. Data will not be made publicly available, but available on the consent of the shipowner. Estimated data can be used but has lower accuracy.

Energy Efficiency Operational Index (EEOI): The total operational emissions to satisfy transport work demanded, this is usually quantified over a period of time which encompasses multiple voyages (e.g. a year). It measures the ratio of a ship's carbon emissions per unit of transport work (e.g., cargo x nm sailed). The EU MRV has made EEOI publicly available for voyages into and out of the EU.

Managed Reduction Plans:

In the case where the underlying asset is not already zero emissions, the bond issuer is required to provide a managed reduction plan that states the compatibility and plans to add retrofit technologies or a fuel switch that would enable the asset to comply and also explain how these plans are cost-effective.[45] This reduction plan can rely on future technologies/fuels that are not available today but are expected to become available and cost-effective in the future, in time for the continued compliance with the decarbonisation trajectory. The list of candidate fuels for use in the managed reduction plan will be regularly reviewed, but initially includes:[46]

- Hydrogen
- Ammonia
- Advanced Bioenergy
- Methanol (from bio or synthetic feedstock)
- Wind
- Electric

The managed plan should include the following details:

- The time period within which a significant fuel switch will be necessary
- Any modifications required to fuel storage systems onboard (including any additional space required and how this modifies cargo carrying capacity)
- Any modifications required to fuel handling systems (including bunkering systems)
- Any modifications required to machinery
- The estimated total additional cost

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[42] For bonds where proceeds will be used for dry bulk carriers, issuers must show that (a) coal did not constitute more than 25% of dry bulk by tons carried by the firm over the previous 3 years, based on the bills of lading, and (b) coal does not constitute more than 25% of dry bulk carried by the asset and the firm during the lifetime of the bond, reported annually and based on the bills lading.

[43] In the case of a newbuild, the year of bond issuance may not be the same year the ship is operating. In this case, the ship must meet the alignment criteria from the first year the ship is expected to be in operation.

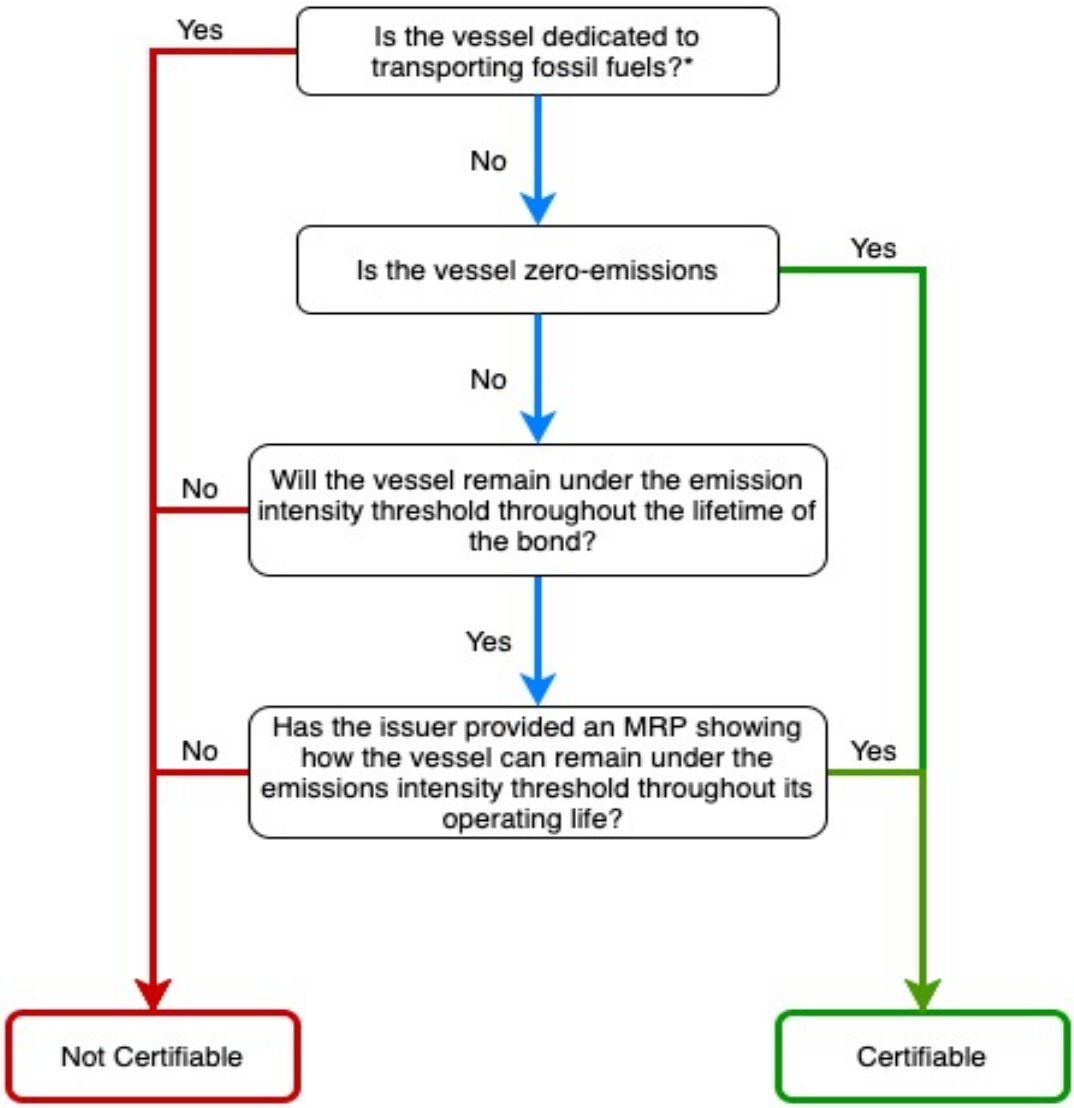
[44] Refer to Annex 1. to identify the respective, initial emissions intensity for a certain size and class of ship. The threshold declines to zero by 2050.

[45] Cost-effective, in this case, means that if the planned means to achieve compliance with carbon-equivalent intensity trajectories include some future retrofit or switch in energy source, this can be achieved without significant additional costs (whether capital or operating costs) relative to foreseeable future assets, such that the asset should remain competitive. For example, a fossil fuelled ship built in 2025 may plan to undertake a refit after 5 years of operation at which additional fuel tanks (for non-fossil fuel) are installed and an engine conversion undertaken. Efforts taken at design/build can ensure that space for the tanks and access to machinery can minimise the cost of that refit, such that the ship can be competitive against newbuild ships entering the fleet in 2030 and operating on non-fossil fuel.

[46] At present, there is no evidence that synthetic or bio LNG or synthetic or bio diesel will be available at sufficient volumes and so they are not eligible for use in a reduction plan.

In essence, issuers must demonstrate that the expected carbon-equivalent intensity of the ship is aligned with the decarbonisation trajectory (emissions intensity threshold) of the ship's type/size category ("the ship's class") over the lifetime of the bond, reaching zero emissions by 2050.[47],[48] Issuers are required to show that each asset targeted for the Use of Proceeds from a Certified bond, is operating below the emissions intensity threshold in each respective year that the bond is outstanding. Ships that are not zero-emissions must provide a managed reduction plan (MRP) that shows how the ship can remain under the emissions intensity threshold during the operational life of the ship. Figure 7 below provides an overview of the eligibility criteria for certifying a vessel under the Climate Bonds Standard and Certification scheme.

Figure 7. below provides an overview of the eligibility criteria for certifying a vessel under the Climate Bonds Standard and Certification scheme.



[47]* For bonds where proceeds will be used for dry bulk carriers, issuers must show that (a) coal did not constitute more than 25% of dry bulk by tons carried by the firm over the previous 3 years, based on the bills of lading, and (b) coal does not constitute more than 25% of dry bulk carried by the asset and the firm during the lifetime of the bond, reported annually and based on the bills lading.
In the case of a newbuild, the year of bond issuance may not be the same year the ship is operating. In this case, the ship must meet the alignment criteria from the first year the ship is expected to be in operation.

[48] Refer to Annex 1. to identify the respective, initial emissions intensity for a certain size and class of ship. The threshold declines to zero by 2050.

Appendix 1: TWG and IWG members

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Ted Shergalis, Magnuss
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Appendix 2: Carbon Intensity Metrics

Although technically carbon intensity and energy efficiency have different meanings, they are synonymous in the IMO's nomenclature. Table 10 provides descriptions of various efficiency related terms. As shown in Table 10 below, no single definition provides all the information that might be wanted to understand energy efficiency or carbon intensity. Definitions that might be useful for some stakeholders can obscure information that might be useful to others. For example, shipowners and charterers might be most interested in understanding the performance of a ship in a reference condition and therefore may find the different types of 'technical efficiency' most useful, whereas a regulator or a shipper who wants to understand the carbon intensity of shipping as a mode of transport might be more interested in 'total efficiency'.

Metric	Description	Pros/Cons	Data/practical considerations
Absolute emissions	The emissions generated to produce transportation service. Specified as tank-to-wheel (the operations of ship) or well-to-tank, from the well where fuel was produced to wheel.	Total emissions are important at sectoral level as it provides a baseline for mitigation required by sector. However, it does not measure the CO2 efficiency with which a company/ship conducts its business activities.	Data is available from the 3rd GHG Study for total shipping emissions and ship type/size. For individual ships, data from IMO DCS can be used but not publicly available (on consent of shipowner only), although estimated data could be used, but has lower accuracy.
As-designed technical efficiency (e.g., EEDI)	The efficiency of a ship in its as-designed condition (straight from the yard) in ideal conditions.	Not a reliable for estimating carbon intensity as assumes ship sails at design (full) speed, fully loaded and operates in calm sea conditions, all of which are unrealistic assumptions.	Can be measured from technical fleet database.
Technical efficiency at a point in time (e.g., EVDI)	The efficiency of a ship of a certain age, following wear, deterioration and fouling, benchmarked to ideal conditions.	Although metric takes into account the age, wear and tear as ships deteriorate through life, which all reduce efficiency (controlling for design speed and load), the metric does not represent the real-world operational conditions of the ship.	Data is available from technical fleet database, using assumptions on wear, deterioration and fouling.
Annual Efficiency Ratio (AER)	The ratio of a ship's carbon emissions per actual capacity-distance (e.g., dwt x nm sailed).	Assumes ships are fully loaded on all miles travelled during the year. In practice, ships are not always fully loaded and many ships (e.g., tankers and bulkers) operate with ballast voyages where for several voyages a year they have no cargo.	The IMO's Data Collection System (DCS) enables AER to be calculated for all ships 5000 GT and above trading on international voyages. Data will not be made publicly available, but available on the consent of the shipowner. Estimated data can be used but has lower accuracy.
Energy efficiency operational Index (EEOI)	The total operational emissions to satisfy transport work demanded, this is usually quantified over a period of time which encompasses multiple voyages (e.g. a year). The ratio of a ship's carbon emissions per unit of transport work (e.g., cargo x nm sailed).	Considered the ultimate measurement of a ship's estimated real world efficiency in that it incorporates all of the components listed above, emissions when the ship is in port/anchor etc. This is what the EEOI metric is attempting to measure.	The EU MRV has made EEOI publicly available for voyages into and out of the EU. Estimated data could be used but has lower accuracy.

Table 10. Definitions of carbon intensity in Shipping

Efficiency metrics (gCO2/tonne-nm) allow for an apple-to-apple comparison between two vessels whose cargo movements produce different levels of transport work. They also enable the tracking of progress over time and comparison across different shipping fleets, companies, and different modes of transport.

The carbon intensity of a ship in real operating conditions is known as the Energy Efficiency Operational Index (EEOI). It is the metric adopted by the IMO and represents the CO2 emitted per tonne nautical mile for a voyage or specific time period. It can either be calculated from fuel consumption measurements and information on cargo carried and distance travelled or estimated using satellite tracking data and fleet technical specifications. EEOI therefore accounts for the real operating conditions of the vessel and their impact on fuel consumption (e.g., speed, weather, draught). and is therefore a more accurate representation of the CO2 efficiency than if the efficiency were estimated in the vessel's designed (or optimal operating) condition as is done by the Energy Efficiency Design Indicator (EEDI) or EVDI. The as-designed efficiency assumes that a ship operates in its designed speed (often above the actual ship speed) in ideal weather conditions and is fully loaded.

The EEOI is influenced by speed, utilisation and a ship's technical efficiency. Increasing the energy efficiency of a ship lowers the EEOI, controlling for all other factors. In practice however, there could be rebound effects as a result of the lower marginal operating cost from the technical efficiency improvement. If the ship is operating on zero emissions fuels, this rebound effect is no longer an issue.

The Annual Efficiency Ratio (AER) measures carbon emissions associated with transport work, but it uses a ship's size (deadweight) as a proxy for cargo carried. This doesn't provide an apples-to-apples comparison between two ships which carry different cargo amounts. Cargo influences the numerator (carbon emissions) because a ship which carries a larger cargo requires more energy for propulsion and the denominator (transport work is a function of cargo carried and distance). Because ships are not typically fully utilised, the AER would overestimate the efficiency of the ship. The IMO's Data Collection System, will require data to be collected (e.g., fuel consumption, distance sailed and DWT) for all ships 5000 DWT and will enable the calculation of AER.

The Clean Cargo Working Group, a global carrier-shipper initiative dedicated to environmental performance improvement in marine container transport through measurement, evaluation, and reporting, uses a modified version of the Annual Efficiency Ratio for carbon intensity reporting. It applies a utilisation factor of 70% to estimate EEOI.

The CDP 2018 transport services climate change questionnaire request companies to report primary intensity metrics. These metrics measure the efficiency of transportation based on the actual work being done. The work done is expressed as a common unit in tons of CO2e per unit of goods/passengers, per unit of distance. The framework presents a harmonized approach to calculating both absolute emissions and emission intensity across all transport modes in the 2018 CDP questionnaire. Wherever possible, the GLEC framework has aligned its approach to existing sector methodologies that have already been developed and are widely used within the logistics sector.[49] In shipping, GLEC has adopted two leading standards as base methodologies: the International Maritime Organization's (IMO) Ship Energy Efficiency Operational Indicator (EEOI) and Clean Cargo Working Group (CCWG) CO2 Methodology (IMO, 2009; CCWG, 2014). The Framework recommends upscaling emissions to include upstream emissions (well-to-wheel accounting) and upscaling CO2 emissions to CO2-equivalent emissions.

[49] [Placeholder for GLEC Framework ref]

Appendix 3: Decarbonisation Trajectories

Calculation of decarbonization trajectories per ship type and size category:
The following describes the method applied for establishing the target carbon intensity for a given ship type and size category in a given year. This is carried out by calculating a decarbonization-consistent carbon intensity trajectory from 2012 out to 2050. The method is derived from IMO Secretariat-commissioned data sources, both the Third IMO GHG Study and publication IMO MEPC 68 Inf. 24. Assumptions for formulating the trajectory are also taken from the Initial IMO GHG Strategy, including the use of a 2008 baseline.

Ship type and size definitions:
Carbon intensities vary as a function of ship type and size, as well as a ship's technical and operational specification. To enable the carbon intensity of ships to be compared to a peer group of ships of a similar type and size, a classification system is applied. The classification system is taken from the Third IMO GHG Study,[50] to enable consistency with the IMO's process. Full details of the definitions can be found in that document. In the event that the IMO updates the classification system used in future work, a decision on whether to update the classification system used in the Poseidon Principles will be taken.

Estimating the ship type and size-specific carbon intensity:
Publication IMO MEPC 68 INF. 24, commissioned by the IMO Secretariat, is an addendum to the Third IMO GHG Study and contains a dataset estimating the carbon intensities of individual ship types and sizes between 2010 and 2012. The dataset currently provides the most up-to-date source of IMO-recognized information for the calculation of decarbonization trajectories, but as more recent data becomes available (for example in the Fourth IMO GHG Study), the trajectories can be updated.

The most recent and the most accurate data in the publication is for the year 2012, and therefore this is used as the historical data edge for subsequent steps of the method.

Estimating the carbon intensity improvement required across all ship types:
The overall (all ship type and size categories included as international shipping) improvement required in carbon intensity is calculated from:

1. A projection of the foreseeable growth in tnm across all ship types between baseline (2012) and the target year (2050).
2. The target CO2 emissions in 2050

The projection of foreseeable growth is taken from the Third IMO GHG Study scenario RCP 2.6 SSP2. This scenario is selected because it is most aligned with decarbonization in the wider economy, and most closely represents the rate of GDP and trade growth that has been observed in recent years (between 2012 and 2018).

The estimate of the target CO2 emissions in 2050 is taken by applying the IMO's Initial Strategy Objective 3 maximum target (100% reduction), to the IMO Initial Strategy's baseline year (2008) total CO2 emissions (921Mt), taken from the Third IMO GHG Study. The estimate of 2012 emissions is taken from the Third IMO GHG Study.

Values for the total transport demand, total CO2 emissions, and aggregate carbon intensity in 2008, 2012, and 2050 are given in Table 15 below.

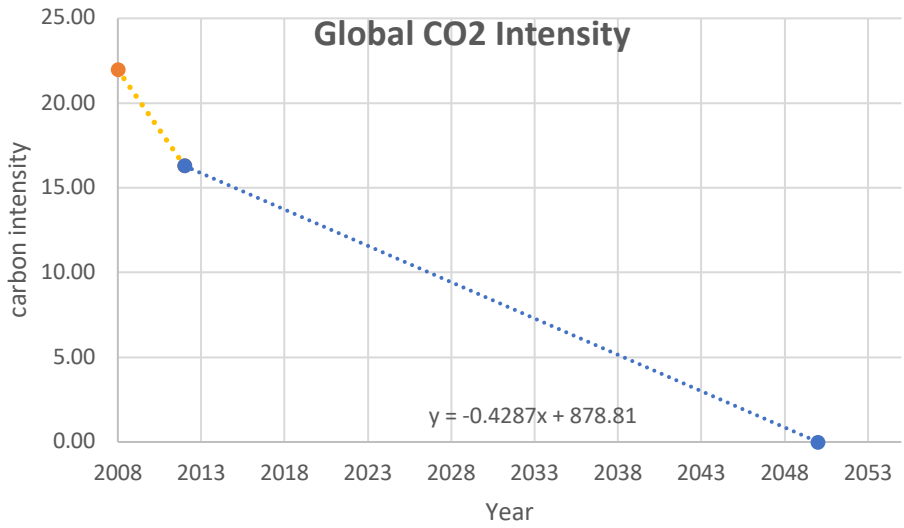
[50] Smith, TWP, Jalkanen, JP, Anderson, BA, Corbett, JJ, Faber, J, Hanayama, S, O'Keeffe, E, Parker, S, Johansson, L, Aldous, L, Raucci, C, Traut, M, Ettinger, S, Nelissen, D, Lee, DS, Ng, S, Agrawal, A, Winebrake, JJ, Hoen, M, Chesworth, S & Pandey, A. 2015, Third IMO Greenhouse Gas Study 2014. International Maritime Organization, London, UK.

Table 15: Transport demand, emissions, and carbon Intensity for international shipping

	2018	2012	2050
Total transport demand (million tonnes)	42,000	49,000	169,000
Total CO_2 emissions (million tonnes)	921	796	0
Estimated aggregate carbon intensity (gCO_2/tnm)	22.0	16.0	0

Figure 16 plots the intensity values in Table 5 and a linear trend line connecting them. There are many different assumptions that could be applied to specify the shape of the curve that defines the rate of carbon intensity reduction between 2012 and 2050. However, there is no strong justification for one or another. The chosen trajectory represents a gradual and consistent rate of improvement on average across the fleet; the assumption applied here is for a constant improvement year-on-year, which is described by a straight line between 2012 and 2050.

Figure 16. Global carbon intensity trajectory



The trajectory exceeds the IMO Initial Strategy Objective 2 intensity reduction values of 40% (2030) and 70% (2050), because it is derived to ensure achieving the IMO Initial Strategy Objective 3 (the absolute emissions objective). Meeting Objective 3 ensures that all IMO Initial Strategy Objectives are achieved.

Calculating the target carbon intensity, corrected to AER, in a given year as a function of the ship type and size

The rate of reduction required per year is relative to the last historical data point (2012). The trajectory is shown relative to 2012 carbon intensity (indexed to 2012 carbon intensity) in Figure 17. While the trajectory is presented for the time period 2012 to 2050, it is consistent with the 2008 baseline year as specified in the IMO Initial Strategy Objectives as the end point is determined by applying a 100% reduction relative to the baseline. The formula for the trajectory is given in Figure 17, and allows the index value to be calculated for a given year. The index value represents the required carbon intensity value relative to the carbon intensity in 2012.

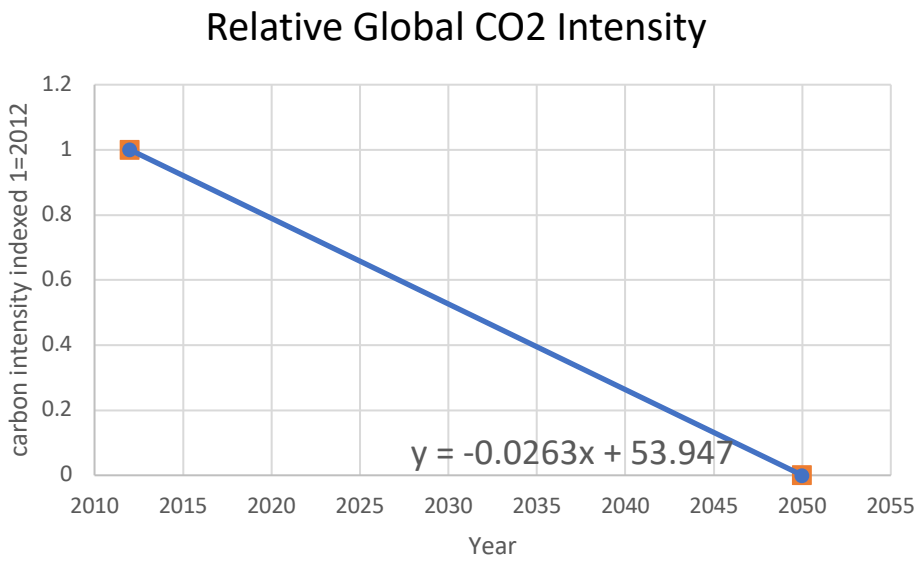


Figure 17. Indexed decarbonization trajectory, from 2012 to 2050

The index currently chosen for CBI is AER (the same metric used for the Poseidon Principles). This index is not explicitly calculated in the study presented in IMO MEPC 68 inf. 24, which is focused on the indicator EEOI. However, the study contains data on both the EEOI and the average utilization (both mass of cargo as a share of dwt and number of load voyages relative to overall voyages), broken down by ship type and size. The utilization data is therefore used to calculate AER from the median EEOI.

The AER trajectory value for a given year is calculated in the following manner:

1. Calculate carbon intensity index for the given year
2. Multiply the carbon intensity index by the adjusted median 2012 AER value

The fleet type and size category median values in 2012 are included in Table 6. The AER median values will be adjusted using the average utilisation for each ship type and size. Values for 2019 onwards will be provided in the next update.

Type	Size (GT)	2012 Median EEOI	2012 Median AER	2019 EEOI	2019 AER
Bulk carrier	0-9999	44.5	31.1	36.3	25.4
Bulk carrier	10000-34999	15.4	8.3	12.6	6.8
Bulk carrier	35000-59999	11.7	5.8	9.5	4.8
Bulk carrier	60000-99999	10.7	4.6	8.7	3.7
Bulk carrier	100000-199999	5.83	3.0	4.8	2.4
Bulk carrier	200000-+	5.13	2.9	4.2	2.3
Chemical tanker	0-4999	51	44.9	41.6	36.6
Chemical tanker	5000-9999	33.7	24.1	27.5	19.7
Chemical tanker	10000-19999	23.7	15.1	19.3	12.3
Chemical tanker	20000-+	15.6	8.2	12.7	6.7
Container	0-999	34.6	21.4	28.2	17.5
Container	1000-1999	31.6	18.8	25.8	15.3
Container	2000-2999	24.70	12.65	20.2	10.3
Container	3000-4999	21.30	10.52	17.4	8.6
Container	5000-7999	20.50	9.94	16.7	8.1
Container	8000-11999	17.90	8.47	14.6	6.9
Container	12000-14500	13.20	5.87	10.8	4.8
Container	14500-+	13.20	5.87	10.8	4.8
General cargo	0-4999	38.20	30.65	31.2	25.0
General cargo	5000-9999	34.50	21.15	28.1	17.3
General cargo	10000-+	30.70	16.65	25.0	13.6
Other liquid tanker	0-+	135.00	123.66	110.1	100.9
Ferry-pax only*	0-1999	1611372.0	1611372.0	1314540.3	1314540.3
Ferry-pax only*	2000-+	2204768.4	2204768.4	1798626.9	1798626.9
Cruise*	0-1999	2589577.6	2589577.6	2112550.2	2112550.2
Cruise*	2000-9999	1629745.6	1629745.6	1329529.3	1329529.3
Cruise*	10000-59999	1893748.6	1893748.6	1544900.2	1544900.2
Cruise*	60000-99999	2202243.9	2202243.9	1796567.4	1796567.4
Cruise*	100000-+	1693881.6	1693881.6	1381850.8	1381850.8
Ferry-RoPax*	0-1999	1041356.9	1041356.9	849528.0	849528.0
Ferry-RoPax*	2000-+	1440204.8	1440204.8	1174903.9	1174903.9
Refrigerated bulk	0-1999	92.20	61.68	75.2	50.3
Ro-Ro	0-4999	327.00	268.98	266.8	219.4
Ro-Ro	5000-+	80.90	58.10	66.0	47.4
Vehicle	0-3999	158.00	58.26	128.9	47.5
Vehicle	4000-+	73.60	17.42	60.0	14.2

Table 6. Fleet type and size specific AER in 2012 and trajectory values for 2019.
**For Ferry-pax only, Cruise, and Ferry RoPax, the denominator is GT*nm instead of tnm.*

*Table 7. Fleet type and size specific AER and EEOI values for each decade starting from 2020 to 2050. For Ferry-pax only, Cruise, and Ferry RoPax, the denominator is GT*nm instead of tnm.*

Type	Size (GT)	2020 EEOI/AER	2030 EEOI/AER	2040 EEOI/AER	2050
Bulk carrier	0-9999	35.1 / 24.6	23.4 / 16.4	11.7 / 8.2	0
Bulk carrier	10000-34999	12.2 / 6.6	8.1 / 4.4	4.1 / 2.2	0
Bulk carrier	35000-59999	9.2 / 4.6	6.2 / 3.1	3.1 / 1.5	0
Bulk carrier	60000-99999	8.4 / 3.6	5.6 / 2.4	2.8 / 1.2	0
Bulk carrier	100000-199999	4.6 / 2.4	3.1 / 1.6	1.5 / 0.8	0
Bulk carrier	200000-+	4.1 / 2.3	2.7 / 1.5	1.4 / 0.8	0
Chemical tanker	0-4999	40.3 / 35.4	26.8 / 23.6	13.4 / 11.8	0
Chemical tanker	5000-9999	26.6 / 19	17.7 / 12.7	8.9 / 6.3	0
Chemical tanker	10000-19999	18.7 / 11.9	12.5 / 7.9	6.2 / 4	0
Chemical tanker	20000-+	12.3 / 6.5	8.2 / 4.3	4.1 / 2.2	0
Container	0-999	27.3 / 16.9	18.2 / 11.3	9.1 / 5.6	0
Container	1000-1999	24.9 / 14.8	16.6 / 9.9	8.3 / 4.9	0
Container	2000-2999	19.5 / 10	13 / 6.7	6.5 / 3.3	0
Container	3000-4999	16.8 / 8.3	11.2 / 5.5	5.6 / 2.8	0
Container	5000-7999	16.2 / 7.8	10.8 / 5.2	5.4 / 2.6	0
Container	8000-11999	14.1 / 6.7	9.4 / 4.5	4.7 / 2.2	0
Container	12000-14500	10.4 / 4.6	6.9 / 3.1	3.5 / 1.5	0
Container	14500-+	10.4 / 4.6	6.9 / 3.1	3.5 / 1.5	0
General cargo	0-4999	30.2 / 24.2	20.1 / 16.1	10.1 / 8.1	0
General cargo	5000-9999	27.2 / 16.7	18.2 / 11.1	9.1 / 5.6	0
General cargo	10000-+	24.2 / 13.1	16.2 / 8.8	8.1 / 4.4	0
Other liquid tanker	0-+	106.6/ 97.6	71.1 / 65.1	35.5 / 32.5	0
Ferry-pax only*	0-1999	1272135.8	848090.5	424045.3	0
Ferry-pax only*	2000-+	1740606.6	1160404.4	580202.2	0
Cruise*	0-1999	2044403.4	1362935.6	681467.8	0
Cruise*	2000-9999	1286641.3	857760.8	428880.4	0
Cruise*	10000-59999	1495064.7	996709.8	498354.9	0
Cruise*	60000-99999	1738613.6	1159075.7	579537.9	0
Cruise*	100000-+	1337274.9	891516.6	445758.3	0
Ferry-RoPax*	0-1999	822123.9	548082.6	274041.3	0
Ferry-RoPax*	2000-+	1137003.8	758002.5	379001.3	0
Refrigerated bulk	0-1999	72.8 / 48.7	48.5 / 32.5	24.3 / 16.2	0
Ro-Ro	0-4999	258.2 / 212.4	172.1 / 141.6	86.1 / 70.8	0
Ro-Ro	5000-+	63.9 / 45.9	42.6 / 30.6	21.3 / 15.3	0
Vehicle	0-3999	124.7 / 46	83.2 / 30.7	41.6 / 15.3	0
Vehicle	4000-+	58.1 / 13.8	38.7 / 9.2	19.4 / 4.6	0

*For Ferry-pax only, Cruise, and Ferry RoPax, the denominator is GT*nm instead of tnm.

Continuously updating the trajectories as further data becomes available

Over the timescale that the decarbonization trajectories are estimated, a number of the parameters that are used in their calculation may change. These include:

- The IMO may modify the Objectives, including when the Revised Strategies are adopted, expected 2023 (e.g., if the Objectives increase in ambition, the carbon intensity trajectory will steepen).

- The Fourth IMO GHG Study (expected 2020/2021) and subsequent studies may update or modify the estimates of the historical carbon intensity and carbon intensity trends (e.g., if historical estimates are revised upwards, the carbon intensity objective will steepen).

- Transport demand growth may develop differently to the estimate used here to calculate the carbon intensity trend consistent with a 2050 absolute GHG objective (e.g., if demand growth exceeds the trend used in these calculations, the carbon intensity objective will steepen).

- Demand growth may develop differentially between ship types and increase the demand for ships with different carbon intensity than the 2012 fleet (e.g., if demand modifies the fleet composition to increase the share of emissions by ships which have higher carbon intensity, the carbon intensity objective will steepen).

- Utilization may differ from the values estimated for 2012, which will modify the relationship between AER and EEOI and mean that the climate alignment trajectory set using AER will need to be modified (e.g., if utilization reduces relative to 2012, the carbon intensity objective will steepen).

While the decarbonization trajectory and the ship type and size-specific trajectory values have been calculated using the best available data, there are a number of foreseeable reasons why these values may need to change in the future. For this reason, it is proposed that decarbonization trajectories are reviewed every five years, approximately consistent with the periodic release of new analysis (the IMO GHG Studies). Any update to the decarbonization trajectories should be applied for future climate alignment, not reanalysis of historical climate alignment.

Appendix 4: CBI Climate Resilience Principles

The Climate Resilience Principles provide the framework for sector-specific resilience criteria. Despite our best efforts, the Principles were found to be inapplicable to the shipping sector. The following section summarises the key concepts and questions that arose when applying the Climate Resilience Principles to these Shipping Criteria. The derogation of the Shipping Sector from the Climate Resilience Principles will be reviewed biennially.

The CBI AREG Principle 1 requires issuers to demonstrate that the defined systems, boundaries and critical interdependencies that a ship operates in are understood and clearly articulated in accordance with Principle 1. The class and size of the ships within scope of these Shipping Criteria include those which can sail globally. It was therefore deemed untenable to require issuers to define the operating boundaries of ships as these are expected to change drastically throughout the ship's operating life.

CBI AREG Principle 2 requires that an assessment of the physical climate hazards to which the ship will be exposed and vulnerable over its operating life is taken. Because ships can travel globally, their primary risks are extreme weather events. Unlike ports, ships are naturally capable of withstanding sea level rise, extreme weather events (due to storm monitoring and weather routing systems) and are not vulnerabilities to landside risks.

CBI AREG Principle 3 requires that ships must be 'fit for purpose' and resilient to the risks identified in Principle 2. The shipping sector is supported by a classification society that uses standards that reflect an operating environmental envelope, because ships are used for global deployment, they take into account the most extreme conditions. Assumptions on the environmental events are written into these standards and rules and derived from data sources taking into account meteorological and oceanographic data. This includes factors such as strength, loading conditions, and fatigue design. As such, these criteria do not require that issuers prove that a ship is 'fit for purpose'.

CBI AREG Principle 4 requires that an assessment of a ship's impact on system resilience is conducted, to determine whether a ship presents a risk to system resilience or provides a benefit to system resilience.

CBI AREG Principle 5 questions whether, in a case where ships are providing a substantial contribution to adaptation and resilience, the ship can be derogated from fulfilling the mitigation criteria. This implies that certification is awarded based on the adaptation/resilience benefit of the ship, and that the vessel meets a minimum mitigation threshold. Considering the limitations in pursuing CBI AREG Principle 4, it was deemed impractical at this stage to instigate such an option. Furthermore, we could not identify a reason that a vessel should be derogated from this requirement. Similarly, CBI AREG Principle 6, which requires ongoing monitoring and evaluation of the relevant risks and resilience measures and related project adjustments when needed, is not required in the Shipping Criteria at this stage.

Recommendations for future adaptation and resilience criteria development

This section serves as a record of the discussions that were had as we attempted to apply the CRPs to the CBI Shipping Criteria. It is hoped that they can be used as guidance to support future development of the CRP to these criteria. Issuers are not required to provide this information CBI Certification.

CBI AREG Principle 1: Defining the boundaries and critical interdependencies

Clear boundaries and critical interdependencies between the ship and the systems they operate within are identified. Bonds will typically be used to finance international shipping vessels that are global in scope and reach, however, it is expected that there may be some issuers seeking to use proceeds for short-haul ferries on dedicated routes or within a specific region. Issuers are welcome to explain the ecological and economic system within which a ship will operate, this can include a description of the geographical region of the ship's expected use, and if applicable, the specific conditions of that region.

CBI AREG Principle 2: Understanding the climate risks to the asset

Issuers are welcome to provide an assessment of the key physical climate hazards which the vessel will be exposed to over its operating life if deemed relevant. Key physical climate risks and indicators of these risks can include:

1. Rising temperatures leading to Melting Ice, Large Variations (Spatial and temporal), Frequent freeze and thaw cycles, may damage infrastructure, equipment or cargo.
2. Extreme Weather Conditions such as Hurricanes, Storms, Floods, Increased precipitation and Wind, may damage infrastructure, equipment or cargo, and lead to reduced safety and sailing conditions which compromise service reliability.

As this information is Optional guidance for forecasting climate related risk, Issuers can use a broad range of models to generate climate scenarios, that may be based on Representative Concentration Pathways (RCP), or a worst-case scenario basis. Risks can be characterized by the associated annual probability of failure or annual costs of loss or damage. The following linguistic guidance can be used to help issuers characterise the consequences that may fall upon the operations of a certified asset as a result of climate risk:

Consequence of risk factor

1	*Time delay/Disruption*	The severity of time delays varies significantly, depending on the types of cargo being transported. For example, a shipping delay of time- and temperature-sensitive products will have more severe consequences than that of normal goods. Here, disruption might be identified as a breakdown in a maritime supply chain, where the minimum requirements cannot be achieved.
2	*Damage to quality*	Damage to any component within a maritime supply chain, including transported goods, port infrastructure, crew, and vessels.
3	*Additional running cost/ Financial Loss*	Additional costs include costs associated with additional operations and management (such as additional inventory costs and production costs), and fees attributable to risk drivers.

The following linguistic guidance can be used to help issuers explain the severity of the disruption/effect of the risk factor:

Severity of effect

Delay/Disruption	*Low*	A delay of fewer than 24 hrs in total.
	Medium	A delay but no more than 20% of the original schedule.
	High	A delay of more than 20% of the original schedule.
Damage to quality	*Low*	Near miss or slight crew, cargo, equipment, or system damage but fully functional and serviceable.
	Medium	Minor incapability of crew, systems or equipment and a small portion of goods may be damaged.
	High	Damage/loss of major crew, systems or equipment, and serious damage to the transported goods.
Additional running cost/Financial Loss	*Low*	An additional cost no more than 10% of the total cost.
	Medium	An additional cost between 10% and 50% of the total cost.
	High	An additional cost of more than 50% of the total cost.

The following linguistic guidance could by issuers to explain the likelihood of the disruption/effect of the risk factor occurring and/or the likelihood that the risk factor will be detected.

Linguistic grades for likelihood

Likelihood of risk factor occurrence	*Low (Unlikely)*	Occurs less than one per year.
	Medium (Occasional)	Occurs more than once, but fewer than 10 times in a decade.
	High (Frequent)	Occurs annually.
Likelihood of risk factor detection	*Low (Unlikely)*	Not possible to receive an accurate forecast.
	Medium (Occasional)	Possible to receive an accurate forecast 6 hrs in advance.
	High (Frequent)	Possible to receive an accurate forecast 24 hrs in advance.

CBI AREG Principle 3: Identifying the adaptation measures for different climate risks

Having identified what the potential climate risks will be for the vessel over its operating life, issuers must then outline the measures that have been or will be adopted to manage these risks. The measures that have or will be taken to address those risks mitigate them to a level so that the ship(s) are 'fit for purpose' in the face of coming climate change over its operational life and do no harm to the resilience of the defined system they operate within, as indicated by the boundaries of and critical interdependencies with that system as identified in Criteria 1.

A 'fit-for-purpose' ship (from the climate-resilience perspective), might be considered one that operates without additional 'downtime' as a direct effect of climate events (extreme weather). This might be interpreted to imply that ships' maintenance schedules are not extended or increased as a result of climate impacts. Operators are encouraged to provide additional data on how they will ensure that their ships will be able to continue operating in the conditions that will result from climate change.

Having identified the risks that might cause an asset to be not fit-for-purpose, issuers are then welcome to provide information on the measures that can adopted to improve the ship's resilience to climate change.

Potential Adaptation Measures in response to Extreme Heat include:

1. Heat resistant construction and materials
2. Continuous inspection, repair and maintenance
3. Monitoring of infrastructure temperatures
4. Reduced cargo loads, speed and frequency of service
5. Refrigeration, cooling and ventilation systems
6. Insulation and refrigeration
7. Modal Shift
8. Transit management scheme and navigation of northern regions
9. Ships design, skilled labour and training requirements
10. Upgrading of infrastructure parameters in UNECE agreements on pan-European rail, road and inland waterway and combined transport networks

Potential Adaptation Measures in response to Extreme Weather Conditions include:

1. Integrate emergency evacuation procedures into operations
2. Barriers and protection structures
3. Monitoring of infrastructure conditions
4. Prepare for service delays of cancellations
5. Strengthen foundations, raising dock and wharf levels
6. Smart technologies for abnormal events detection
7. Improved ship design

CBI AREG Principles 4 & 5: Addressing resilience benefits

International shipping can impact the health of our ocean ecosystems and their ability to absorb and recuperate from climate and other environmental stress. In addition to climate change mitigation criteria, this section considers whether ships must meet a minimum threshold for reducing the risks posed to system resilience, and also explore instances where a ship provides a substantial contribution to system resilience that it may be derogated from the mitigation criteria.

From an environmental systems-resilience perspective, ships can pose a climate resilience risk if, for example, shipping activity is conducted near vulnerable ecosystems which provide ecosystem services, such as mangrove forests offering flood defence services. While CBI recognises the immense significance of marine life and ecosystems and supports future efforts to incorporate these factors into investment guidelines, it was determined that existing IMO regulations provide a sufficient standard for the environmental responsibility and stewardship within shipping sector. And it was therefore deemed unnecessary at this stage to require such reporting from issuers.

Examples of conventions that help to reduce the shipping sector's impact on the environment include: the International Convention for the Prevention of Pollution from Ships (MARPOL); the International Convention for the Safety of Life at Sea (SOLAS); the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other

Matter; the Protocol on Preparedness, Response and Co-operation to pollution Incidents by Hazardous and Noxious Substances (OPRC-HNS Protocol); the International Convention on the Control of Harmful Anti-fouling Systems on Ships (AFS), and the International Convention for the Control and Management of Ships' Ballast Water and Sediments.

On the other hand, the ships that are within scope of these criteria typically provide a transport service for goods and people. It follows that ships which can load and unload without port access or landside support can provide a resilience benefit as this would facilitate the flow of goods and people, even following climate change-related disasters or emergencies. Another example of ships that might provide a resilience benefit are ice breakers, which can enable access to hard-to-reach locations and provide access to communities or critical waterways. In both cases the ship provides a resilience service, the first example is a technical capability that allows it to be resilient, the other is a specific service offered by the ship.

While these anecdotal cases were useful for highlighting how ships can provide a resilience benefit, there was insufficient evidence to suggest that additional benefit of these examples was sufficient to award certification without meeting the mitigation criteria.

As such, there is no requirement to meet AREG Principles 4 & 5 at this stage in the Shipping Criteria. This derogation will be subject to periodical review.

Appendix 5: Summary of public consultation

Feedback Summary	Feedback Response
Exclusion of fossil fuel carriers Excluding fossil fuel carriers reduces the effectiveness of these criteria in helping fossil fuel carriers (which represent a significant portion of the global fleet) decarbonise. Furthermore, excluding LNG transport also limits the transitions across the energy systems because LNG can be used as a bridging fuel. Finally, dry bulk vessels can also be used to transport coal. So the draft criteria suggest that while there might not be green bonds for LNG ships, there might for coal transporting ships.	We recognize that LNG vessels and crude carriers represent a significant portion of the world's fleet, excluding them from Certification is a missed opportunity to transition this sector. However, the CBI Standard and Certification scheme is designed to provide a binary label on what assets are (or are not) aligned with the Paris Agreement. Such assets are simply not aligned with the Paris Agreement. CBI has a blanket ban on assets and activities that are dedicated to supporting the fossil fuel sector. Currently, dedicated fossil fuel carrying vessels are excluded because such assets do not provide a substantial contribution to the Paris Agreement. The criteria are reviewed biennially, this exclusion can be reviewed if there is evidence that such assets can also be used to support activities that are aligned with the Paris Agreement. We have also expanded the ban on dedicated fossil fuel carriers to include a criteria for screening out dry bulk vessels which would be used to transport coal.
Ambition of Trajectory The criteria are too ambitious, they are not aligned with the IMO, and there are no realistic opportunities for a ship to be net-zero emissions today.	The linear decline/slope is a function of both the climate science which defines what would be required for a proportionate response by shipping to the overall mitigation challenge across the whole economy and the potential pathway for GHG reduction in the shipping sector. Temperature rise is a function of cumulative emissions. The pathway of emissions reduction is therefore as important as the year in which zero emissions is reached. The commonly referenced target (for all sectors) of zero emissions before 2050 is only aligned to the Paris Agreement temperature goals if accompanied with a high rate of reduction to that target.
Choice of Metrics EEOI and AER metrics do not account for the full life cycle emissions of fuels. This does not treat all fuels equally.	Well-to-wake metrics have their benefits. However, such metrics are currently unavailable. The CBI criteria require measurement, not estimation of emissions. Such measurement is not currently available for the upstream emissions associated with the different energy systems that the transition will require. That said, the shipping criteria will be reviewed on a biennial basis and will be updated as more evidence becomes available.
Inclusion of logistics infrastructure Reefer units contribute to global warming through increased energy consumption and leakage of greenhouse	While recognizing that these assets offer a significant decarbonization opportunity they have not been included within the scope of the shipping criteria because they are an asset which transcends across multiple transport modalities.

gasses, these have not been included in the criteria.	Reefer units, as well as land-side port infrastructure and other logistics terminals will be reviewed as part of updates to our overall transport criteria.
Clarity on Threshold The exact requirement needs to be made clearer. What is the threshold for each class and size of ship?	Issuers are required to show that each asset targeted for the Use of Proceeds from a Certified bond, is operating below the emissions intensity threshold in each respective year that the bond is outstanding.
Managed Reduction Plans The requirements of the MRPs is unclear, due to the novelty of this document. How will issuers be judged on their MRPs?	The MRP seeks to encourage issuers to continue their decarbonisation efforts throughout the operating life of an asset, even after the Certified bond matures. We are concerned that issuers might Certify a bond which matures well before the end of the asset's operating life, and that the asset's emissions intensity will stop decreasing to zero by 2050. To that end, we have provided five questions which issuers must answer. These responses would constitute the issuer's 'MRP'. Submission of an MRP is mandatory but given the novelty of this document we are (at this stage) unable to point to 'best practice'. We expect that over time, as the volume of Certified bonds grows, we will be able to provide more guidance on what is required. This will be reviewed biennially. To clarify, we will not at this stage, withhold certification on the basis of an MRPs quality, provided that the relevant information is made available by the issuer.
Clarity on BioLNG BioLNG presents an opportunity for issuers to cut emissions without incurring major costs. What is the Shipping Criteria's position of BioLNG?	BioLNG provides a significant opportunity to reduce emissions from the shipping sector. However, there is a substantial challenge in ensuring that BioLNG is sourced from feedstocks and practices that contribute to climate mitigation. The production of energy crops (primary bioenergy) is well known to contribute to climate change through deforestation and land-use change. To ensure that the Shipping Criteria enable rapid decarbonization of the shipping sector without simply shifting emissions to other areas, we will only deem BioLNG which is produced from Advanced Bioenergy sources as eligible. We derive the definition of Advanced Bioenergy from the EU Renewable Energy Directive II (2018/2001/EU). Issuers who reference the use of Advanced Bioenergy in their MRPs are encouraged to submit certificates of origin where available, to prove that BioLNG used in their operations reflects the ambition of these criteria.