

# Preparing shipping banks for climate change: How can internal carbon pricing help ship-financing banks in risk management?

**T**his Executive Briefing discusses the progress being made in reducing greenhouse gas (GHG) emissions, challenges to achieving effective GHG emissions reduction, and the key role that financiers can play in both mitigating their own risks and helping the industry towards a more orderly, effective decarbonization.

## SEGMENTS & KEY CHARACTERISTICS

The global shipping fleet is mainly comprised of dry bulk carriers, oil, gas, and chemical carriers, container ships, and general cargo ships (in addition to specialized vessels such as roll-on/roll-off ships, ferries and cruise ships, and various offshore support vessels). As of the beginning of 2016, the world commercial fleet consisted of a combined 1.8 billion deadweight tonnage (dwt) capacity spread among 90,917 vessels, representing a 3.5% growth from the previous year. The average vessel age in 2016 was 20.31 years, with the oldest being the general cargo ship fleet (24.72 years) and bulk carriers as the youngest (8.83 years). Table 1 (next page) provides a summary of the key characteristics for the primary maritime shipping segments. It is important to note that these vessels are long life-cycle assets that cannot be rapidly replaced or adapted, and this lack of adaptability augments financial risks within the shipping industry.

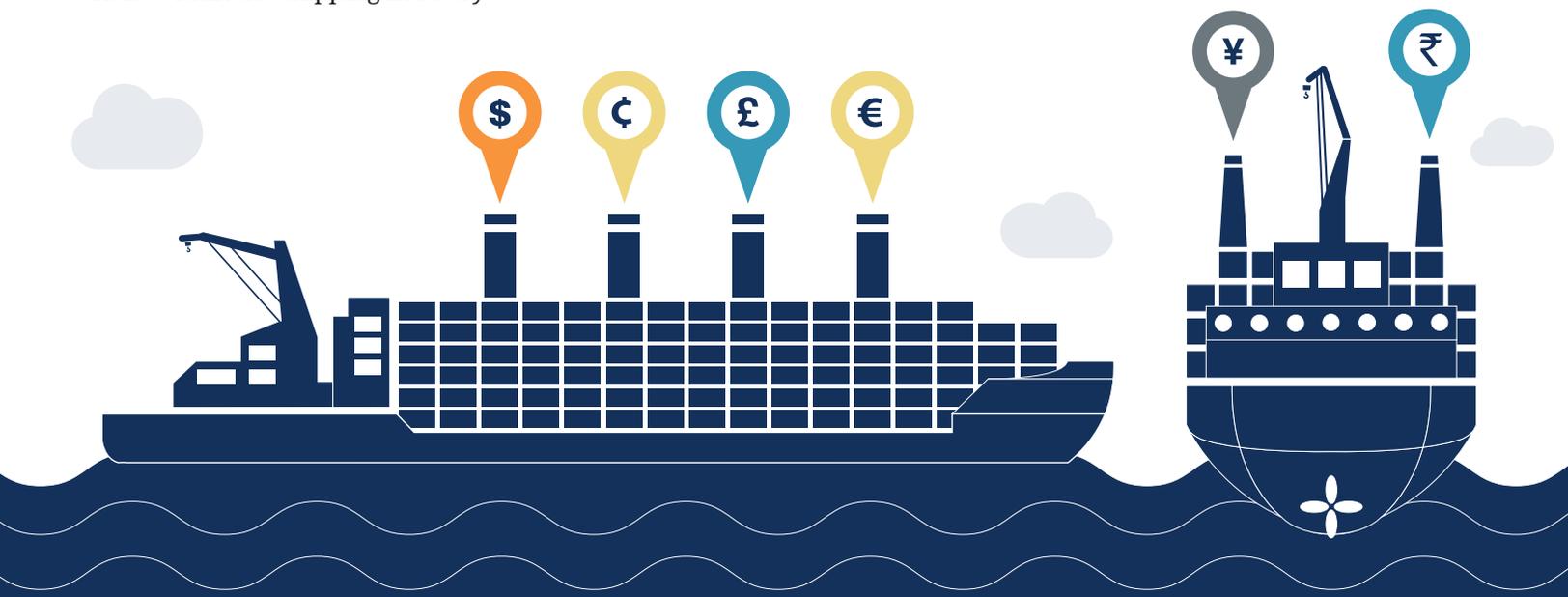
## SUMMARY

**I**t is difficult to overstate the economic importance of maritime shipping. Shipping allows trade at a scale that has been fundamental for globalization and many recent key developments in the world economy. Today, global maritime shipping accounts for around 80% in volume and 70% in value of all world trade.

The shipping and aviation industries have not been included in the Paris Agreement. While aviation has forged a global agreement on GHG emissions through the International Civil Aviation Organization (ICAO), shipping still remains outside of any such agreement. Official projections of the International Maritime Organization (IMO) suggest that business-as-usual GHG emissions from the maritime shipping industry will increase between 50% and 250% in coming decades.<sup>1</sup> Despite these trends, experts foresee a necessary decarbonization of this industry in the near future.

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<sup>1</sup> A separate 2017 study by CE Delft, *Update of Maritime GHG Emissions*, suggests revising this figure to 20-120%.



The IMO will deliver a GHG reduction strategy in 2018 and will revise that strategy in 2023. Given the immense pressure on the IMO, the implementation of measures may reasonably occur before 2023. In February 2017, the European Parliament voted to include shipping within the scope of EU ETS regulation starting in 2023, unless the IMO adopts a comparable scheme that covers shipping emissions by 2021. The reasonable likelihood of at least one GHG reduction measure in the early 2020s as well as the goal for the broader economy of a below 2°C pathway – whilst pursuing efforts to limit the temperature increase to 1.5°C – set forth by the Paris Agreement, create material risks.

The shipping community, particularly financiers, will need to better understand and begin to manage these possible risks and opportunities. There is a need to develop best practices and industry principles to encourage implementation as well as reduce concerns about impacts on competitiveness.

In internal carbon pricing, a shadow carbon price is a hypothetical price selected by a company, in this case a ship-financing bank, that is used to evaluate the sensitivity of investments to future potential regulatory scenarios. Shadow carbon pricing can be used as an effective tool to identify and manage risks associated with the implementation of GHG mitigation policies on the maritime industry. Minor amendments to sensitivity analysis on freight rates can be used to identify and manage risks associated with the implementation of the Paris Agreement.

Together, these approaches can serve to enable risk departments to quantitatively inform due diligence practices for project finance and leasing to the shipping industry. This will better enable financiers to work with owners to identify and manage climate transition risks in an institution- and sector-appropriate fashion.

Corporate lending will require a much heavier emphasis on due diligence to ensure that the companies to which institutions are lending take similar measures. The process and tools would remain much the same, however.

## SHIP FINANCIERS

There are many sources of capital for the shipping industry, including commercial banks, private equity, institutional investors, and others. The largest of these is a group of commercial banks, which hold \$355.25bn of collective exposure to shipping, excluding lease financing. The largest lender to the maritime shipping industry is DNB, part of Norway's largest financial services group DNB ASA. At the end of 2016, DNB's ship financing portfolio stood at \$21bn. Other major lenders include Bank of China, China Exim, KfW, Korea Exim, Nord/LB, DVB, BNP Paribas, MBTU, and Credit Suisse. SMBC and KEXIM have also moved into

top positions globally. This report is most relevant to these commercial banks because of the relevance of internal carbon pricing mechanisms to project finance, which these banks provide.

Due to the hugely detrimental impact of the global financial crisis on traditional European shipping lenders and the capital requirements imposed by Basel III regulations, in the last decade there has been a complete shift away from the German Kommanditgesellschaft - or KG - model and a partial shift away from traditional European lenders towards Asian financial institutions, private equity, and other alternative sources of capital.

**Table 1. Summary of key characteristics of the primary maritime shipping segments.**

Vessel Type	Dry Bulk	Oil Tanker	Gas Carrier	Container	General Cargo	Passenger	Chemical	Cruise
Average Vessel Age (years, 2016)	8.83	18.49	N/A	11.21	24.72	N/A	N/A	N/A
Capacity (thousand dwt, 2015)	778,890	503,343	54,469	224,272	75,258	5,950	44,347	24,284*
Capacity (% , 2015)	43.1%	27.9%	3%	13.5%	4.2%	0.3%	2.5%	1.3%*
Emissions (% , 2012)	20.8%	15.5%	5.8%	25.6%	8.5%	3.5%	6.9%	4.4%
Growth rate (% , 2015 to 2016)	2.25%	3.1%	9.7%	7%	1.48%	5.5%	4.43%	5.24*

\* Figure also includes specialized tankers, reefers, tugs, dredgers, and other non-cargo ships.

Source: Data on average vessel age, capacity, and growth rate from UNCTAD 2016. Data on emissions from IMO's Third GHG Study 2014.

## ENVIRONMENTAL IMPACT

Seaborne trade, which in 2015 surpassed 10 billion tons of goods transported annually, is not without significant environmental costs. Shipping emitted 938 million metric tons of CO<sub>2</sub> in 2012, which accounts for about 2.6% of all global emissions that year. This CO<sub>2</sub> was emitted from a fleet that continues to expand. From 2015 to 2016, the year with the slowest growth rate in over a decade, the world fleet increased by 3.5%.

Air pollution, such as NO<sub>x</sub>, SO<sub>x</sub>, and fine particulate emissions, represent another significant environmental impact from maritime shipping. Shipping relies on heavy fuel oil, a residual product from oil refineries, and when combusted it emits considerable amounts of sulphur oxides, nitrogen oxides and particulate matter. These emissions are harmful to both human health and marine environments.

## CLIMATE MITIGATION & MARITIME SHIPPING

### AREAS OF PROGRESS

Areas of climate mitigation progress exist within the maritime shipping industry today. Examples of policy tools that contribute to such progress include:

- **EU ETS:** The EU ETS places a single, EU-wide cap on CO<sub>2</sub>, N<sub>2</sub>O, and PFC emissions. In February 2017, the European Parliament voted to include shipping within the scope of EU ETS regulation starting in 2023, unless the IMO adopts a comparable scheme that covers shipping emissions by 2021. The potential for this inclusion in the EU ETS is likely to have a large impact on energy efficiency and associated emissions, even if the carbon price used is initially low, potentially resolving or partially resolving the split-incentive challenge in the maritime shipping industry.
- **Monitoring, Reporting and Verification (MRV):** Both the IMO and the EU employ MRV policies. The EU MRV obliges ship owners to monitor, publicly report, and verify fuel consumption, CO<sub>2</sub> emissions, cargo carried, distance travelled, “transport work” (which is the distance travelled times cargo carried), and other parameters for each of their ships. The IMO MRV policy has fewer data requirements (for example, transport work metrics are not recorded) and thus provides less transparency on emissions. These initiatives in themselves have the ability to begin addressing the exacerbating factors of shipping’s split incentive discussed below.

- **IMO GHG reduction strategy:** In 2018, the IMO’s initial strategy will define a vision statement, quantified emissions reduction objectives, and a set of candidate policy measures for action on GHG emissions both in the immediate and longer term. A revised strategy is scheduled for release in 2023. There is mounting pressure at the IMO due to its current lack of action with regard to GHG emissions reduction. This slow progress is increasingly scrutinized both regionally (at EU level) and at the United Nations Framework Convention on Climate Change.
- **Ship Energy Efficiency Management Plan (SEEMP):** A mandatory initiative of the IMO started in 2013, SEEMP requires all vessels to have onboard a plan for energy management. However, SEEMP requirements have not caused significant changes in energy consumption practices and are only seen as a compliance matter.
- **Energy Efficiency Design Index (EEDI):** Another IMO initiative, the EEDI introduced mandatory design limits that specify minimum energy efficiency levels for all new ships delivered after 2013. But, the EEDI only concerns ships of a specific type that are in new design phases and fails to address inefficiencies in the operation of current ships.
- **Science-based targets:** Science-based target commitments are driving public-facing corporate climate action and will eventually have an impact on the shipping industry. To date, only one shipping company has committed to science-based targets: Kawasaki Kisen Kaisha, Ltd., known as “K” line, the sixteenth largest container transportation and shipping company in the world. Until more shipping companies make such commitments, science-based targets on behalf of shippers (Wal-Mart Stores, Inc., CVS Health, Carrefour, and others) will positively impact the industry as this target setting strategy filters down to shipping in the supply chain of these companies, thereby requiring ships to meet these targets.

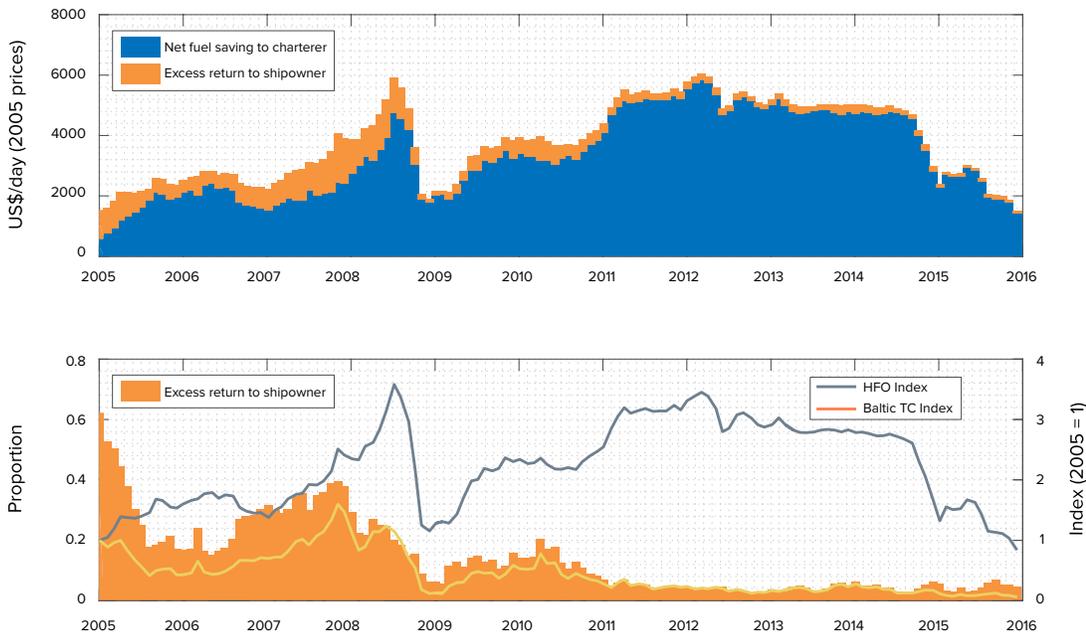
### CHALLENGES

Any successful climate initiative in shipping must recognize the following challenging realities of the shipping industry:

1. **Split Incentive:** Shipping’s split incentive (principle-agent) problem is driven by the fact that for a large portion of the industry, ship owners invest in fuel efficiency technologies while charterers pay for the fuel. Other contributing factors are fleet overcapacity, which gives charterers more negotiating power on rates, and

**Figure 1. Actual accrual of savings from energy efficiency**

**Panamax**



Analysis of where the benefits accrue when a choice is made to charter a more energy efficient ship – showing large majority going to the charterer over the owner, and also an effect of this being linked to the market conditions (fewer savings are passed back to owners in poor markets).

Source: Raucci et alii 2016.

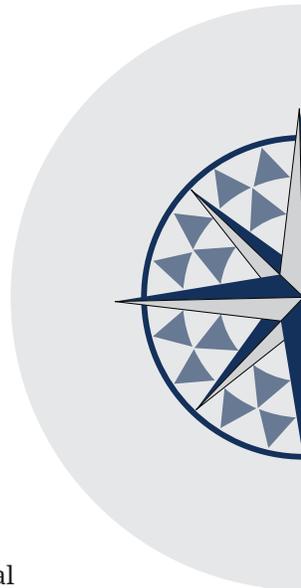
poor availability of high-quality information on fuel efficiency. The effects of these factors are that in some current markets less than 10% of fuel savings from fuel-efficiency are actually passed back to the ship owners from charterers through rates – as illustrated by Figure 1. This is highly significant because this effectively prevents serious investment in fuel efficiency technologies and preparation for GHG policies.

The implementation of GHG policies is expected to resolve or partially resolve this phenomenon. This suggests that the onset of market-based GHG policies such as carbon pricing or emissions trading should impact markets abruptly. Given that a new-build vessel financed today will very likely be competing under some form of a carbon price before its first dry-dock – a period of scheduled maintenance when efficiency modifications can be made – there is a strong argument to begin making these considerations.

**2. Ship ownership:** The long-term nature of climate change mitigation is at juxtaposition with the short-term

nature of many ship owners, who trade vessels. This “asset play” is driven by extreme volatility in freight rates and ship values. This is rational behavior from a ship owner’s perspective, but prevents long-term investments in efficiency technologies and long-range planning on transition to low-carbon fuels unless these attributes were to become priced by the market. This suggests that we may now be entering a period where those stakeholders with long-term vested interest in assets – such as financiers – need to begin assessing future climate transition risks.

**3. Overcapacity and cyclical markets:** Overcapacity is the product of the cyclical nature of the shipping industry. At present, overcapacity is a serious concern for the shipping industry because of its depressive impact on rates and detrimental impact to the financial health of owners and lenders. Despite being at the lowest growth rate in 15 years, between 2015 and 2016, the dwt capacity of the global fleet grew by 3.5%, outstripping demand growth of 2.1%. While rates have recovered slightly from



historic lows over the past several years, industry leaders expect this to be an issue for years to come. Due to the detrimental effect of overcapacity on the financial health of owners and financiers, investments in efficiency technologies are harder to justify due to their impact on loan to value.

## SHIP-FINANCING BANKS & INTERNAL CARBON PRICING

There are two types of policy changes with the potential to impact the cash flow, value, and liquidity of vessels and the companies that own them. Supply-side risks are those risks driven by policies meant to decarbonize shipping itself. For example, market-based GHG mitigation policies will, by design, advantage those vessels that are more carbon efficient. In practice, this will benefit those vessels able to install energy efficiency technologies and eventually switch to the use of low-carbon fuels.

Demand-side risks are those driven by the Paris Agreement's impact on demand for specific vessels. For example, a worldwide decline in demand for coal or oil could feasibly depress the day rates for classes of tankers and bulkers.

### WHY WOULD A SHIP-FINANCING BANK APPLY AN INTERNAL CARBON PRICE?

The rationale behind using an internal carbon price is to identify sectoral and sub-sectoral risks and opportunities so that the policy-induced climate transition can be understood and managed.

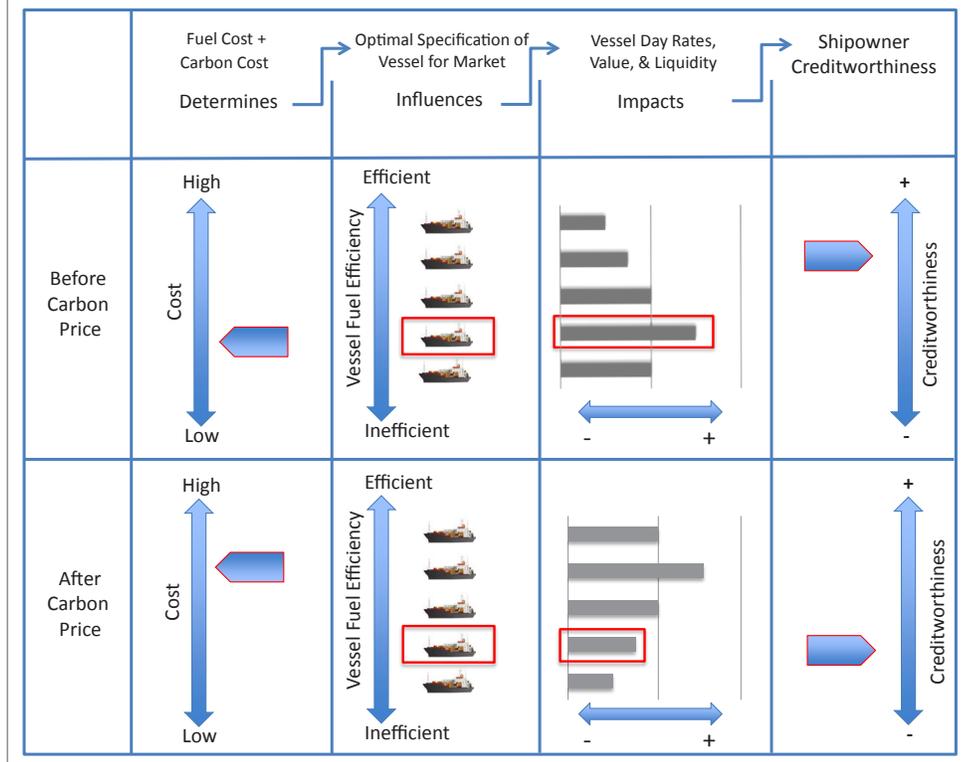
GHG mitigation policies will initially accelerate the differentiation between efficient and inefficient vessels. This will impact the companies that own them and accelerate the differentiation between companies that are innovative, well-managed, and well-capitalised and those companies that are not.

Figure 2 is a highly simplistic demonstration of how carbon pricing will influence optimal vessel design, which in turn will influence that vessel's day rates, value, and liquidity. These factors impact the shipowner's creditworthiness. It is important to also state that if policy may exacerbate this effect by at least partially correcting the market failure demonstrated in Figure 1 (previous page). This highlights a key challenge of managing risks that are created by future GHG mitigation policies. Vessels must be built to be competitive in today's markets, which do not fully reward vessel efficiency, and remain viable in the carbon-constrained markets of the 2020s and beyond.

Impending EU policy could have material financial impacts and potential future IMO regulation could deepen those impacts. While addressing these risks will require actions by owners as well, it is in the interest of financiers to initiate identification and management of risks because of the relatively long window of payback of ship mortgages.

Research suggests that carbon pricing well below what would be required to actually decarbonize the industry will already have material financial impacts and could require the modification of vessels to keep them

**Figure 2. Example of how carbon pricing impacts optimal vessel design and shipowner creditworthiness.**



competitive within markets. Given that a new build vessel financed today could be potentially competing under EU ETS pricing before its first drydock, there is a strong argument that risks should be assessed and managed as appropriate for each financial institution.

Going beyond the initial introduction of market-based measures to shipping, to decarbonize at the level of ambition of the Paris Agreement will require a significant departure from business-as-usual GHG emissions projections (Figure 3). As international trade is expected to increase, experts suggest that the carbon intensity of each vessel will have to decrease 60-90% by 2050.

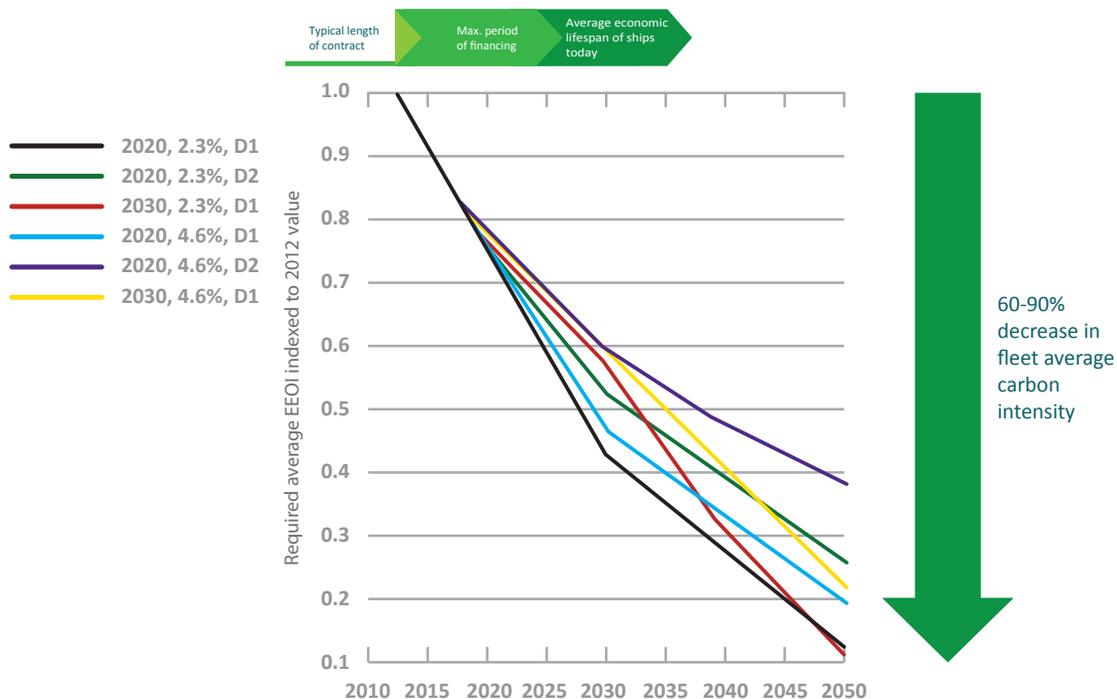
A GHG emissions intensity reduction of this magnitude goes well beyond what can be achieved through energy efficiency interventions alone. Such GHG emissions reduction will require a combination of operational changes and technical modifications in the short to medium-term as well as a switch to low-carbon fuels in the medium to long-term. While no such policy agenda is scheduled for implementation today, it is highly prudent to understand potential impacts. This approach is also recommended by the G20's Task Force on Climate-related Financial Disclosures (TCFD).

In contrast to the short-term nature of much ship ownership and even shorter-term chartering practices, financiers have the longest-term vested interest in vessels. Depending on the type of finance provided (e.g. project finance, leasing, corporate lending), this can expose ship financiers to different, longer-term risk profiles than ship owners and charterers. Understanding and managing these different risk profiles is key to ensuring good loan performance in the carbon-constrained markets of the 2020s.

### HOW COULD A SHIP-FINANCING BANK APPLY INTERNAL CARBON PRICING IN PRACTICE TO THE MARITIME SHIPPING INDUSTRY?

In internal carbon pricing, a shadow carbon price is a hypothetical price selected by a company that is used to evaluate the sensitivity of investments to future potential regulatory scenarios. Shadow carbon pricing can be used as an effective tool to identify and manage downside climate risks associated with the implementation of GHG mitigation policies in the maritime industry. Minor amendments to sensitivity analysis on freight rates can be used to identify and manage downside risks associated with the implementation of the Paris Agreement.

**Figure 3. Absolute versus relative targets for reducing GHG emissions from shipping**



Conversion of CO<sub>2</sub> pathway for 2°C into pathways of carbon intensity (gCO<sub>2</sub>/tnm) under different assumptions of transport demand growth and start year from regulation. Shown in the context of the key time-horizons driving asset investment and operation.

Source: Smith & Rehmatulla, 2015.

Together, these approaches can serve to enable risk departments to quantitatively inform due diligence practices for project finance and leasing to the shipping industry. This will better enable financiers to work with owners to identify and manage climate transition risks in an institution- and sector-appropriate fashion.

Corporate lending will require a much heavier emphasis on due diligence to ensure that the companies to which institutions are lending take similar measures. The process and tools would remain much the same, however.

First, the initial step is to use a techno-economic model to predict the impact of a range of shadow carbon prices on specific fleets in which the financier holds existing loans or is considering making loans. The latest modeling on climate transition risk has considered carbon prices ranging from \$50/metric ton CO<sub>2</sub> to \$200/metric ton CO<sub>2</sub>. This will provide a benchmark of where a vessel sits amongst its peers today and the potential technical decarbonization pathways for vessels in that fleet, which can be used to assess an individual vessel's ability to be modified and the associated capital required to keep it competitive in carbon constrained markets.

Second, amendments to sensitivity analysis on freight rates can be used to identify and manage downside risks associated with the implementation of Nationally Determined Contributions (NDCs) under the Paris Agreement. This is particularly relevant in bulk and tanker markets.

Third, these assessments can be used to adjust risk premiums to better balance lending portfolios as well as to inform a sectoral policy of either managing or avoiding certain risks. For risks that will be managed, these insights can be used in the due diligence process to identify the following:

1. Particularly if it is a new build, what actions are being taken to ensure that the vessel can be modified in line with decarbonization pathways as easily and cheaply as possible?
2. Are there plans to use innovative cost-sharing measures to make vessel modifications, which can help overcome split incentive issues before carbon pricing is applied to shipping?
3. When vessels need to be modified, converted, or retrofitted, where will the capital come from and what incentives are available to accelerate these modifications?

## LOOKING AHEAD

Applying internal carbon pricing to lending decisions is technical, often outside the usual skill set of financiers, and likely too time-consuming to be done in-house. However, this is not dissimilar to the modeling services that shadow credit rating agencies or other consulting firms provide to shipping financiers today. One such model, University College London's GloTraM, was already employed to predict the impact of carbon pricing and NDCs on vessel cash flow in the report Navigating Decarbonisation.

Likely due to the novelty of climate risk to ship financiers, products designed to assess climate risks have only just been developed and will require further refinement. This is not unsurprising. Research that polled ship financiers with portfolios representing 25% of all shipping debt in 2016 found extremely limited assessment of vessel efficiency when making lending decisions and mixed awareness of climate-related stranded asset risks.

However, in 2017 the materiality of climate-related financial risks to maritime lenders was clearly established by the report Navigating Decarbonisation and several European central banks began to warn of the financial risks of climate change. The report suggests that while a wholesale stranding of entire asset classes like in some other sectors is unlikely, risks will still need to be managed proactively given lenders' fiduciary duty.

This new reality looks to have started a productive conversation amongst leaders in the industry who have collectively identified key steps to integrating climate risk into maritime lending decisions. These include the following:

1. Raise awareness of the materiality of risks
2. Develop best practices for integrating climate risk into lending decisions
3. Create a standard for integrating climate risk into lending decisions

Key areas of concern for financiers are potential impacts on competitiveness of first movers and the availability of tools or products to assess the impact of climate policies on investments. These areas need to continually be addressed and updated.

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## MORE INFORMATION

**Context:** The Carbon Pricing Leadership Coalition (CPLC) includes governments, businesses and civil society groups working together to identify and address the key challenges to successful use of carbon pricing as a way to combat climate change. The CPLC's maritime work program is led by the CPLC partners: University College London and Global Maritime Forum. This Executive Briefing was made possible thanks to kind support from Carbon War Room. It was authored by James Mitchell (Carbon War Room) and Luke Elder (CPLC Secretariat).

**References:** This Executive Briefing is a synthesis of ideas and literature derived from the key references listed here. Due to limited space, the print version does not include references to specific sources in the text. Such references are included in the digital version available online: [www.carbonpricingleadership.org/resource-library/](http://www.carbonpricingleadership.org/resource-library/)

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