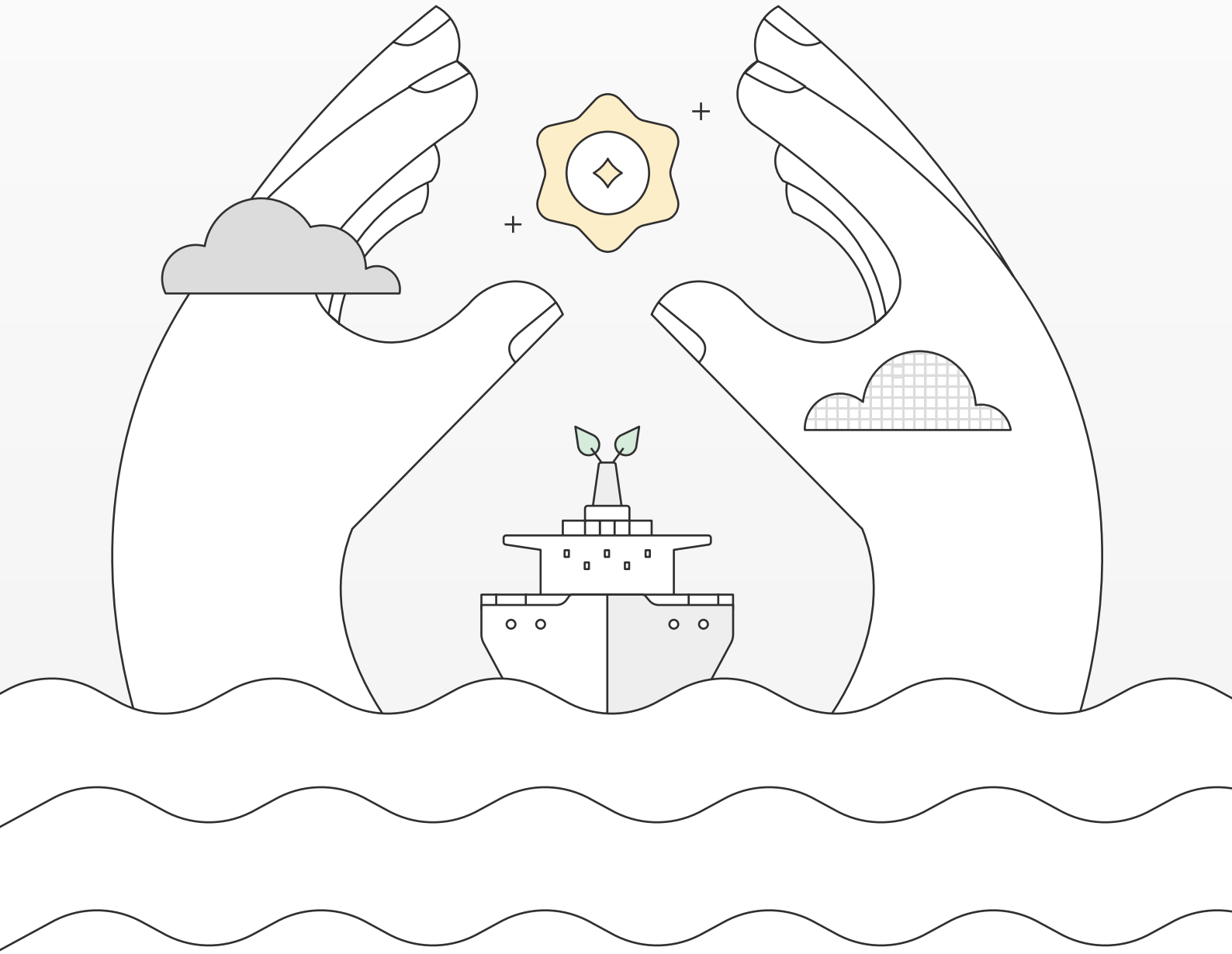
Setting Sail on a Sustainable Course

Implications of the 2023 IMO GHG Strategy for the Shipping Industry



Mærsk Mc-Kinney Møller Center
for Zero Carbon Shipping

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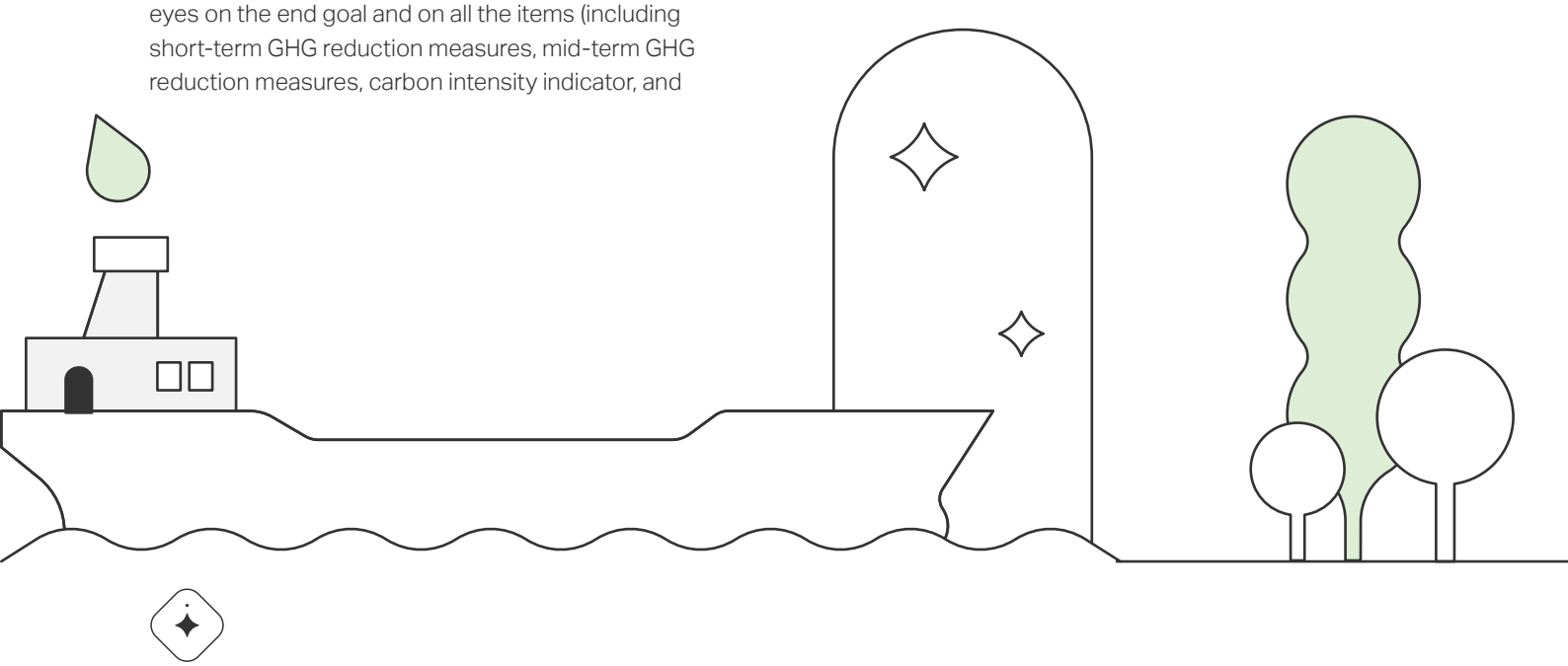
Executive summary

The International Maritime Organization's (IMO) Marine Environmental Protection Committee held its 80th session (MEPC 80) from 3 to 7July 2023. During this session, all 175 Member States of the IMO unanimously supported the adoption of the 2023 IMO Strategy on Reduction of GHG Emissions from Ships (2023 IMO GHG Strategy). As the name suggests, the aim of this strategy is to reduce greenhouse gas (GHG) emissions from international shipping. The strategy revised the target of net-zero emissions set in the initial strategy adopted in 2018 and accepted that the industry should reach net-zero GHG emissions around 2050. Implementing this strategy will lead to the greatest acceleration of decarbonization in shipping seen so far.

The IMO set out indicative checkpoints for the shipping industry to meet in 2030 and 2040 to ensure that the industry is headed in the right direction to achieve the goal of net-zero emissions by 2050. It would seem from the strategy that, if the industry achieves the two ambition levels for 2030 (uptake of zero or near-zero GHG energy and decrease in carbon intensity of shipping), then GHG emissions would have been sufficiently reduced by 2030 to get the industry to its checkpoint of reducing absolute emissions by 20-30% compared to 2008. However, this is not the case. Our calculations show that if the IMO Member States focus only on these levels of ambition and draft initiatives around them, then they will be unable to reach the 2030 indicative checkpoint, thereby falling behind on the 2040 indicative checkpoint and 2050 target as well. Hence, it is crucial for IMO Member States to set their eyes on the end goal and on all the items (including short-term GHG reduction measures, mid-term GHG reduction measures, carbon intensity indicator, and life cycle analysis guidelines) in the complete strategy, rather than on individual items in the strategy. The first part of this paper explains our calculations in more detail.

According to our projection, the cost of producing the alternative fuels needed to reduce GHG emissions could require an investment of 200-300 billion USD by 2030. Investing in energy efficiency on board vessels can substantially reduce the costs of transitioning from conventional vessels to green vessels. If the energy efficiency on board vessels is improved, then each vessel would require less fuel, thereby reducing the demand for alternative fuel, and, in turn, lowering the cost of producing these alternative fuels. Our analysis indicates that enabling investments that reduce energy consumption could towards 2030 result in fuel production cost savings that are up to a factor 10 higher than the cost of implementing energy efficiency

The 2023 IMO GHG Strategy has given the international shipping industry a compelling reason to put decarbonization at the center of its business strategy. The shipping industry needs to steer itself quickly away from fossil fuels and towards sustainable alternatives, as the cost of not doing so can prove to be high for both the industry and the planet.



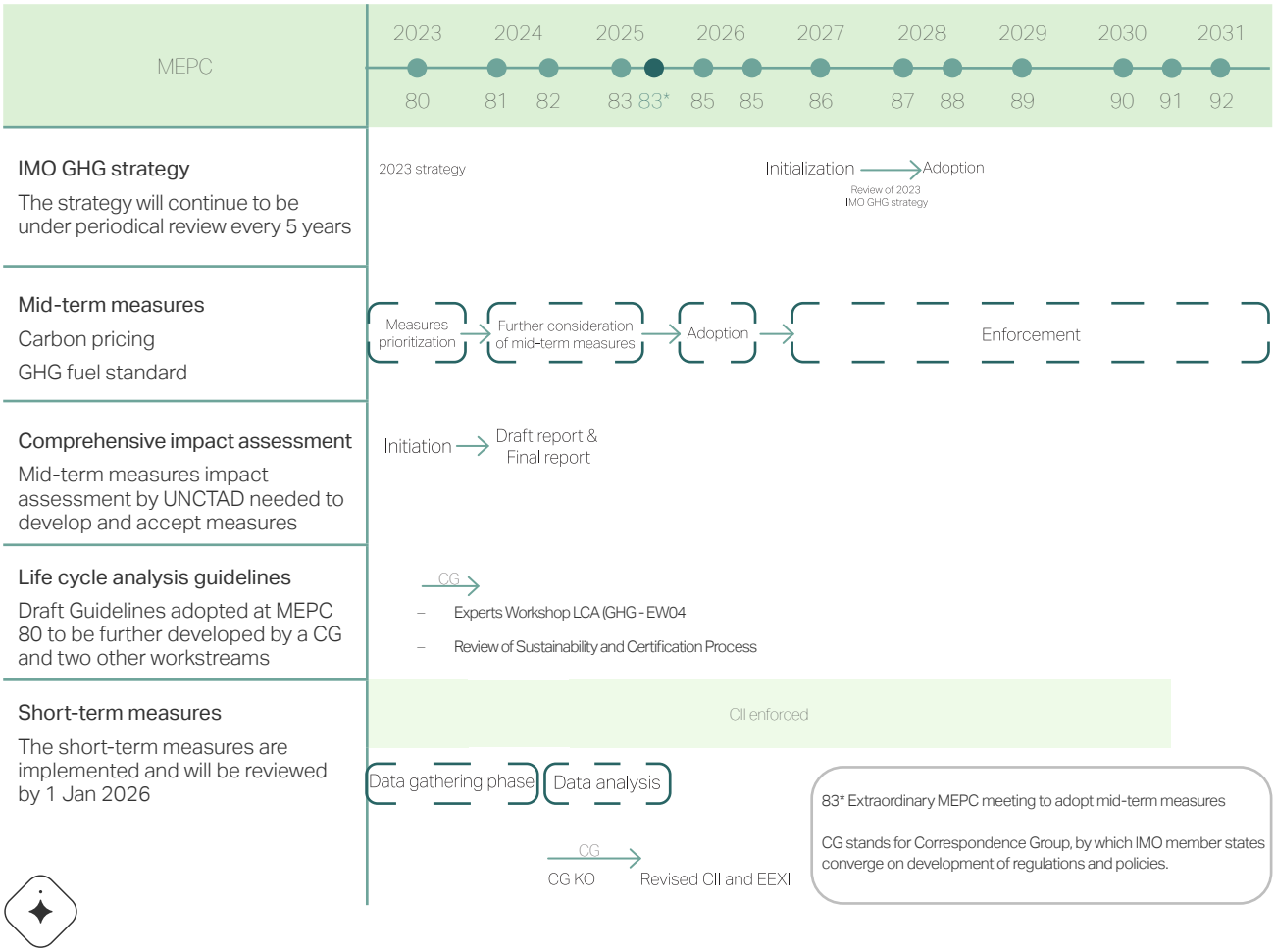
01 Introduction

The need to fight climate change is urgent and ongoing. The global shipping industry has a huge role to play, as its 100,000 vessels consume 300,000,000 tonnes of fuel and contribute to 3% of global carbon dioxide (CO_2) emissions every year. Of this, international shipping contributes to around 70% of emissions. If the industry continues on this trajectory, CO_2 emissions from international shipping will steadily increase due to projected trade growth. The time to decarbonize the shipping industry is now.

The 2023 IMO GHG Strategy changed the IMO's earlier target of reducing the total annual GHG emissions from shipping by at least 50% by 2050 compared to 2008 — set in 2018 when MEPC 72 adopted the Initial IMO Strategy on reduction of GHG emissions from ships — and decided to target net-zero well-to-wake (WTW) emissions by 2050. The strategy does not stop with an end goal: it also considers the milestones that need to be met for the final target to be achieved and a series of measures that will help Member States achieve the milestones. These measures are called the short-term, mid-term and long-term GHG reduction measures. The IMO is also developing a comprehensive impact assessment to discuss the mid-term measures and is working on finalizing the life cycle analysis guidelines.

Overall, the IMO is committed to putting together all the complex pieces necessary to achieve the goal of decarbonizing the shipping industry (Table 1). The fact that the Member States have agreed to hold an extraordinary MEPC meeting in 2025 to formalize the adoption of mid-term measures so that they can be in place by 2027 proves the Member States' commitment to reaching the 2030 targets. In such a scenario, the industry has a lot to lose if it does not catch up with the IMO's efforts.

Table 1: IMO's ongoing and upcoming efforts as part of the decarbonization strategy.



The key items from the revised IMO strategy that are relevant for this paper are:

- Levels of ambition:
  - Target net-zero around 2050 on a WTW basis
  - Uptake of zero or near-zero GHG emission technologies, fuels, and/or energy sources to increase and represent at least 5% (striving for 10%) of energy used by 2030
  - 40% carbon intensity reduction by 2030 with respect to 2008
- Indicative checkpoints for absolute emissions reduction:
  - 2030: 20% reduction with respect to 2008 (striving for 30%)
  - 2040: 70% reduction with respect to 2008 (striving for 80%)
- Commitment to have mid-term measures in force by 2027, with a combination of technical (fuel standard) and economic (GHG emissions pricing) measures, and an extraordinary MEPC meeting in 2025 between MEPC 83 and MEPC 84 to approve the measures.

The 2023 IMO GHG Strategy gives a pathway for new regulations to be developed and provides a vision for the shipping industry to follow to achieve net-zero emissions by 2050.

02 Scope of the strategy

If the industry is to move together in the same direction at a sufficiently fast pace, it is important to have a clear understanding of the scope of the strategy in terms of quantities of GHG emissions and energy demand. The IMO regulates only international shipping. On the basis of the data in the Third IMO GHG Study[1] and the Fourth IMO Greenhouse Gas Study,[2] we can estimate that, of the total emissions released by the shipping industry globally every year, approximately 70% comes from international shipping and approximately 30% from domestic shipping. By combining the data collected in the Fourth IMO Greenhouse Gas Study and the data on fuel consumption reported by the IMO Data Collection System for the years 2019, 2020 and 2021, we can estimate that, in 2021, the quantity of emissions from ships under the scope of the IMO was approximately 814 million tonnes of CO_2 equivalent on a WTW basis and 8.8 EJ in energy demand.[3]

We project these values to 2050 by using a trade growth scenario assumption as modelled in our in-house transition simulation model, NavigaTE[4] — which is based on knowledge and insights from experts at Maersk Mc-Kinney Moller Center for Zero Carbon Shipping (MMMCZCS) — and calculate the levels of reduction in GHG emissions required to meet the 2030 and 2040 checkpoints as well as the final ambition for 2050. We then translate these values into an estimate of energy based on a very low-sulfur fuel oil (VLSFO) equivalent to understand how much fossil energy consumption must be avoided to meet the checkpoints. These estimates, in terms of avoided energy consumption from fossil fuels in each selected year, can be seen in Table 2:

Table 2: Estimated fossil fuel energy consumption that needs to be avoided at each checkpoint year and the final 2050 target

Year	Avoided fossil fuel energy consumption
2030	2.6 - 3.6 EJ
2040	8.3 - 9.2 EJ
2050	12 EJ

In terms of the 2023 IMO GHG Strategy, it would seem that reaching the two ambitions for 2030 (uptake of zero or near-zero GHG energy and decrease in carbon intensity of shipping) would sufficiently reduce GHG emissions to get the industry to 20-30% lower levels than in 2008, thereby meeting the indicative checkpoint. However, this may not be the case.

We made a top-down calculation on the assumption that the industry will meet the intended levels of ambition. Our assumptions are as follows:

Energy uptake: We use VLSFO equivalency as a base to calculate the amount of emissions or energy that needs to be replaced by zero or near-zero emissions fuels.

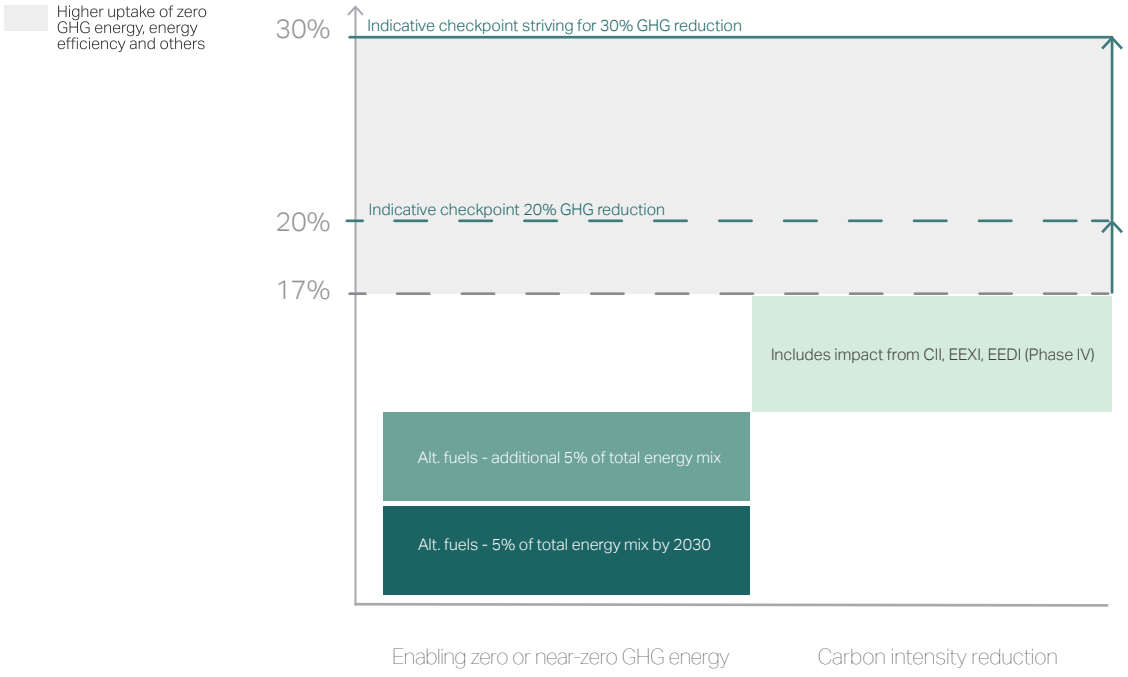
Carbon intensity: We assume that reaching the carbon intensity ambition would negate the increase in emissions due to trade growth projections from 2022 to 2030. By analyzing the results of the Fourth IMO GHG Study, we can see that trade increased between the years 2008 and 2018, while absolute emissions have been fairly stable and carbon intensity decreased in the same period.[5] Thus, while it is optimistic to assume that future emissions growth will be flattened, this assumption provides a baseline for understanding interactions between the strategy's checkpoints and levels of ambition.

[1] Third IMO Greenhouse Gas Study, International Maritime Organization, 2014.
[2] Fourth IMO Greenhouse Gas Study, International Maritime Organization, 2020.
[3] Note that in our Maritime Decarbonization Strategy (2022), we used the global shipping industry as scope, resulting in a higher energy demand.
[4] Navigate Explainer, Maersk Mc-Kinney Møller Center for Zero Carbon Shipping, 2023.
[5] Fourth IMO Greenhouse Gas Study, International Maritime Organization, 2020.

Based on these two assumptions, our calculation shows that meeting both the energy uptake and carbon intensity targets would result in a GHG emissions reduction of approximately 17% by 2030 with respect to 2008 levels. The indicative checkpoint for 2030 is a 20% reduction compared to 2008, striving for 30%. Therefore, based on our assumptions, the industry will fall short of the target by between 3 and 13 percentage points.

In this case, the shipping industry would need to reduce or convert to zero or near-zero emissions an additional amount of approximately 30 million tonnes of VLSFO-equivalent energy to meet the striving indicative checkpoint of 30% in 2030. This means that simply meeting the two levels of ambition currently in the strategy will not necessarily guarantee that the industry can deliver on the 2030 GHG indicative checkpoint.

Figure 1: The projected cumulative impact of different regulatory measures on reaching the 2030 indicative checkpoint.



The question now arises as to how Member States and the industry can meet the indicative checkpoints of 2030 and 2040.

One of the answers for the Member States is the IMO's mid-term GHG reduction measures, which are currently being developed. They may include economic measures such as GHG pricing or feebate mechanism, and technical measures such as GHG fuel standard. The IMO is conducting a comprehensive impact assessment to evaluate the measures and will release an interim report at MEPC 81. The measures are to be approved by MEPC 83 in 2025, adopted at the extraordinary MEPC meeting in 2025, and enforced in 2027.

Hence, when the IMO Member States are developing their approaches, they should focus on all elements of the strategy — level of ambition, indicative checkpoints, short-term GHG reduction measures, and mid-term GHG reduction measures — and not just on individual aspects of the strategy in isolation.

For the shipping industry, the answer lies in further action and investments in sustainable technology, as outlined in the next section.

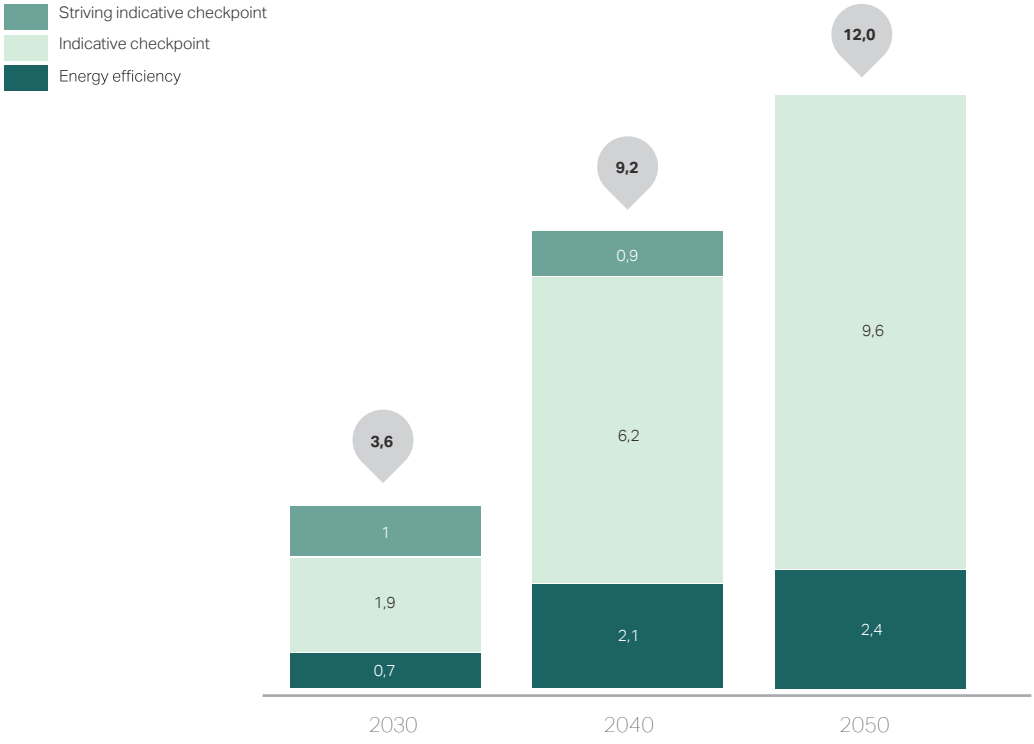
03 Smart investments bring huge savings

To meet the checkpoints outlined in the IMO 2023 GHG strategy, the shipping industry will have to switch to zero or near-zero GHG energy and accelerate the wider adoption of energy efficiency measures. In this section, we estimate the quantity of sustainable fuels and the level of energy efficiency that the industry will require to be able to meet the defined indicative checkpoints for 2030 and 2040 and the net-zero target for 2050. This paper follows the indicative checkpoints because of their higher stringency compared to the ambition levels, especially for 2030.

Using calculations from NavigaTE, and assuming mid-term measures are enforced in 2027, we can estimate that the amount of energy saved through technical energy efficiency (excluding other operational measures such as speed reduction) will reach 0.7 EJ in 2030, 2.1 EJ in 2040, and 2.4 EJ in 2050 (Figure 2, teal bar segments). This will not be sufficient to reach the reductions in fossil fuel energy consumption required by the indicative checkpoints and final net-zero target (Table 1). This gap, visualized in Figure 2, will have to be filled by additional energy efficiency improvements, adoption of sustainable fuels, and/or trade reduction and optimization.

Working with the NavigaTE model, we can project the fuel mix towards 2050 based on (1) the current assumptions developed by the MMMCZCS and explored in our 2021 Industry Transition Strategy,[6] and (2) the hypothesis of mid-term measures being implemented as soon as 2027.

Figure 2: Estimated energy demand (in EJ) that must be met using zero- or low-GHG emissions energy to meet indicative checkpoints for 2030, 2040, and 2050.



[6] We show the world it is possible: Industry Transition Strategy, Mærsk Mc-Kinney Møller Center for Zero Carbon Shipping, 2021.

Based on the numbers in Figure 3, the hypothesis that the remaining energy (on top of that saved through energy efficiency) will come from sustainable fuels, and the fuel mix predicted by NavigaTE towards 2030 as a baseline, we can say that if the industry focuses on individual fuel pathways to reach the checkpoints for 2030, then it will have to invest around 200-300 billion USD in fuel production.

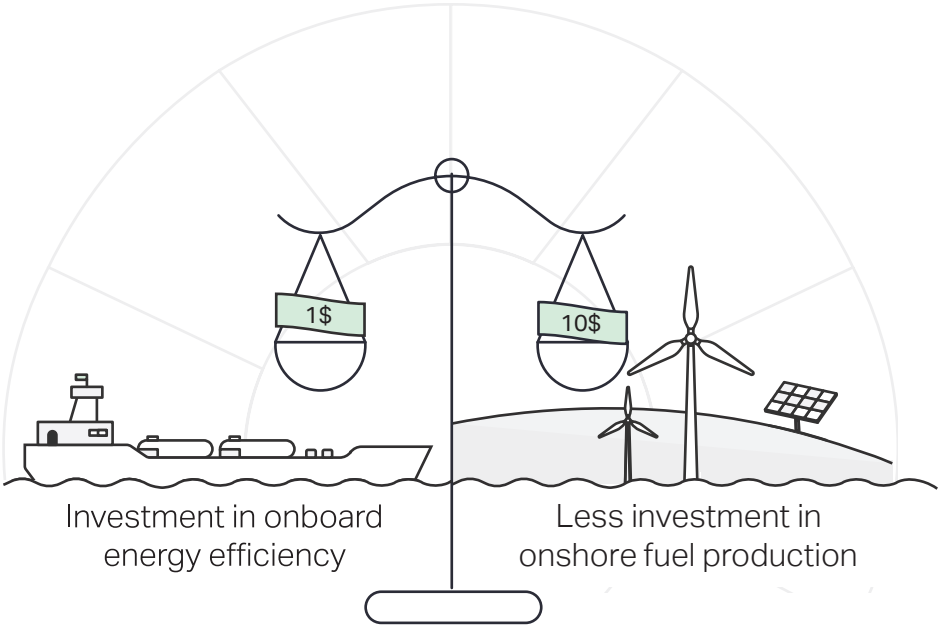
However, the industry can lower the cost of transition if it also invests in onboard energy efficiency. One of the main reasons for this is the energy loss that occurs from the time the energy is produced until it is used to propel the vessels: 1 EJ saved on the propeller escalates to approximately 4 EJ less energy needed to be generated upstream. This results in savings in the costs of building and operating the production units.

When vessels are energy-efficient, the demand for sustainable fuels will reduce. This, in turn, will reduce the need to build production plants, thereby saving on costs. Our calculations show that an improvement in energy efficiency of the world fleet would require CapEx investment of double digit billion USD in energy efficiency measures on board vessels, while yielding fuel production cost savings of up to a factor of 10 higher, in the early stages of the transition, i.e., towards 2030. In the long term, the ratio reduces but should still remain above a minimum threshold of 1 to 4, i.e.,1 USD invested in Energy Efficiency would yield 4 USD less invested in fuel production.

In other words, from an industry transition perspective, policy makers and industry should prioritize the implementation of energy efficiencies, while still promoting the uptake of sustainable marine fuels production, as this will reduce the total required investment in onshore fuel production significantly.

It is important to note that the transition will require vessels to be equipped with engines capable of burning sustainable fuels. The regulatory process in the IMO is set to implement measures to bring its 2023 GHG strategy into action as soon as 2027. With vessels having a lifespan of about 25 years, this means that vessels which are now beginning to start operations will be a part of the industry transition towards net-zero in 2050. The revised strategy is a sign for the entire industry that the business case for all new vessels must account for a future where they will have to be able to run on sustainable fuel. Vessels hitting the water must be either dual-fuel or capable of being retrofitted in the near future.[7]

Figure 3: The investment opportunity for onboard energy efficiency towards 2030.



[8] Preparing container vessels for conversion to green fuels, Maersk Mc-Kinney Møller Center for Zero Carbon Shipping, 2022

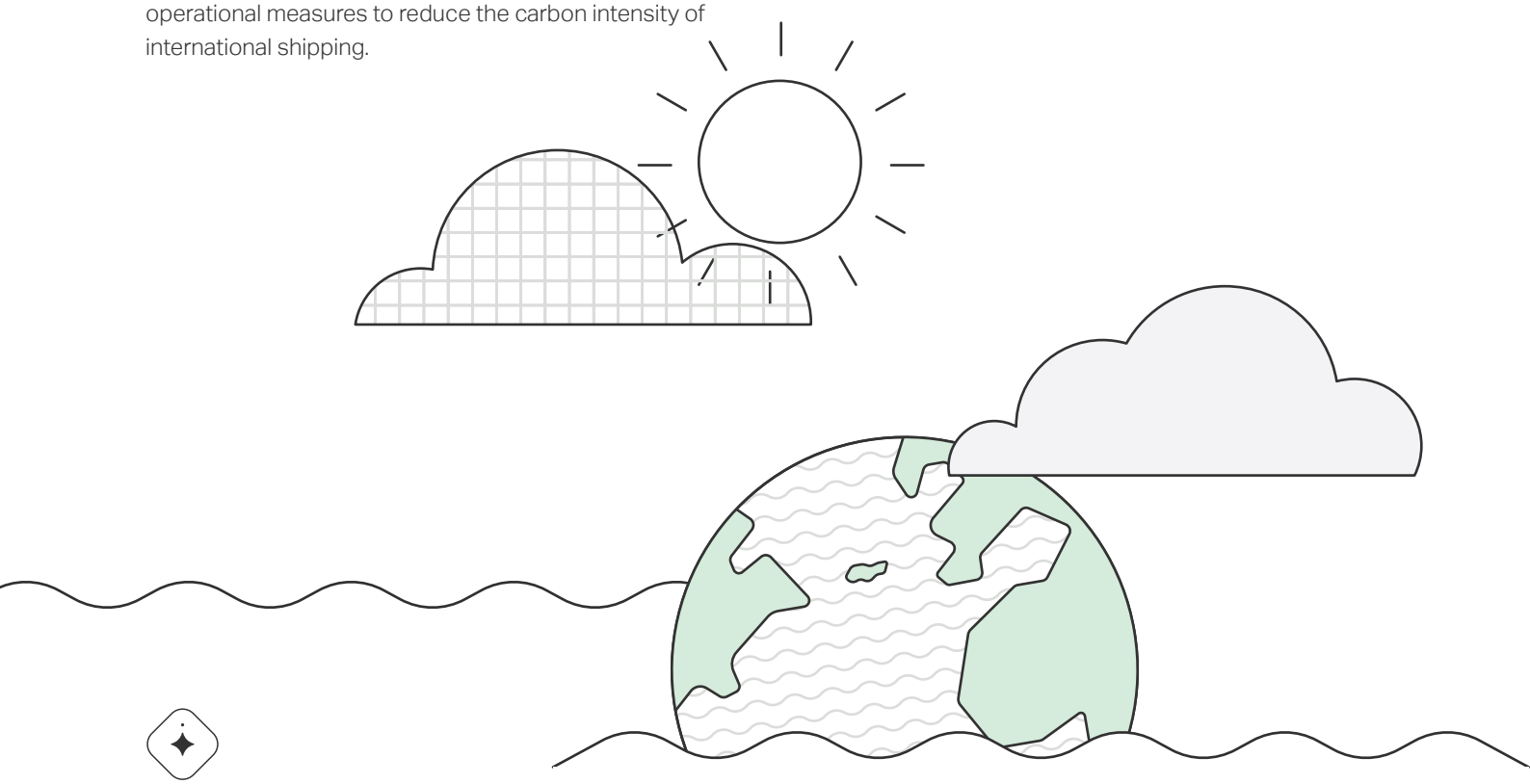
04 Conclusions

With the revised 2023 IMO GHG Strategy, the IMO Member States have taken an ambitious step towards reducing GHG emissions from international shipping and achieving net-zero by 2050. We must come together as an industry, embrace this strategy, and ensure that we deliver on the numbers. As our calculations indicate, this is not going to be an easy task. Both the investment needed and the amount of energy that will have to be switched from fossil energy to sustainable sources are substantial. The industry needs to revisit its business models to ensure that the assets that will be put on water from now on will be able to survive a future where vessels will not be allowed to sail on fossil fuels.

The industry also needs to enable new business models that will focus on increasing the uptake of sustainable fuels and on investing in energy efficiency on board vessels. The mid-term measures, which will be finalized and agreed on by the IMO Member States by 2025, and the revised short-term measures, which will be finalized by January 2026, will play a key role in enabling these new business models. The mid-term measures are expected to include the basis of a maritime GHG emissions pricing scheme and a marine fuel standard regulating the phased reduction of the marine fuels' GHG intensity. The revised short-term measures will reinforce technical and operational measures to reduce the carbon intensity of international shipping.

IMO Member States should thus focus on fulfilling the entire strategy by developing holistic approaches that include both short-term and mid-term measures. Together, these measures will enable them to meet the level of ambitions for energy efficiency and the uptake of fuels so that they can achieve the needed GHG reductions in 2030, 2040, and 2050.

On a similar note, the shipping industry should take both the short-term measures and the mid-term measures into consideration while revisiting their existing business models. The IMO's decision to unanimously revise its earlier strategy and aim for net-zero by 2050 proves that the organization is committed to its goal and to developing the measures needed to attain it. The industry needs to recognize the urgency of the situation and build business cases for investing in fuel production and energy efficiency on board vessels. The investment needed now may be substantial, but not stepping up now may prove to be even costlier.



05 Project team

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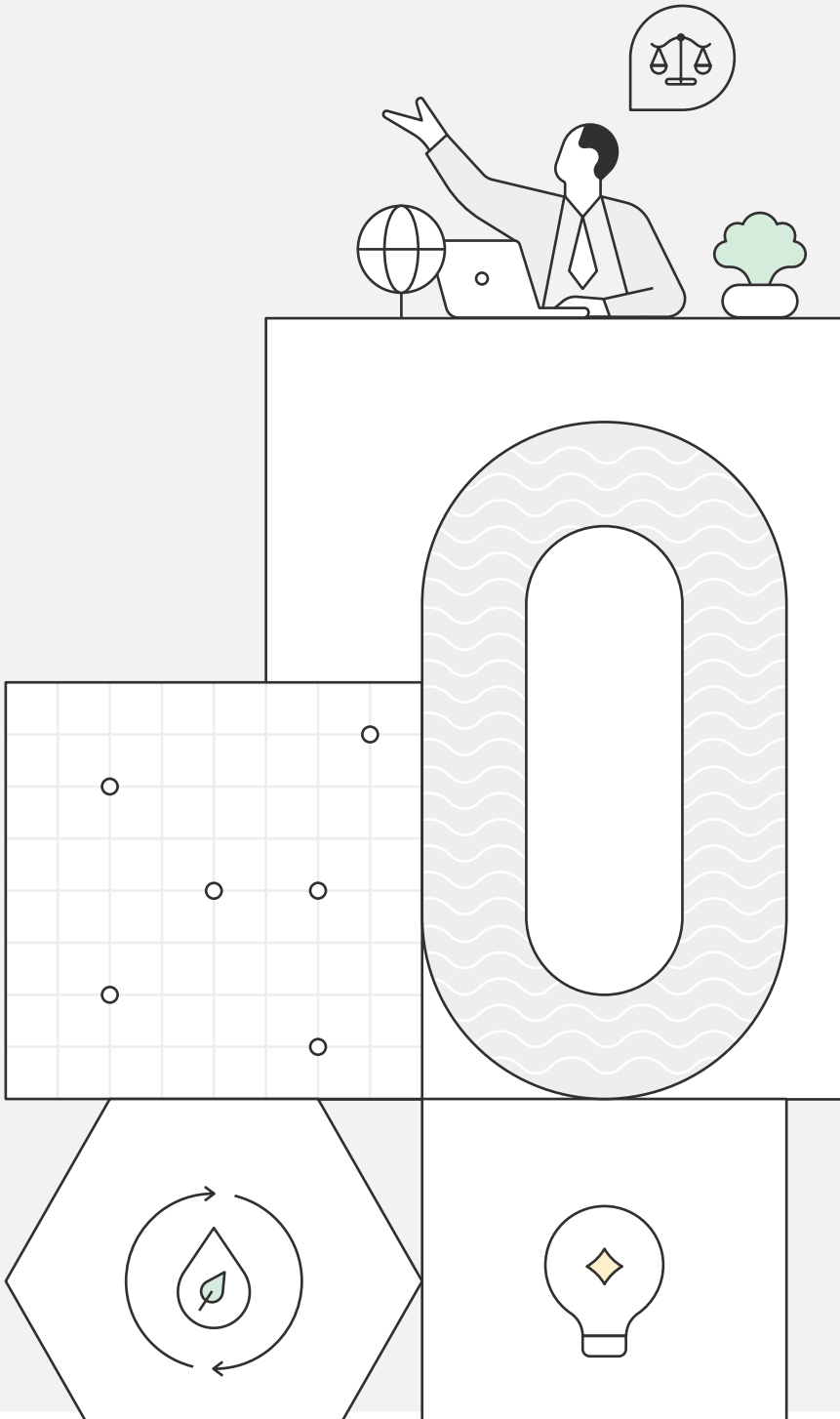

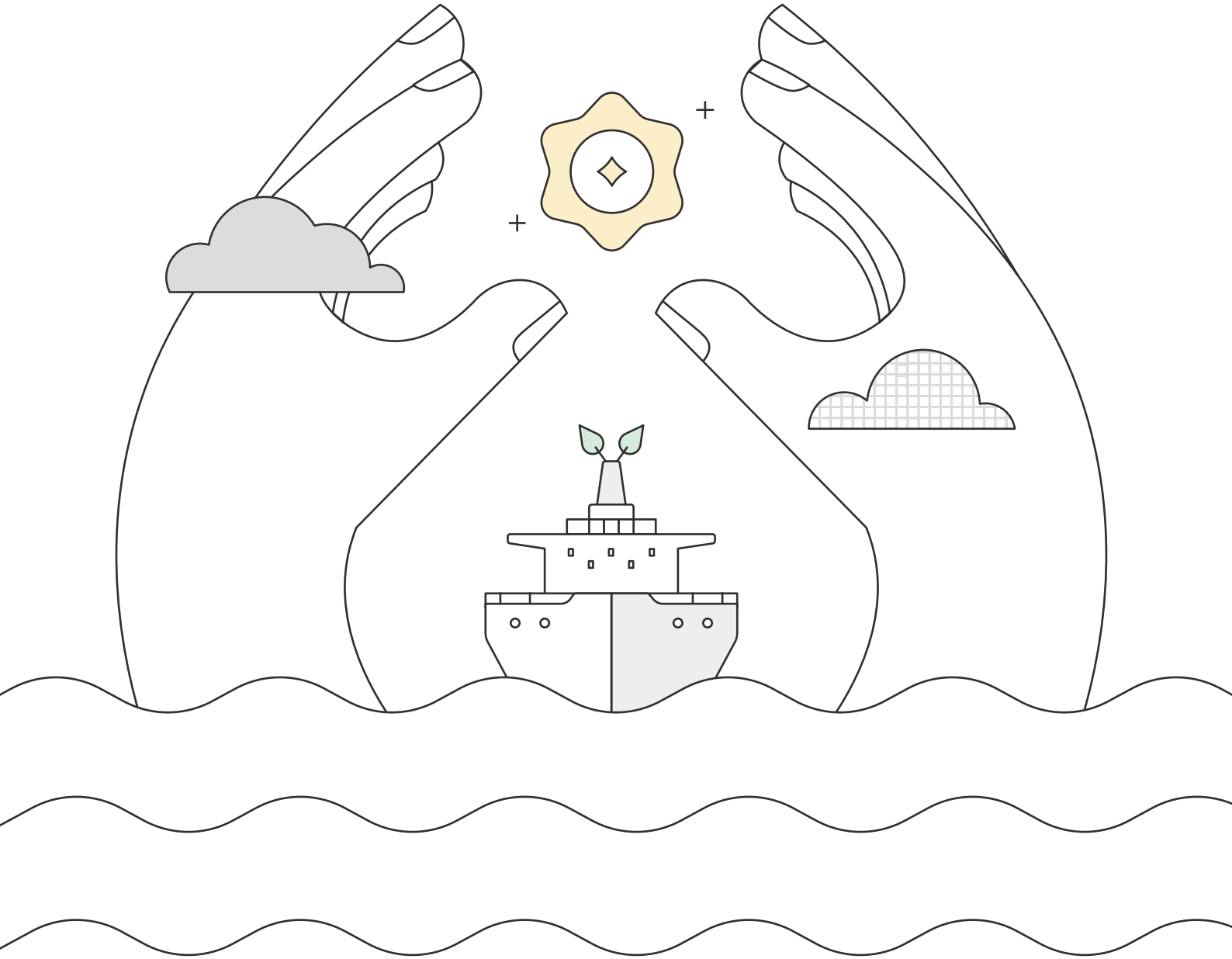

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