Sustainable Edge Sector Brief: Shipping

Year 2020

Sector definition

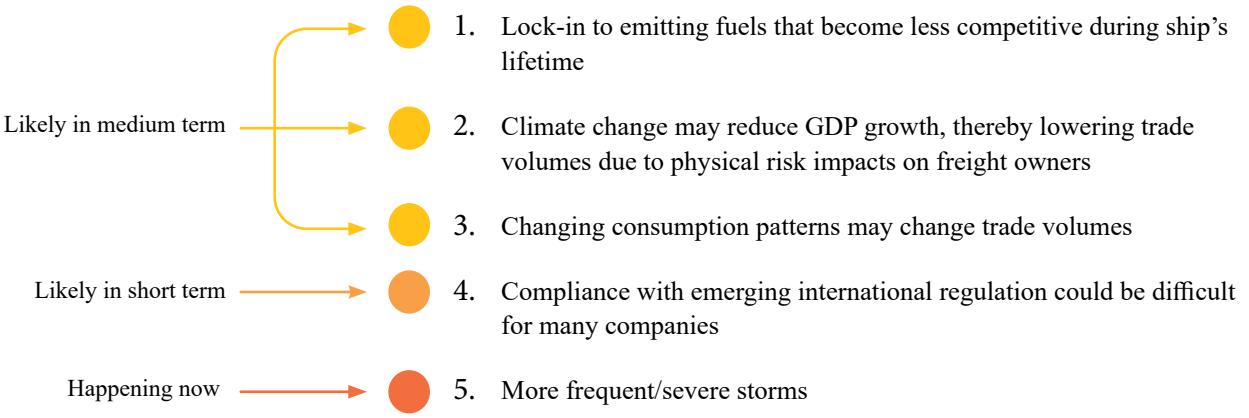
NACE Level 2 Code H50: Water transport

This includes the transport of passengers or freight over water. Also included are the operation of towing or pushing boats, excursion, cruise or sightseeing boats, ferries, water taxis etc.

Summary

Emissions from shipping account for 3% of global GHG emissions and have increased in recent years. Zero-emissions technologies are available only for short distances and small ships, while the majority of emissions are from long-distance freight. To reach GHG reduction targets set by the International Maritime Organization (IMO), zero-emissions technologies for long distance trade must be developed, as improvements in fuel efficiency will not suffice. For ships built today, there is a significant risk of lock-in to fuels that become uncompetitive during the ship's lifetime due to emerging regulations.

Main climate and environmental risks[1]



[1] The selection of key risks and categorization of those is based on expert judgement. Short-term refers to impacts that are likely in the next decade.

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Physical risk exposure

- Physical risks are not expected to have major direct impacts on shipping in the next 20-30 years (KLP).
- More severe storms may raise costs in the following ways (IPCC 2014):
  - ► Additional safety measures
  - ► Longer routes that are less storm prone
  - ► Destruction of port infrastructure connecting to road or rail
  - ► Maintenance costs for ships and ports
- More frequent weather-related delays
- Ports will in addition be affected by higher temperatures, sea level rise, and increased precipitation.
- Inland shipping affected negatively (IPCC 2014), through e.g., more flooding but also longer periods of low flow in some inland rivers and lower water levels in some lakes..

Transition risk exposure

- Significant risk that for a vessel built in 2020, the most competitive fuel in the ship's early life will not be the same as when it is scrapped (DNV GL 2019).
- Likely emerging regulations regarding emissions to air (DNV GL 2019)
- Ships with outdated technologies may be denied access to certain waters and ports. Fossil fuel cruise ships may no longer be welcome in all ports (e.g., Oslo).
- Climate policies may favor more local value chains hence decoupling economic growth from marine transport (KLP).
- Increasing scrutiny from customers seeking to cut supply chain emissions.
- Increasing pressure from investor groups, and increased cost of capital for companies not responding to investors' climate concerns (e.g. not implementing the Poseidon Principles*).
- Shipping's share of emissions is expected to increase as other sectors can decarbonize more easily, likely leading to more pressure and scrutiny.

Key statistics & background figures

- International shipping is not covered by the Paris Agreement, but regulated through the IMO.
- GHG emissions from shipping (international, domestic, and fishing): 2.9% of global (IMO 2020). Emissions have increased by 10% since 2012 but are still 10% below the peak level from 2008.
- Improvements in fuel efficiency have slowed since 2015, with annual improvements of 1-2% (IMO 2020).
- Deep-sea (long haul) segment accounts for more than 80% of the sector's emissions.
- Shipping transports at least 80% of international trade (IPCC 2019).
- Ship-related health impacts include ~400,000 premature deaths from lung cancer and cardiovascular disease and ~14 million childhood asthma cases annually (Sofiev et al 2018).
- Emissions from Norwegian domestic shipping and fisheries: 3.2Mt CO2e = 6% of total (SSB, 2018). Slight decrease in absolute emissions over last 20 years.
- Domestic shipping is subject to the general Norwegian CO2 tax, which will be 544 NOK/ton CO2e in 2020 (increase of 5% from 2019 in real terms). An exemption for liquefied natural gas (LNG) is removed in 2020.

**The Poseidon Principles are a voluntary framework for assessing and disclosing ship finance portfolios' alignment with the IMO GHG strategy.*

Contents

About this brief

This sector brief was developed by CICERO as a part of the Sustainable Edge research project. The purpose of the brief is to outline the key material climate-related issues for the sector. The audience for the brief is the financial sector, either as potential investors or lenders to the sector. The reader is expected to have background knowledge of the sector and of climate risk assessment. The analysis methodology is rooted in CICERO's climate science and build on CICERO Shades of Green's methodology for green bond frameworks. This brief is to be considered a science-based opinion.

CICERO Shades of Green AS is a subsidiary of CICERO established in November 2018. CICERO Shades of Green AS has commercialized a corporate climate risk assessment based partially on the Sustainable Edge research, in addition to their own methodological development.

The Sustainable Edge project is financed by ENOVA SF and our financial sector partners: Oslo Pensjonsforsikring, CICERO Shades of Green AS, Nysnø, Sparebank 1 SMN, Sparebank 1 Nord-Norge, SR-Bank, Samspar and Sparebank 1 Østlandet. Thank you also to our partners Finans Norge and Schjødt.

Please note this assessment focuses on climate-related issues and risks. Other environmental and social aspects may be noted, but assessing material social, ethical and governance issues are outside the scope of the assessment. We discuss governance specifically in the context of climate governance, this should not be viewed as a substitute for a full evaluation of the governance of the sector and does not cover, e.g., corruption.

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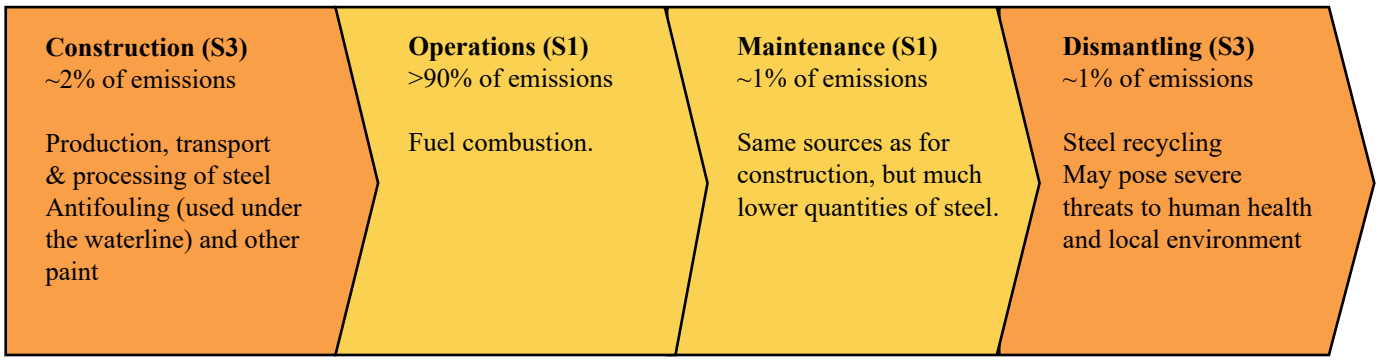
Emissions

Main sources[2]



Note that scope 2 emissions are currently negligible. With conventional fuels, the vast majority of emissions are scope 1. With alternative fuels, scope 2 emissions will be much more relevant.

Scope 1 (S1)

Status:

- On-site fossil fuel combustion is the largest source of emissions for the sector
- Shipping accounts for 2.9% of global GHG emissions (IMO 2020).
- New mandatory reporting schemes under both IMO and EU.
- IMO has set targets, but policies are not yet in place for achieving them.
- European Commission will propose to extend EU ETS to shipping. Current tax exemptions will be reconsidered (EC 2019).

Potential and challenges: to reduce scope 1 emissions

- Currently only few technically viable alternative fuels for deep-sea segment (LNG and biofuels).
- Emissions reductions from LNG are modest and uncertain. Methane emissions have increased by 150% from 2012 as number of LNG ships have surged (IMO 2020). Not a long-term decarbonization option (Victor et al 2019).
- Batteries are presently limited to trades ≤1h and small ships.
- Hydrogen is a realistic option for short-sea shipping in medium-term.
- Ammonia is the tentative frontrunner for deep-sea (Victor et al 2019).
- Main challenge for hydrogen and ammonia: pilot and prove technology at scale.
- Fuel-efficiency improvements not sufficient for achieving IMO targets; zero-emissions technologies also needed.

Targets

- IMO Strategy on reduction of GHG emissions from ships:
  - ▶ Reduce CO2 intensity by ≥40% by 2030, pursuing efforts towards 70% by 2050, compared to 2008.
  - ▶ Reduce total GHG emissions by at least 50% by 2050 compared to 2008.
- Paris Agreement goals would require steeper decarbonization.

2 (example of life cycle emissions shares for an oil tanker from Chatzinikolaou and Ventikos 2018)

Scope 2 (S2)

Status:

- With conventional fuels, the vast majority of emissions are scope 1, but with alternative fuels, scope 2 emissions will be much more relevant.
- IMO will develop guidelines for lifecycle GHG intensity for all relevant types of fuels.

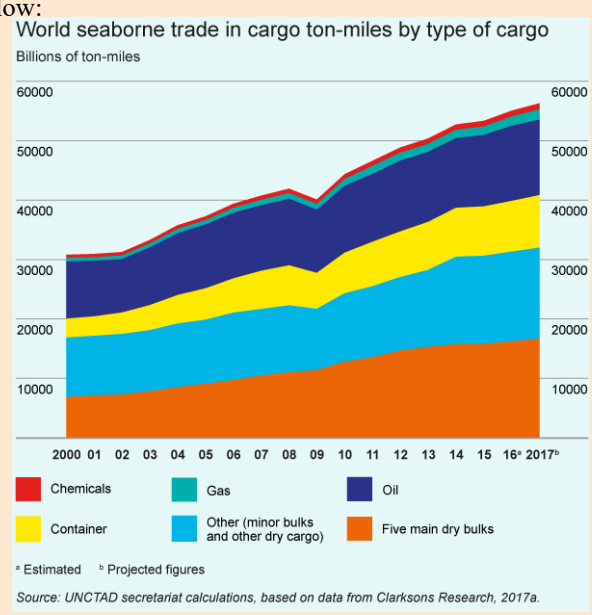
Potential and challenges:
- While switching from conventional to alternative fuel would reduce scope 1 emissions, the effect on lifecycle emissions is more uncertain.
- Scope 2 emissions are more difficult to quantify and are not included in current reporting schemes.
- Therefore, the IMO guidelines will be important.

No existing targets

Scope 3 (S3)

Status:

- Emissions from construction and dismantling are minor compared to scope 1 emissions. Dismantling could have large negative impacts on the local environmental, old shipyards can be a source of local pollution and toxins.
- Emissions embodied in the cargo could be large. Petroleum products account for a large share of cargo, see figure below:



(Five main dry bulks are iron ore, grain, coal, bauxite/alumina and phosphate)

Potential and challenges:
- No reporting scheme for scope 3 emissions.
- Investors should demand reporting on cargo and revenue / type cargo

No existing targets

Current risk management

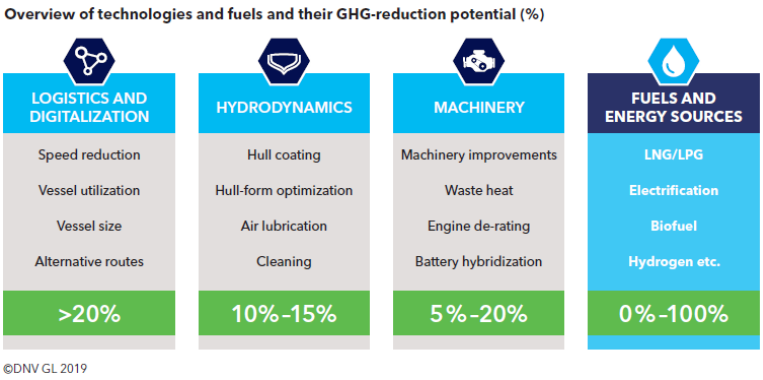
- The IMO has recently adopted a target to reduce GHG emissions by 50% by 2050 compared to 2008. While some policies are in place and scheduled to be strengthened, new policies are needed to reach the target (IEA 2018). New proposals are under discussion in the IMO and the EU. The regulatory environment for international shipping is therefore expected to change significantly over the coming years, i.e., well within the lifetime of ships entering the market today.
- New reporting requirements have recently entered into force, under IMO (from 2019) and the EU (from 2018).
- Norway has no specific emissions target for the shipping sector. However, several policies are in place, including a carbon tax, procurement policies, and support for low-carbon technologies.
- Recently, a framework has been launched for investors to assess and disclose shipping finance portfolios' alignment with the IMO GHG strategy (Poseidon Principles).
- The world's shipping heavyweights are not investing in key technologies to reduce their carbon footprint, with the sector at risk of not meeting the IMO target for 2050. Only a few of the largest companies show evidence of collaborating to develop zero-carbon fuels. Technology adoption is challenged by low margins and high debt (CDP 2019).
- Only one green bond in the sector has been issued in Norway (Teekay, 2018, total volume of USD 125 million)

Key opportunities

- Decarbonization and digitalization are the most transformative forces in shipping (DNV GL 2019). Thus, reducing emissions is key to long-term financial competitiveness.
- Forward-leaning charterers have begun paying premium rates for energy efficient ships (DNV GL 2019).
- Shipping is more energy efficient than air and road transport. Short-haul shipping may therefore benefit from climate policies. Shifting cargo from road to sea is part of Norwegian transport policies and the European Green Deal.
- Deep sea shipping faces relatively low risk of losing business to other transport modes. So, the costs of decarbonization could be passed on to the consumer, if a level playing field could be created within the sector (Victor et al 2019).
- The Norwegian shipping sector may serve as a laboratory, in which the government supports development of green solutions which may later provide export opportunities (KLP).
- Shorter sea routes will become available with Arctic sea ice reductions (IPCC 2019).

Key pitfalls

- Investing in technologies that reduce emissions but not enough to be in line with IMO targets. E.g. LNG.
- For "zero-carbon" fuels, scope 2 emissions can be large (e.g., biofuels, Hydrogen, Ammonia batteries).
- Energy efficiency improvements generally reduce shipping costs and could therefore lead to higher trade volumes. If the cargo is emissions intensive, that could lead to increased emissions from other sectors.
- Lower Sulphur fuels will have health benefits and reduce acid rain, but also reduce cooling from aerosols, hence increase the sector's contribution to climate change.
- Arctic sea routes compete with traditional shipping corridors - Black carbon emissions (soot) have greater climate impact when emitted in the Arctic



Disclosure and integration of climate risk

Disclosure of climate risk and environmental impact

- The shipping sector has poor rates of disclosure – only 5 out of the 18 largest publicly listed shipping companies participated in CDP's 2018 Climate Change questionnaire, and only 4 officially support the Task Force on Climate-related Financial Disclosures (TCFD).
- Only 3 of 18 companies have a formal climate committee at the board level (CDP 2019), low compared to other sectors.
- 12 of the 18 companies have disclosed emissions reductions targets.
- New mandatory IMO Data Collection System (DCS): Ships ≥5,000 gross tonnage (GT) (~85% of emissions from international shipping) are required to collect fuel oil consumption data for annual reporting to IMO, from 1st January 2019. Individual ship data is not publicized by the IMO.
- Ships ≥5000GT must report emissions for voyages to/from EU ports to EU MRV scheme from 2018. Individual ship data is available at https://mrv.emsa.europa.eu/#public/emission-report
- No public disclosure of cargo carried.

Integration of climate risk in operations / decisions

- A Ship Energy Efficiency Management Plan (SEEMP) is a practical tool for monitoring and improving ship and fleet efficiency performance over time and encourages the ship-owner to consider new technologies and practices at each stage of the plan. Mandatory for ships >400GT. Shall be developed following IMO guidelines.
- ISO 50001 is a voluntary best-practice standard for energy management that outlines a framework for improving energy efficiency. Becoming more commonly used to demonstrate achievements in reducing consumption to third parties.
- Commercial tools are available for optimizing fleet performance to save emissions and costs.
- Only a few of the largest companies collaborate to develop zero-carbon fuels. Technology adoption is challenged by low margins and high debt (CDP 2019). The sector is at risk of not meeting the IMO target for 2050.

Regulations and scenario information

Policies in Norway

(see Norwegian Ministry of Climate and Environment 2019)

- Domestic shipping is not covered by EU ETS. Along the EU's NDCs (Paris Agreement), Norwegian non-ETS emissions shall be reduced by 40% by 2030 relative to 2005. Government's ambition is to reduce emissions from shipping and fishing vessels by 50% by 2030 and promote development of zero- and low-emission solutions for all vessel categories. Domestic shipping is subject to the general Norwegian CO2 tax, which is 544 NOK/ton CO2eq in 2020 (set to increase by 5% annually). An exemption for liquefied natural gas (LNG) will be removed in 2020.
- Covered by the nitric oxide (NOx) tax & NOx fund[3].
- Biofuel quota under consideration.
- Low- or zero-carbon technology is required in public procurement of ferry services.Support to develop low- or zero carbon technologies through Enova, Innovation Norway, Research Council, 'Klimasats'.

EU Taxonomy

The March 2020 version of the EU Taxonomy includes two sub-sectors of shipping: H50.3.0 Inland passenger water transport and H50.4.0 Inland freight water transport. The following activities are included in the taxonomy:

- Zero direct emissions inland waterway vessels are eligible.
- Vessels that run exclusively on advanced biofuels or renewable liquid and gaseous transport fuels of non-biological origin[4], guaranteed either by technological design or ongoing monitoring and third-party verification. In addition, for investments in new vessels, only those below emissions thresholds are eligible.[5]
- Other inland waterways vessels are eligible if direct emissions are below 50 gCO2e emissions per passenger kilometre (gCO2e/pkm) (or 92.6 g per passenger nautical mile (gCO2e/pnm)) or direct emissions per tkm CO2e emissions per tonne kilometre (gCO2e/tkm) or per tonne nautical mile (gCO2e/tnm) are 50% lower than the average reference value defined for HDVs (Heavy Duty CO2 Regulation).

Note that vessels that are dedicated to the transport of fossil fuels or any blended fossil fuels are not eligible even if the above criteria are met.

The current EU taxonomy draft sets additional requirements in the area of "Do no significant harm" in terms of physical risk assessment, building materials, water consumption etc.

The current draft also requires minimum social safeguards, currently defined as meeting the International Labour Organisation (ILO) Core Labour Practices.

3 For more information about the Nox fund see: https://www.nho.no/samarbeid/nox-fondet/the-nox-fund/
4 As defined in Art. 2 (34) and Art. 2 (36) in line with Directive (EU) 2018/2001)
5 Direct emissions below 95g CO2 e /pkm (including biogenic CO2) for passenger transport, and below the average reference value defined for freight HDVs (Heavy Duty CO2 Regulation) are eligible.

Global scenarios

- Initial IMO Strategy on reduction of GHG emissions from ships (2018, to be revised in 2023):
  - Reduce carbon intensity by at least 40% by 2030, pursuing efforts towards 70% by 2050, compared to 2008.
  - Total GHG emissions should peak as soon as possible and fall by at least 50% by 2050 compared to 2008.
  - Phase out emissions as soon as possible within this century.
  - The demand for seaborne trade is projected to grow by 39% until 2050 (IMO 2018).
  - The 2050 target thus requires approximately:
    - 30%–40% share of carbon-neutral fuels in world fleet energy, in addition to improving energy efficiency (IMO 2018).
    - 50-70% carbon intensity improvement for ships built in 2020-2030 relative to 2008 (the official 2008 baseline pending).
  - BAU emissions in 2050 are projected to be 90-130% of 2008 levels (IMO 2020).
  - IMO regulatory tools to improve energy efficiency of ships (2013):
    - Mandatory design requirements (EEDI) for new ships, which set increasingly strict carbon intensity standards.
    - Mandatory Ship Energy Efficiency Management Plan (SEEMP) to improve energy efficiency of all ships > 400GT.
  - These tools do not regulate methane emissions.
- Proposal under discussion in IMO: National Action Plans, Energy Efficiency Existing Ship Index with standards; power limits; and a carbon tax earmarked for R&D fund.
- IMO Sulphur regulation: max 0.5% sulphur content applies universally from 2020. Previous limit was 3.5% outside emissions control areas. In emissions control areas, including Baltic and North Sea, the limit is 1% (scrubbers needed if exceeded).
- In IEA New Policies Scenarios (2018), shipping and aviation are the only sectors where oil demand in advanced economies is projected to grow from 2017 to 2040. (These scenarios are not consistent with the IMO strategy).
- Paris Agreement's well-below 2°C objectives would require a steeper decarbonization trajectory than the IMO absolute target. The IMO intensity targets imply less steep decarbonization (Poseidon Principles 2019).

CICERO Shades of Green & analyst perspective[6]

CICERO Dark Green for the sector

Considerations for main activities

- The only zero-carbon technology currently suitable for deep-sea shipping is sustainable biofuel. This is a "drop-in" fuel, requiring no technological innovation into ships.
- Innovation into alternative zero-carbon fuels is the most important long-term policy for deep-sea shipping. Energy efficiency improvements are also needed to cater for these fuels, as they have lower energy density.
- For short-distance shipping, batteries are an available technology.
- Technological innovations in fuels or design should be made available to the entire market

Considerations for upstream and downstream factors

- Life-cycle emissions from "zero-carbon" fuels must be assessed.
- Could petroleum products be included in the cargo? Is the cargo in other ways part of a carbon-intensive supply chain? If yes, what is the share and does the investment add capacity or replace existing ships?
- Transparency regarding ship dismantling should be required.

Current best practice – activities

- ★ Battery-electric vessels are available for short-distance shipping.
- ★ Sustainable biofuels is currently the only low carbon technology suitable for deep sea shipping.
- ★ To date, Maersk, HMM and Norden are the most ambitious among the 18 largest companies in setting long-term targets to reduce carbon emissions, consistent with the IMO's strategy (CDP 2019).
- ★ ISO 50001 is a voluntary best-practice standard for energy management.
- ★ Best practice means including current or future battery capacity, a substantial efficiency strategy, innovation and fuel switch ambitions..

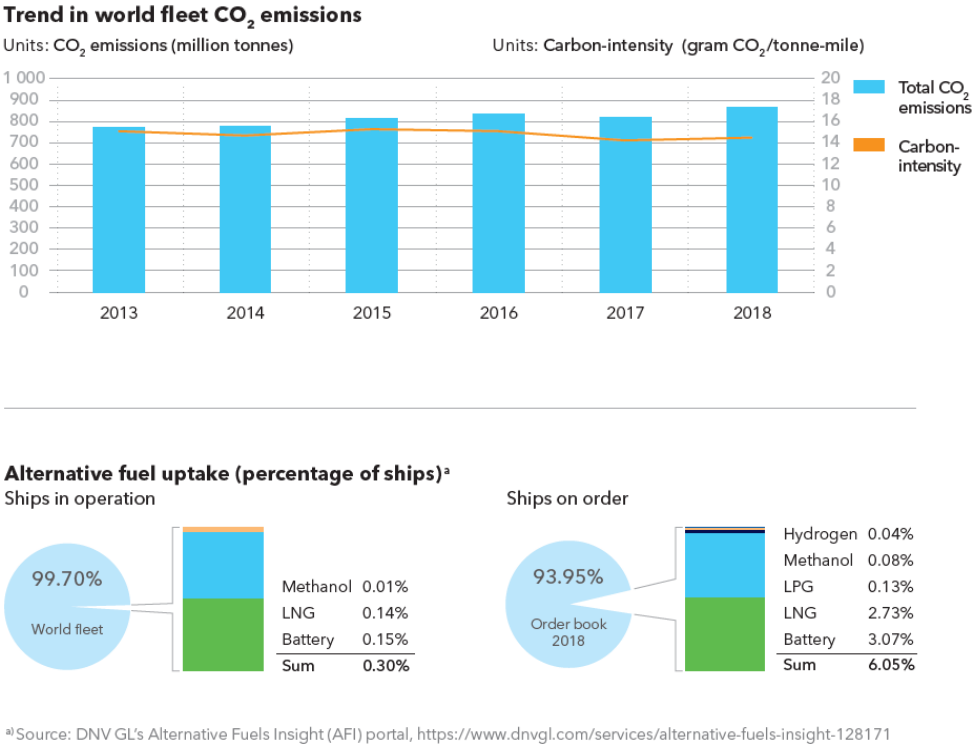
Current best practices – governance

- ★ The Poseidon Principles are a voluntary framework for assessing and disclosing ship finance portfolios' alignment with the IMO GHG strategy. Banks representing 20% of the global shipping portfolio have signed up. Launched in June 2019. Borrow from the Equator Principles. Supportive of the TCFD and the Climate Disclosure Project (CDP).
- ★ Best practice for governance in the shipping sector includes setting relevant and ambitious climate targets, measuring and managing GHG emissions as well as fuel switch ambitions considering current and future battery capacity, rebound and lock-in effects. In addition, participating in or contributing to R&D efforts on new low-emissions technology, implementing climate considerations into the upstream and downstream activities (e.g. aiming to reduce or remove any petroleum products as cargo and having safeguards in place for vessel recycling process)

6 The Shades of Green methodology assesses alignment with a low-carbon resilient future. CICERO Dark Green is allocated to projects and solutions that correspond to the long-term vision of a low carbon and climate resilient future. For more information see: https://www.cicero.green/our-approach

Data and indicators for climate risk disclosure

Historic data



[a] Source: DNV GL's Alternative Fuels Insight (AFI) portal, https://www.dnvgl.com/services/alternative-fuels-insight-128171

Climate-relevant data sources

- The Energy Efficiency Design Index (EEDI) = CO2 per capacity mile. Minimum standards for new ships since 2013.
- The Energy Efficiency Operational Indicator (EEOI) is a monitoring tool for managing ship and fleet efficiency performance over time.
- IMO Data Collection System: Fuel oil consumption reported to IMO for ships ≥5000GT annually from 2019.
- Ships ≥5000GT calling on EU ports must report emissions to EU MRV scheme from 2018.
- 18 largest companies are ranked in terms of climate risk by CDP (2019)

Potential difficulties in attaining / using existing data

- IMO DCS does not measure cargo carried, but instead assumes full load. EU MRV is therefore better for estimating efficiency.
- IMO DCS data is aggregated to national level. Not verifiable by third parties.
- Cargo is typically anonymized, making it difficult to include shipping emissions when calculating life-cycle emissions of final goods.

Indicators which would improve climate risk disclosure

Transition risk

Preliminary indicators and metrics[7]
Carbon intensity, which measures CO2 emissions per unit of transport work. (Should be compared with the competing fleet.)
The Annual Efficiency Ratio is one measure of carbon intensity, which uses vessels' designed deadweight as proxy for carbon carried. Thus, only fuel consumption and distance sailed must be measured, which means it can be calculated from IMO DCS data. However, this assumes ships are always fully loaded.
The Energy Efficiency Operational Indicator (EEOI) includes a true measure of transport work. Calculation requires data on cargo, which is not included in IMO DCS.
Climate alignment (Poseidon Principles): a measure of the degree to which a vessel, product, or portfolio's carbon intensity is in line with a decarbonization trajectory that meets the IMO strategy. Standard trajectories are produced by the Secretariat of the Poseidon Principles for each ship type and size class.
Distribution of cargo carried by fleet.
Share of different low-carbon technologies in fleet.
Lifecycle GHG (note that The IMO will develop guidelines for all relevant types of fuels.)
Absolute annual GHG emissions by vessel
Disclosure of IMO DCS data plus weight and type of cargo.

7 Please note that these are preliminary indicators and metrics that will be further developed. As the methodology and data availability evolves, we expect adjustments to the list. Also note that within the sector there are many different busines models and different indicators and metrics may be more relevant depending on the company under assessment.

Key analyst questions for all companies in this sector

1. Is the investment/activity compatible with the IMO GHG reduction strategy (See Poseidon Principles (2019) for methodology)?
2. Will carbon intensity be measured and reported annually?
3. How does carbon intensity compare with competing fleet? Note that it is important to compare with a similar fleet. E.g. emissions are generally lower in container segment than in bulk segment.
4. Does the investment facilitate retrofitting for future alternative fuels? / Does the vessel allow for modifications to install greener alternative engine systems once these become available?
5. How ambitious is the SEEMP? Are emissions reductions targets and measures to achieve it included?
6. What cargo is shipped? Is this type of cargo compatible with the green transition?
7. Are fleets being extended or are older vessels replaced?
8. What energy efficiency measures are they taking? Note that larger ships have better efficiency. Note also that energy efficiency improvements can only be verified with post-issuance reporting.
9. For which speed is the vessel optimized, and which measures have been taken to achieve fuel efficiency at this speed (slow-steaming has great fuel saving potential)?
10. For LNG ships, how are methane emissions considered?

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