



CARBON LEVY EVALUATION

Could a carbon levy in shipping be an effective way to help reach the IMO greenhouse gas reduction goals?

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WHY ARE WE PRODUCING THIS PAPER?

This paper is prepared to facilitate a discussion at the 2019 Global Maritime Forum (GMF) in Singapore on whether and how a carbon pricing scheme could support greenhouse gas (GHG) reduction targets, including IMO's 2050 GHG ambitions. It should not be viewed as a comprehensive position or policy paper, but rather as a document to stimulate discussion within the shipping industry.

There is a need for the shipping industry to find ways to reduce its GHG emissions. While there is agreement at the International Maritime Organization (IMO) on carbon reduction goals for international shipping, we believe that the industry has a responsibility to find solutions for the carbon challenge, and that an increasing global attention on carbon pricing mechanisms may result in regulatory action.

There are multiple pathways to reduce carbon - new fuels, technologies, and operational approaches. Most of these require significant investment; some can provide financial returns over time; but in the absence

of a carbon pricing mechanism that provides disincentives for consumption of carbon intensive fuels, and incentives for research and development, it is unlikely that we can achieve meaningful decarbonization.

While there are other incentive mechanisms to promote the adoption of new solutions, in this paper we focus on carbon pricing as an effective means to do so. We are only considering CO₂ as it is the primary GHG.

We would like to engage maritime industry players in discussing how a carbon pricing scheme could be designed to deliver the necessary outcomes in a manner that is structured, transparent and provides a level global playing field.

This paper addresses the following key questions:

- Does carbon pricing work and what type of carbon pricing scheme is preferred for shipping?
- How should the price on carbon be determined?
- How should proceeds be collected and enforced?
- How should the proceeds be deployed?

BACKGROUND AND HISTORY

International shipping is responsible for approximately 2% of the world's CO₂ emissions [1]. This corresponds roughly to the emissions of sizeable countries such as Germany or Japan. However, while most countries are parties to the Paris Agreement and thereby formally committed to emission reductions to keep global warming to well below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase even further to 1.5°C, shipping and aviation are not included.

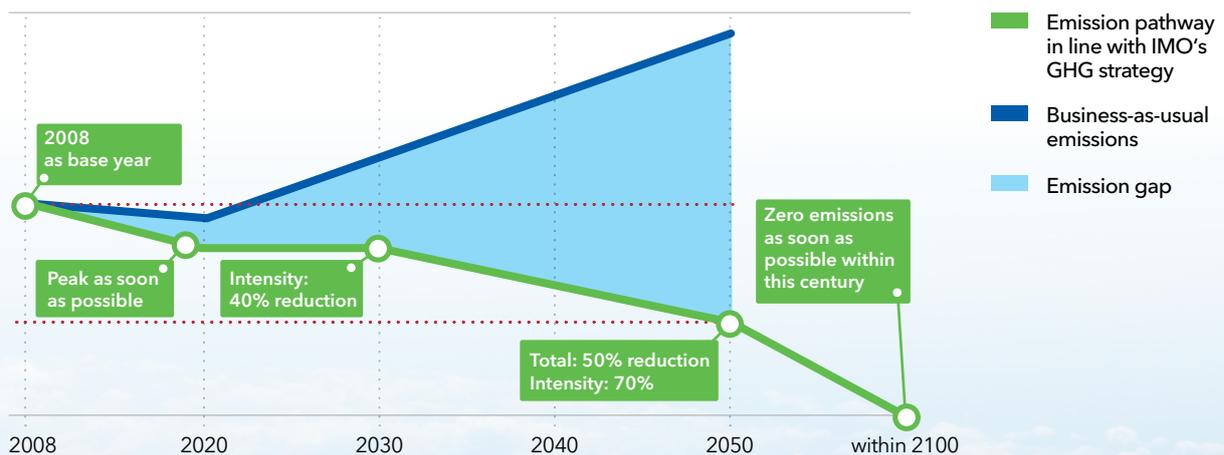
In response to the Paris Agreement, the IMO has committed itself to an emission reduction strategy to phase out GHG emissions as soon as possible within

this century. The strategy contains several intermediate steps, a key one being to reduce total GHG emissions by at least 50% in 2050 compared to 2008.

Presently, the IMO is engaging primarily in a discussion of technical and operational policy measures and focuses on what can be agreed in the short term, i.e. measures intended to come into force by end-2022. Carbon pricing is not yet a significant part of these discussions but has been proposed in the IMO GHG strategy as a measure for the medium and long-term. As the IMO works by the consensus of member states, a proposal on carbon pricing will take time to be agreed and implemented.

IMO strategy for major reductions in GHG emissions from shipping

Units: GHG emissions



Total: Refers to the absolute amount of GHG emissions from international shipping.
Intensity: Carbon dioxide (CO₂) emitted per tonne-mile.

Source: DNV GL [2]

DOES CARBON PRICING WORK AND WHAT TYPE OF CARBON PRICING SCHEME IS PREFERRED FOR SHIPPING?

The purpose of carbon pricing in shipping should be to help reach the IMO GHG emission reduction goals for 2050 by providing financial incentives to invest in emission reduction technologies and solutions. Additionally, a carbon pricing mechanism can be used to raise funds for research, development, and scaling of alternative fuels and technologies.

Carbon pricing schemes can be divided into two general types:

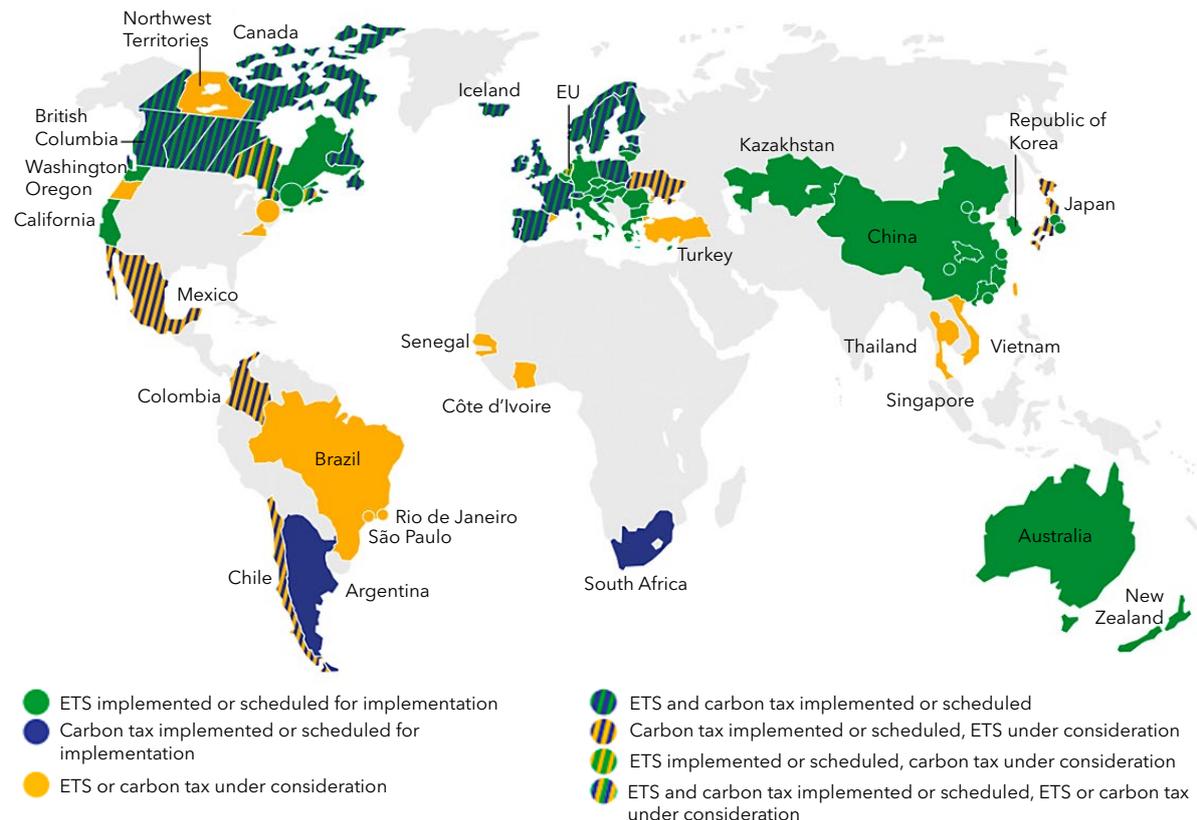
Emissions trading systems (ETS) - sometimes referred to as a cap-and-trade system - where a cap is placed on emissions, and allowances are subsequently traded. The ETS establishes the price indirectly by placing a limit on the total quantity of emissions allowed. This limit is enforced with tradable emission permits, typically called “allowances”, that any emitter must use to cover its emissions. The market for these tradable allowances leads to a carbon price based on demand and supply. Under an ETS, overall emission levels are clear (equal to the cap), but the resulting carbon price is uncertain because it is determined by free market forces through supply and demand. Generally, an ETS does not create excess funds for other purposes such as

R&D, as all transactions happen between stakeholders. However, the auctioning of allowances could be used to generate funds.

Carbon levy - this is where an explicit price is placed on CO₂, or alternatively imposed through other costs that imply a carbon price. Under a carbon levy, the cost of controlling emissions would be certain (it would be equal to the levy), but because there is no predetermined limit on emissions, the overall volume of emissions is unknown. The levy can be adjusted over time, but as a result of technical criteria or political considerations, rather than by the supply and demand of carbon allowances. A carbon levy inherently collects funds that can subsequently be disbursed, for instance towards R&D.

The number of carbon pricing schemes in place or currently being implemented across the globe is increasing, and by 1 April 2019 covered about 20% of global GHG emissions. From 2018 to 2019 (as of 1 April) there was an increase from 51 to 57 schemes. Of these, 28 were ETSs and 29 were carbon levies, with the latter often focusing on fossil fuels. While 46 of the carbon price initiatives are national or even local in scope, only a few are international [3].

Status overview of regional, national and subnational carbon pricing initiatives



Source: World Bank [3]

Research and empirical evidence have shown that CO₂ pricing can be an effective emission reducing instrument, providing a positive incentive to invest in new carbon abatement or energy reduction technology. The Report of the High-Level Commission on Carbon Prices concludes that a well-designed carbon price is an indispensable part of a strategy for reducing emissions in an efficient way [4].

However, the organizational design and level of carbon pricing varies widely among markets and sectors, leading to varying degrees of success. In a review of lessons-learned from CO₂ pricing in the petroleum sector (e.g. [5]), a common finding is how external factors affect emission levels. These factors include market changes, global oil prices, changes in energy systems and security of supply. Should CO₂ pricing be introduced to shipping, similar effects of external factors should be expected.

Few existing carbon pricing schemes are international in scope, which reflects the challenges of cross-border schemes. Shipping is uniquely placed to enact international legislation through the work of IMO, which is critical for a level playing field.

A scheme will have to address impact on states, the critical role of international shipping in global trade, and how it can be properly enforced, collected, and deployed.

Decarbonization technology for maritime applications is still in its infancy, challenged by cost and scalability issues [1]. Zero-carbon and carbon-neutral fuels such as sustainable biofuels, hydrogen and ammonia require significant R&D and large-scale changes to existing infrastructure (both shore-based and vessel-based) before they become significant contributors. Bridging technologies such as LNG, LPG and multi-fuel engine solutions can play a crucial role in easing this transition and ensuring that ships and infrastructure being constructed today remain viable as the decarbonization technology landscape evolves and matures.

We expect that carbon pricing will provide an incentive for transitioning to low/zero carbon alternatives. Given the long asset life of vessels, a clear trajectory on carbon pricing over the long-term should positively influence investment decisions at an early stage. Hence, a carbon levy at a pre-determined level is preferable to a trading scheme where the price of carbon credits can be highly volatile, with a levy resulting in investment decisions being made under conditions of greater certainty and therefore more progress on decarbonization.

A carbon levy also has the advantage of collecting revenue that can be used to stimulate R&D and technology deployment. For example, an investment rebate mechanism has been applied with good results through the Norwegian NOx-fund to stimulate the uptake of abatement technology, and a similar approach could be envisaged for CO₂.

Conclusion: There is evidence that carbon pricing works. Schemes are in place in a growing number of countries, and many governments and industry leaders across different sectors have been on record to express the importance of carbon pricing as a means to incentivize CO₂ reduction.

A transparent carbon levy scheme, where a price is explicitly communicated and charged on CO₂ emissions, works best because limited carbon price volatility allows businesses to invest in abatement measures under conditions of greater certainty. Another advantage is that a relatively stable source of funding allows for research, development, piloting and scaling with some planning horizon.

In order to ensure that the overall emissions trajectory is taken into account, while still giving a good level of price certainty, the scheme could set a clear price path for the initial periods followed by a review thereafter.



HOW SHOULD THE PRICE ON CARBON BE DETERMINED?

There are many different points of view on what the price should be, also within the working group behind this paper. We believe that one of the key considerations in light of the Paris Agreement and the global aspirations it represents, as well as the ambitions set in IMO’s GHG strategy, is that a carbon price needs to be set at a level that incentivizes real GHG emission reduction efforts through technological and/or operational solutions. The carbon price should send a clear signal to industry stakeholders to start investing in decarbonization, but it should also not disrupt trade or have a disproportionate impact on states.

We have looked at appropriate price levels needed to cover the costs of:

- Funding of R&D, pilot projects and initial scaling
- Reducing or leveling the additional cost of alternative fuels

Additionally, to ensure that the price is set at the right level, we have also considered:

- Targets set by the Paris Agreement, and related price levels
- Levels applied to other industries
- Cost impact on consumers and GDP

Funding of R&D, pilot projects and initial scaling-up

R&D and piloting costs per installation are expected to be high initially, but with a limited number of installations, the total cost is not very high. The funds could cover research into carbon neutral or zero-carbon fuels and support scaling initiatives and initial infrastructure development.

For example, a levy of USD 10/ tCO₂ (corresponding to a levy of USD 30/ t fuel) could give annual proceeds of

USD 8 billion assuming an emission level of 800 million tonnes CO₂ [1]. In a scale-up phase and to support infrastructure development, a higher levy may be needed.

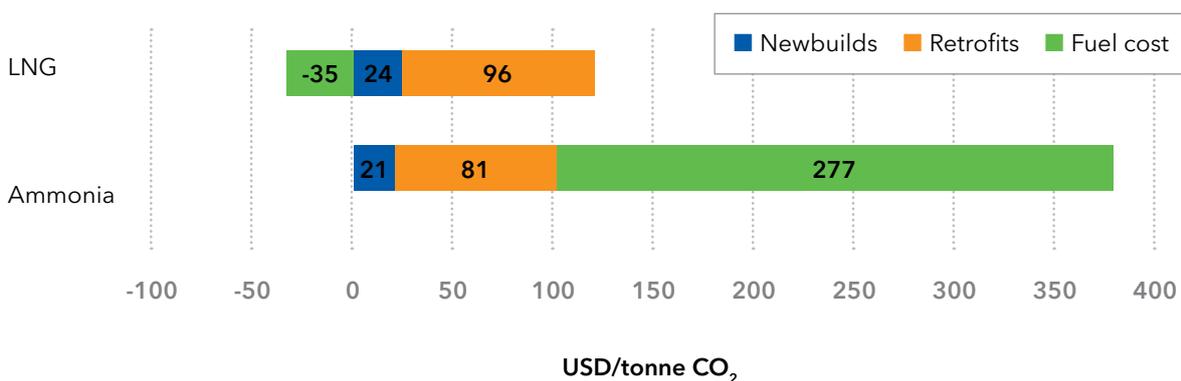
Levelizing the cost of alternative fuels

At some stage, alternative fuel systems will be commercially available, but yards, designers and manufacturers still need to learn how to implement and improve the designs and systems. Over time and with scaling, the cost will go down. Similar learning and scaling effects are expected for the fuel infrastructure and distribution costs.

Comparing total annual investment costs with additional costs for zero carbon fuels, it is expected that the cost of the fuels itself will significantly exceed the investment in onboard systems. The uncertainty of future engine, storage and fuel costs is high, but our analysis indicates that at current price levels the levy may have to be more than USD 400/ tCO₂ to cover the true transition costs from LSFO/MGO to for instance ammonia.

Offsetting only the onboard additional capital expenses through rebates or investment support will not have a significant impact if the operational expenses are so much higher. The onboard capital expenses for converting to ammonia are not expected to be higher than for converting to LNG or LPG. With prices trending lower than MGO - as is currently the case for LNG and LPG but not for ammonia and other zero-carbon or carbon-neutral fuels - we believe that the industry can afford to take on additional investments in onboard systems and onshore fuel distribution infrastructure with the prospect of benefitting later from lower fuel costs.

Additional costs per tonne CO₂ compared to LSFO/MGO



Targets set by the Paris Agreement and levels applied to other industries

The Report of the High-Level Commission on Carbon Prices concludes, “the explicit carbon-price level consistent with achieving the Paris temperature target is at least USD 40-80/ tCO₂ by 2020 and USD 50-100/ tCO₂ by 2030, provided a supportive policy environment is in place”. While we acknowledge that this is an economy wide carbon price target and not one specifically set to decarbonise shipping, we think that it remains a relevant benchmark.

A carbon price for shipping should not be far from the price range for other industries. The major cost element - the cost of a zero-carbon or carbon-neutral fuel - is also closely linked to energy costs in other sectors. We believe it is unlikely that shipping would need a much higher carbon price than other sectors to incentivize the necessary changes.

As of 1 April 2019, about 20% of global GHG emissions were covered by a carbon price, of which only 5% were priced at levels consistent with the goals of the Paris Agreement i.e. USD 40-80/ tCO₂. The carbon price range was USD 1-127/ tCO₂, and typically around USD 5-30/ tCO₂ [3, 4].

Cost impact on consumers and GDP

Shipping is a facilitator of trade and increasing costs can impact consumers and economic growth. In a study published by the IMF, a levy of USD 75/ tCO₂ in 2030 could increase shipping cost by 0.075% of global GDP [6]. For the consumer, if looking at the shipping cost component only, the impact of a levy at this level would be negligible. If a carbon levy is introduced for fossil fuels world-wide, the impact would be more substantial. IMF has calculated that gasoline prices would then rise by 5-15% with carbon levy at USD 75/ tCO₂ [7].

This analysis notwithstanding, some vulnerable economies such as Small Island Developing States (SIDS) with long distances to markets, as well as Least Developed Countries (LDC), may be impacted. The benefit of reduced emissions therefore has to be measured against the impact on the citizens of these nations.

In terms of the impact on industry, fuel costs over the past decade have fluctuated between USD 200-600/ tonne HFO, which is far more than the contemplated levies. This suggests that the industry is well able to absorb these costs. The main considerations should be towards creating a level playing field and introducing a steady increase that gives both visibility and time to adjust to higher prices.

Conclusion: We believe that a carbon pricing scheme for shipping should initially provide sufficient funds for R&D, piloting and initial scaling with regards to onboard ship systems, and for alternative fuels and onshore infrastructure. The price should aim to be in line with the price range for other industries.

Well before 2035, a review should determine the levy needed for Stage 3. This stage would be conducted with a view to incentivise full decarbonization of shipping, while taking into account the progress on technologies and alternative fuels by that time, and broader progress on climate change. The following staged approach concept is envisaged - with price escalation within each stage:

Stage	Use of proceeds	Level (per tCO ₂)	Annual proceeds ¹
Stage 1: Short term (Until 2030)	R&D and piloting	USD 5-30	USD 4-24 billion
Stage 2: Mid-term (2030-2035)	Further piloting, initial scale-up and infrastructure	USD 10-50	USD 8-40 billion
Review and determine levels for Stage 3			
Stage 3: Long term (From 2035)	Towards full scale-up and transition	Level TBD	TBD, but total volume may decrease as decarbonization accelerates

¹ Assuming 800 million tonnes CO₂ emitted annually

HOW SHOULD THE PROCEEDS BE DEPLOYED?

In order to deploy funds in an accountable manner, whether within or outside the shipping industry, an organization should be established under the aegis of IMO and in line with best practice for charitable foundations. This entity would require an independent CEO and management team reporting to a board of trustees, with clear objectives and reporting frameworks. The board of trustees could include a combination of stakeholders, including shipping industry figures and independent experts on environmental technologies.

Proceeds from a carbon levy could be deployed either in shipping or outside the sector.

Within the shipping sector, ship and fuel technology will require fundamental transformations for the 2050 targets to be achievable, not to mention for the ambition of full decarbonization. Significant funds are needed for research, trials, implementation and scaling, the latter to ensure that cost to the buyer is reduced over time.

Any proceeds beyond what is needed to support research and development could be used within the sector to incentivize technology uptake. An option in support of scaling can be to incentivize operational improvements through a rebate mechanism to ship owners. There are a multitude of possibilities for how this could be done, from a fixed rebate sum for each unit of abatement achieved³, to rebates based on calculated or measured CO₂ emissions relative to a benchmark. Recycling funds back to shipping through rebates on documented reductions and investments would be challenging to scale for global applicability, while a rebate based on documented

emissions related to a ship type and size-specific benchmark⁴ would require simple and accepted measurement criteria to ensure enforceability.

Outside the shipping sector, we see two general approaches for deployment of funds.

First, the uptake of low carbon/carbon neutral fuels is dependent on availability, which implies development of new infrastructure and conversion of existing infrastructure. Part of the funds can be deployed to reduce the financial risks for suppliers of this infrastructure, which will support scaling.

Secondly, a non-shipping use of funds that has seen political interest is contribution to United Nations mechanisms such as the UNFCCC Green Climate Fund (GCF). The fund was created in 2010 and has a goal of collecting USD 100 billion per year for climate change adaptation and mitigation. Collection so far lags far behind ambition, and it has been suggested that shipping should contribute to the GCF if a shipping levy is established. Along the same lines, support of the UN Global Environment Facility (GEF) could also be an option.

Conclusion: We believe that the proceeds should primarily be redistributed back to the maritime sector to drive in-sector decarbonization. The funds should be managed by a professional foundation established for the purpose. The main purposes should be to fund R&D and trials, and support technology deployment and scaling. Any proceeds beyond that could go towards globally well-established environmental funds like the Global Environment Facility (GEF) and the Green Climate Fund (GCF).

³ An example is the Norwegian NOx Fund which has been highly successful in creating significant reductions in NOx emissions: <https://www.nho.no/samarbeid/nox-fondet/the-nox-fund/>

⁴ This could for example be the EEDI (Energy Efficiency Design Index) reference line.



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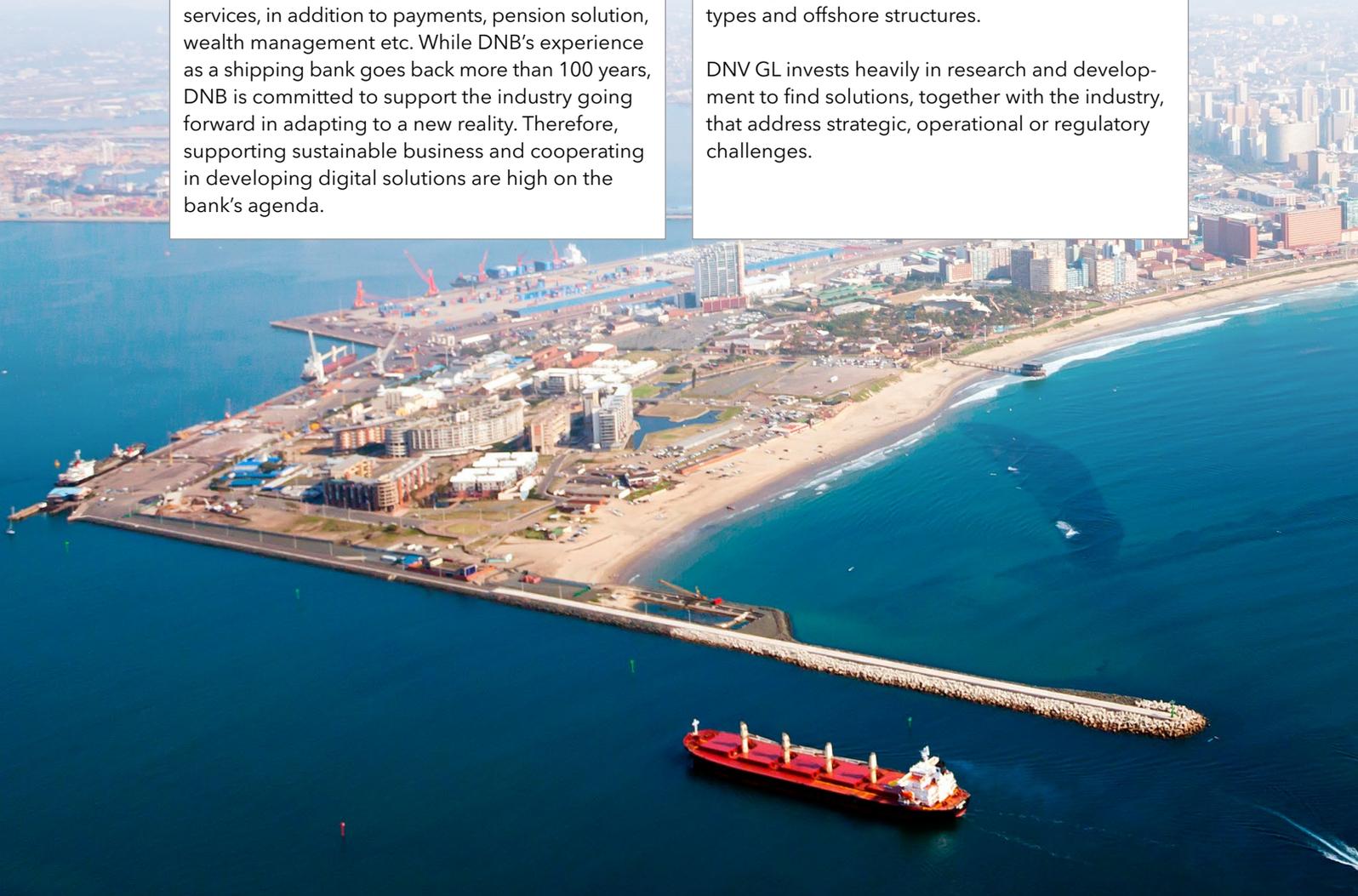


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CONCLUDING REMARKS

The maritime industry is looking to achieve the IMO 2050 ambition of 50% reduction in GHG emissions compared to 2008 levels and has a responsibility to work towards decarbonization. We believe that in addition to other measures, a carbon levy would be an effective enabler towards achieving this goal,

if designed for a level playing field and providing: a predictable price over a period of time, proper enforcement and collection, and with proceeds deployed into research, development and scaling to achieve an effective transition for the industry.

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BHP Group Limited
171 Collins Street
Melbourne Victoria 3000
Australia
www.bhp.com

BW Group
18-00 Mapletree Business City,
10 Pasir Panjang Road
Singapore 117438
www.bw-group.com

DNB
Dronning Eufemias gate 30
0191 Oslo, Norway
www.dnb.no

DNV GL - Maritime
Brooktorkai 18
20457 Hamburg, Germany
www.dnvgl.com/maritime