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A large container ship is shown from a low angle, moving across a body of water. The ship's deck is filled with stacks of colorful shipping containers. The water is calm, and the sky is a soft, hazy orange, suggesting a sunrise or sunset. In the distance, a low-lying coastline with some buildings and trees is visible. A few small sailboats are scattered across the water.

**An overview of the
discussions from IMO's 83rd
Marine Environment
Protection Committee**

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The UCL Energy Institute hosts a world leading research group which aims to accelerate the transition to an equitable and sustainable energy and trade system within the context of the ocean. The research group's multi-disciplinary work on the shipping and ocean system leverages advanced data analytics, cutting-edge modelling, and rigorous research methods, providing crucial insights for decision-makers in both policy and industry. The group focuses on three core areas: analysing big data to understand drivers of historical emissions and wider environmental impacts, developing models and frameworks to explore energy and trade transition to a zero emissions future, and conducting social science research to examine the policy and commercial structures that enable the decarbonisation of the shipping sector. For more information visit www.shippingandoceans.com

Executive summary

The IMO's Marine Environment Protection Committee 83rd meeting has concluded with an agreement on a specification of mid-term measures designed to reduce emissions from the shipping sector and kick-start the energy transition. The meeting follows two working group meetings the previous week, on GHG (19th session of the Working Group) and Air Pollution and Energy Efficiency (APEE).

The meeting agreed to a new mid-term measures policy referred to as "net zero framework". The agreement was reached after Saudi Arabia called for a vote – 63 member states voted for, 16 against, with the decision threshold a simple majority. There is now the conventional 6-month period before the agreed amendment is considered for adoption at a meeting in October 2025 (a simple yes/no decision, expected to be favourable based on the positions taken at this meeting).

The agreement is genuinely momentous for shipping on a number of levels:

- If adopted, the regulation is global and legally binding. Countries can opt out, but international shipping servicing their country would still be under the regulation and enforcement through other countries.
- It sets the sector on a path to net zero in 2050, displacing fossil fuels such that they can be expected to be the minority energy source used by the sector within the next 15 years.
- The agreement sets a clear limit on the viability of Liquefied Natural Gas (LNG) as a marine fuel solution. This pathway now faces basic penalty fees within the next few years, and will face rapidly growing penalty fees from 2033. It is not looking like a competitive choice for newbuilding (e.g. ships ordered from now onwards)
- It implements a global price/levy on a portion of shipping's GHG emissions on a well-to-wake basis, rather than on all GHG emissions.
- The policy is estimated to generate approximately 11-12bn p.a. in the first 3 years, with potential for significant expansion in the subsequent years – though this will be the subject of review in 2030.
- The generated revenues should create benefits for the sector and for member states:
- It is likely that a portion of the revenues will be used to reward Zero and Near-Zero (ZNZ) GHG emission fuels
- Another portion will be used to contribute to "just and equitable transition" (JET), for example national level projects related to maritime and shipping's transition, but including climate protection, adaptation and resilience building.

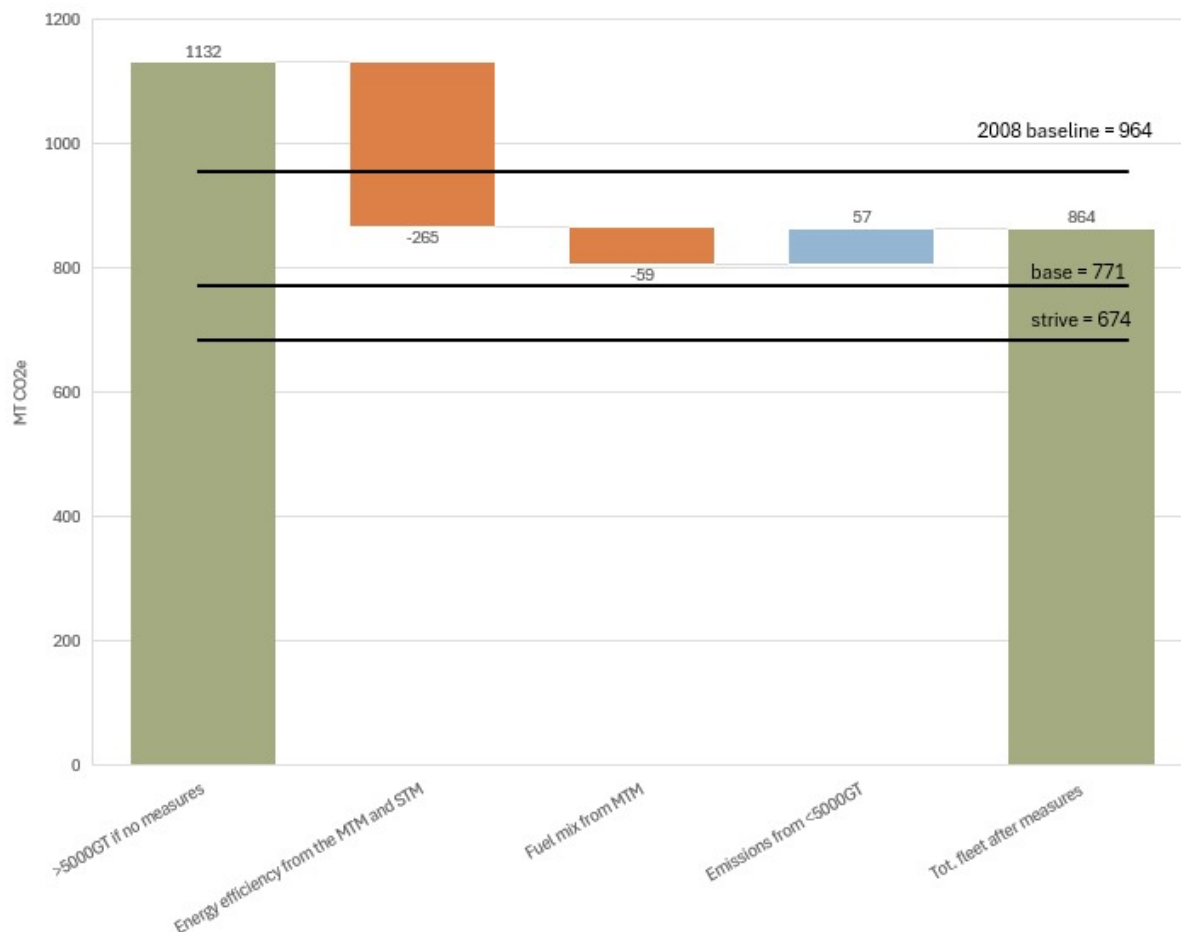
However, the outcome also falls short in the following ways:

- Taken in combination with the revision of IMO's short-term measures (carbon intensity indicators), which have been extended with new increases in stringency to 2030, the new policy is only expected to achieve approximately 10% absolute GHG emission reductions relative to 2008 GHG emissions. This is significantly lower than the 'at least 20%', 'striving for 30%' that the IMO committed to in the Revised Strategy in 2023.
- The policy measure's design is complex – a hybrid of a GHG price and a credit-trading scheme, with a strong link between the competitiveness of different compliance choices and the compliance option decision made by the private sector. This places a significant share of the investment risk for managing the transition onto the private sector, and as such increasing the transition cost.
- The levels of revenues expected from the current policy specifications are insufficient relative to the scale required to both support early adoption of ZNZ (expected needed through to 2035), and to fund just and equitable transition (JET), accounting for the needs of developing countries. Consequently, this revenue shortfall may create a competitive

tension between these two objectives, thus, increasing the likelihood that neither objectives can be achieved at a level sufficient for climate and equitability.

- As a result, this outcome is unlikely to independently drive as immediate and robust investment needed to drive long-run fuel solutions the sector urgently needs, if the solutions are to be globally available at the large volume required in the 2040's. For the sector, and therefore global trade to avoid high and or volatile future energy costs, other sources of finance and support will be needed during the 2030's.
- Countries with poor access to capital, high cost of capital or low state intervention or support will be late to invest in the solutions needed. A major risk now occurs that the future of shipping will, like renewable energy and battery electric vehicles, be significantly owned and driven by nations with strong industrial policy.

Reaching agreement of a policy as contentious and groundbreaking as this, in the multilateral system, and in the current geopolitical context, is a major achievement. However, in order to achieve the agreement on the amendment, much of the key detail has been passed for development in 'guidelines'. Guidelines are supporting documents that are adopted by resolution, likely over the next 2 years, prior to entry into force, expected in 2028. The full detail of risks and opportunities relating to all of the above points, will only become clearer once they are adopted. Further analysis of the implications of the outcome on investments



Estimated emissions from international shipping in 2030 based on agreed outcomes

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1 What was just agreed?

MEPC 83 is the culmination of a workplan to approve mid-term measures that essentially started in 2018, when the IMO adopted its initial strategy and set out an intent to develop mid-term measures – committing at that point to agree these measures between 2023 and 2030.

In 2018, the IMO was tentative about what those measures would constitute as indicated by language on the list of these potential measures such as “new/innovative emission reduction mechanism(s), possibly including market-based measures (MBMs), to incentivise GHG emission reduction”.

Seven years later, the IMO has not only revised its GHG ambition in the Revised GHG Strategy, adopted in 2021 an initial set of policy measures primarily related to efficiency improvements, and now agreed a momentous set of mid-term measures.

The mid-term measures as discussed in this meeting now employ a dual-target approach to assess and encourage enhancements in ships' GHG fuel intensity (GFI). The two targets become increasingly stringent over time (as shown in **Error! Reference source not found.**):

- Base Target Annual GFI: The minimum compliance threshold that all ships must achieve.
- Direct Compliance Target Annual GFI: A more ambitious target that is meant to incentivize early adopters and technology leaders.

These targets are based on reduction factors applied to a reference value that represents the average GFI of international shipping in 2008 of 93.3 gCO₂eq/MJ on a Well-to-Wake basis. The reduction percentages increase over time, requiring ships to continuously enhance their performance. Consequently, various compliance scenarios arise depending on a ship's performance. Three distinct scenarios can be anticipated:

Scenario 1: Direct Compliance (High Performance)

A ship achieves direct compliance when its annual GFI falls below the direct compliance target. When this occurs, the ship earns surplus units (SU) proportional to how much it exceeds the target. These surplus units become a valuable asset that the ship owner can use strategically. The ship has several options for managing these surplus units. The owner can choose to sell the surplus units, transferring them to underperforming ships that need them to meet their compliance obligations. Alternatively, the surplus units can be banked for future use (for up to 2 years), allowing the ship owner to save them in case the ship's performance or energy prices fluctuate in upcoming reporting periods. Another option is voluntary cancellation, where the owner decides to cancel the surplus units.

Scenario 2: Partial Compliance

A ship achieves partial compliance when its attained annual GFI exceeds the base target but does not meet the direct compliance target. In this case, the ship is categorized as having a “Tier 1 compliance deficit”, which indicates a moderate level of non-compliance that necessitates remediation. To rectify this deficit, the ship owner must pay into the IMO Net-Zero Fund by purchasing remedial units at the Tier 1 pricing rate, which is lower than the one for Tier 2 units (starting price of \$100/tCO₂e). This payment is a levy/price on GHG for this portion of its GHG emissions.

Scenario 3: Non-compliance (Underperformance)

A ship is deemed non-compliant when its attained annual GFI exceeds, or is higher than, the more lenient base target. In this situation, the ship incurs both a “Tier 1 compliance deficit” and a “Tier 2 compliance deficit”, indicating significant non-compliance that necessitates more substantial remediation. To address the “Tier 1 compliance deficit” the ship owner must acquire remedial units at the Tier 1 pricing rate, which contributes to the IMO Net-Zero Fund.

For the Tier 2 deficit, the ship has 3 options. First, the ship owner can pay a higher amount by acquiring remedial units at the elevated Tier 2 pricing rate. Second, the ship can purchase surplus units from ships that are over-compliant. Finally, if the ship has any accumulated surplus units from previous compliance periods, it may apply those to help satisfy the Tier 2 compliance requirement.

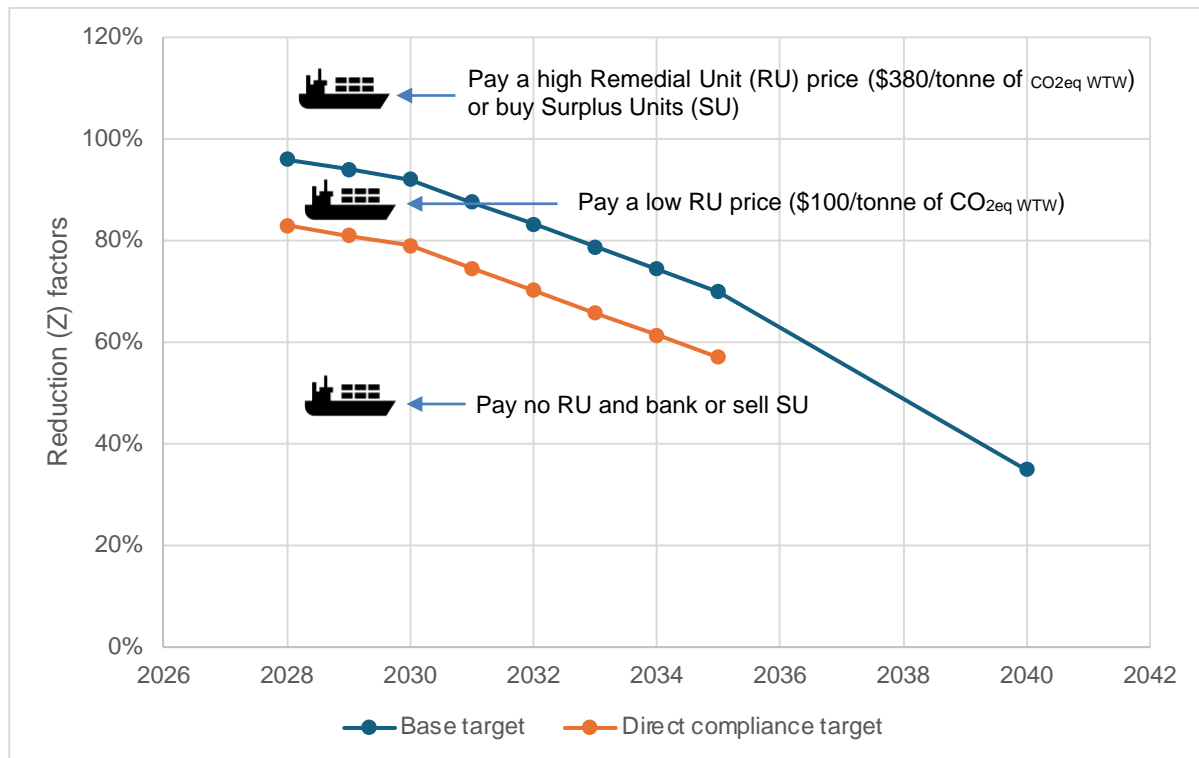


Figure 1: Illustration of Global Fuel Intensity and credit trading mechanism and reduction factors and prices agreed at MEPC 83

2 What are the expected emission reductions of the outcomes?

The IMO’s mid-term measures complement the short-term measures in driving GHG emission reductions in international shipping. The total saving is estimated to be around 10%, with an uncertainty of +/- 2% given a number of uncertain parameters in the GHG emissions projection.

- Emissions are expected to grow under “BAU” (e.g. no policy) scenario, this is because of expected growth in trade and therefore demand for shipping since 2008, taking into account the effect of market trends in efficiency since 2008.
- Emissions reductions relative to BAU are expected from the short-term measures due to the increasing energy efficiency and reducing carbon intensity. These reductions are estimated from the combination of EEXI and CII regulations (upgraded to 21.5% reduction on 2019 carbon intensity, in line with the latest amendment of MARPOL), leveraging calculations performed by DNV in the IMO’s MTM Comprehensive Impact Assessment (CIA).
- There is also an incentivisation of energy efficiency as a consequence of energy + GHG pricing effects e.g. the effect of the RU prices are essentially an increase in energy prices, which in turn incentivises efficiency. These are also estimated from the calculations in DNV’s work in the IMO’s MTM CIA.

- The new mid-term measures can also be expected to drive a change in the fuels used and their GHG intensity directly (in order to comply with the GFI). The emissions of the >5000GT once the mid-term measures are implemented are estimated based on scenario 24 of the CIA, inflated by the difference between the Z-factor corresponding to the GFI in scenario 24 (21%), and the base Z-factor agreed (8%).
- Ships <5000GT, which are not covered by the short-term and mid-term measures, represent 5% of the fleet's energy. Their emissions are assumed to increase in line with the CIA's BAU low growth scenario, inflated by the energy intensity improvements in 2030 from the short-term measures assumed in the CIA (19% in 2030), as those ships are not covered by the short-term measures.

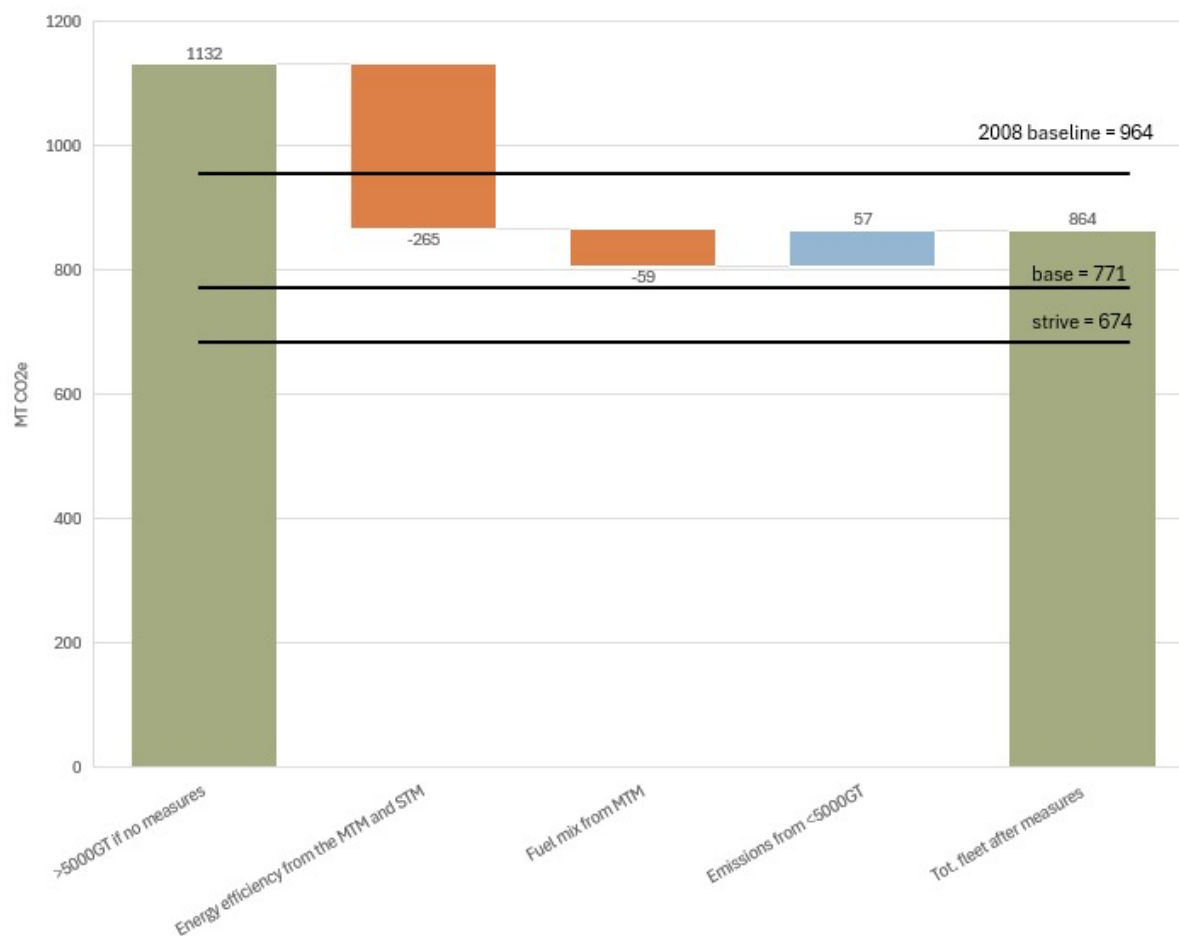


Figure 2: Estimated emissions from international shipping in 2030 based on agreed outcomes

There are multiple sources of uncertainty in this calculation including:

- The baseline GHG emissions – the value for the emissions in 2008 is estimated from the IMO's GHG study, and has to be modified to represent 'well to wake' GHG emissions
- An unknown overlap between the incentivisation of carbon intensity reduction by CII and the mid-term measures – both measures can incentivise the same action/solution and so may end up being double counted.
- There is an unknown magnitude of emissions associated with ships smaller than 5000GT. The IMO's website lists this value as 15% of total GHG emissions. However, estimates derived from AIS GHG inventories suggest this might be significantly below this level. These calculations have used a value of 5%.
- There is an unknown level of compliance relative to the CII measure's stringency (Z factors). There is currently a weak enforcement mechanism associated with CII, which makes level of compliance with the target unpredictable.

- The efficiency and fuel mix consequences of the new mid-term measures are uncertain and will depend on choices and prices. The assumption behind these calculations is that ships comply with the Zbase trajectory, if significant portions of the global fleet choose not to do this but instead continue using conventional fuels and pay the penalty fee, the achieved emission reduction will be less.

In combination, these changes all mean that the estimated GHG reduction from this calculation is conservative and may be significantly less – or even result in rising emissions. Relative to the magnitudes of the IMO Revised Strategy checkpoints - ‘at least’ 20% reduction in 2030, ‘striving for’ 30% reduction, this represents significant misalignment.

Further work, and analysis using measured data from DCS, and particularly the 5th IMO GHG Study, expected in later 2020’s, will be important for clarifying some of these sources of uncertainty and estimating the likely outcome in 2030, and any corrections to policy parameters that will be needed to address any shortfall.

3 What are the energy transition implications of the outcome?

The IMO’s Revised Strategy objectives for the mid-term measures include “effectively promoting the energy transition of international shipping”.

E-fuels (fuels produced solely from renewable energy sources, such as green ammonia) are expected to dominate the future energy mix (in the 2040’s). They can be scaled to meet the total energy demand of international shipping (approximately 250 million tons of fuel today), and if they are produced, stored, and used correctly, they can operate with zero (or near-zero) GHG emissions.

There are also several alternative energy sources and technologies, apart from current technologies and fossil fuels, that reduce GHG intensity. However, they are either unscalable or unable to achieve zero (or near-zero) GHG emissions levels, which will be necessary by around 2050.

Ideally, the IMO’s mid-term measures should carefully manage the early adoption of e-fuels while minimizing the overall cost of transition, addressing evolving fuel availability, and managing the risk of over-investment or dependence on these lower GHG intensity solutions, considering their potential for only a temporary role in shipping decarbonization.

A recent study by UMAS and UCL¹ found that under a ‘credit trading only’ policy scenario, and assuming no reward mechanism or means of generating sufficient (high) revenues, IMO’s measures are currently unlikely to lead to competitive use of e-fuels before the 2040s. A combination of fossil fuels (including LNG), biofuels and CCS would be most competitive until up to 2036, thereafter ammonia dual fuel ships would be the lowest cost solution, albeit operating on blue ammonia until the 2040’s.

Ships that are more competitive during the period from 2027 to 2035 will incur at least a 25% higher total cost of operation beginning in 2040, increasing the risk associated with the transition. For instance, if shipowners order tonnage to maximize competitiveness over a short time frame (e.g., looking only about five years ahead), the sector faces a risk of technology

¹ Aymer and Smith (2025) How IMO mid-term measures might shape shipping’s energy transition final <https://www.shippingandoceans.com/post/only-targeted-subsidy-for-e-fuels-coupled-with-a-ghg-levy-would-ensure-e-fuel-early-adoption>

lock-in, potential for greater volatility in asset values (stranded assets), and exposure to higher transport costs. This is also a finding in the IMO's CIA Task 2.

Conversely, the study found that a GFS combined with a levy and an e-fuel reward mechanism would ensure that e-fuels remain competitive with other forms of GFS compliance from 2027 onwards, facilitating early adoption.

In practice, the measure parameters adopted include:

- A hybrid of these two policy options – a credit trading scheme in combination with a price/levy mechanism.
- A total revenue expected to generate approximately 11-12bn p.a. in the first 3 years, with potential for significant expansion in the subsequent years – though this will be the subject of review in 2030. This total revenue is significantly lower than any of the policy scenarios modelled so far (e.g. a \$30 and \$150 universal levy), so will need further analysis to understand the volumes of ZNZ use it might be able to support and what the implications are to investment decision making.
- A 2040 GFI limit (Zbase), for reductions in GHG intensity of at least 65% e.g. clarity that in the long-run there will be a rapidly diminishing business case for incremental solutions and rapidly improving business case for very large volumes of ZNZ's.

3.1 ZNZ implications

It is very positive for ZNZ early adoption, that there is a stable revenue collection mechanism (the levy), significant potential for high priced credits for Zdirect compliance, and a ZNZ reward mechanism proposed.

However, the draft amendment includes a ZNZ definition that is not pathway specific (for now) but instead limits ZNZ's to fuels which have a GHG intensity of less than 19gCO₂e/MJ. This is currently a technology agnostic definition, and until this has been clarified in further work on guidelines (defining how rewards will be allocated), it will remain unclear as to how it might affect different fuel options and their business cases.

The organisation has adopted a ZNZ definition before it has finalised its LCA guidelines. Therefore it remains hard to know in advance which specifications of projects might be likely to be assessed favourably relative to that threshold, but also how different fuel options (both different molecules and different production pathways) will be assessed and therefore competitive relative to each other.

As a result both of the agnosticism in the ZNZ definition and the level of revenues, this outcome is unlikely to independently drive the immediate and robust investment needed to start capital flowing into the long-run fuel solutions the sector urgently needs, if the solutions are to be globally available at the large volume required in the 2040's.

The policy does signal positively towards the most competitive ZNZ projects globally – given the long-run, and will hopefully have a strong beneficial effect on the volumes of ZNZ production FID's (financial investment decisions), a key metric to indicate the likelihood of future fuel/energy availability. However, many may also now wait and watch the guidelines development process

3.2 LNG and Biofuels

The agreement sets a clear limit on the viability of Liquefied Natural Gas (LNG) as a marine fuel solution. This pathway now faces basic penalty fees within the next few years and will

face rapidly growing penalty fees from 2033. It is therefore not looking like a competitive choice for newbuilding projects (e.g. ships that are being ordered at this point in time) and the existing vessels will now likely face residual value consequences (e.g. a version of stranded asset risk).

Many will argue that LNG will be able to continue to operate on bio-methane and synthetic methane, and use this as a basis for justifying existing investments. However there is a broad consensus in analysis and models of future fuel prices, that these variants of methane are unlikely to be competitive choices relative to the ammonia pathway, or even conventional oil-equivalent biofuels.

Biofuels will have a good short-run role, but their relative performance in the longer term is unpredictable, given the constraints on their supply and the multiple sources of demand that will affect their price and competitiveness within the shipping sector.

The policy measure's design is complex – a hybrid of a GHG price and a credit-trading scheme, with a strong link between the competitiveness of different compliance choices and the compliance option decision made by the private sector. This places a significant share of the investment risk for managing the transition onto the private sector, and as such increasing the transition cost.

4 What are the just and equitable transition implications of the outcome?

Revenue generated by the IMO Net-Zero Framework, as outlined in Regulation 41 (Disbursement of Revenue), is allocated by the IMO Net-Zero Fund. The Fund is designed to use the collected revenue for various purposes. First, it provides annual rewards for ships that utilize zero or near-zero GHG emissions technologies, fuels, or energy sources (as defined in the Framework). Second, a "sufficient" portion of the fund is dedicated to promoting a just and equitable transition, particularly for developing countries, especially SIDS and LDCs. More specifically, the collected funds aim to assist countries – particularly those in need of extra support – in transitioning to cleaner shipping. This includes environmental protection, tackling the impacts of climate change, and empowering nations to bolster their resilience against future challenges. Thus, the funds will be allocated to five different purposes, including the development and rollout of low- and zero-emission technologies, maritime infrastructure, and a fair transition for the maritime workforce. It also promotes knowledge sharing, capacity building, and National Action Plans while covering administrative costs and ensuring relief for those that suffer from a disproportionately negative impact.

Generally, this language suggests a welcome continuation of the idea of a just and equitable transition that flows from the revised strategy into the Net-Zero Framework. However, some shortcomings could jeopardize a fair and equitable transition for all. The language in the regulation makes it very clear that there is a limit to "boundaries of the energy transition in shipping". While it is not defined what the boundaries of the energy transition in shipping include, it suggests that revenues cannot be used to address, for example, climate change-induced negative effects more generally. Though the arguably biggest risk to a just and equitable transition is that with an anticipated revenue of around \$10 to \$15 billion and an estimated initial (e.g. early 2030's) need of \$12 to \$24 billion for fuel rewards if zero/near-zero (ZNZ) adoption occurs, there is a trade-off between allocating funds for ZNZ rewards and other revenue distributions that support a just and equitable transition. However, if ZNZ adoption and use does not happen due to other investment limitations, it would also impact the distribution of revenue.

All countries will face an increase in transport costs, due to the regulation. As shown in Figure 3. However, with uncertain quantities of revenues, and uncertainty in the magnitude of the transport cost increase and subsequent economic impact, it is not clear how these will be addressed. Further monitoring and analysis of impacts will be important.

The inclusivity of this transition is also hard to guarantee. Countries with poor access to capital, high cost of capital or low state intervention/support will be later to invest in the solutions needed. A major risk now occurs that the future of shipping will, like renewable energy and battery electric vehicles, be significantly owned and driven by nations with strong industrial policy.

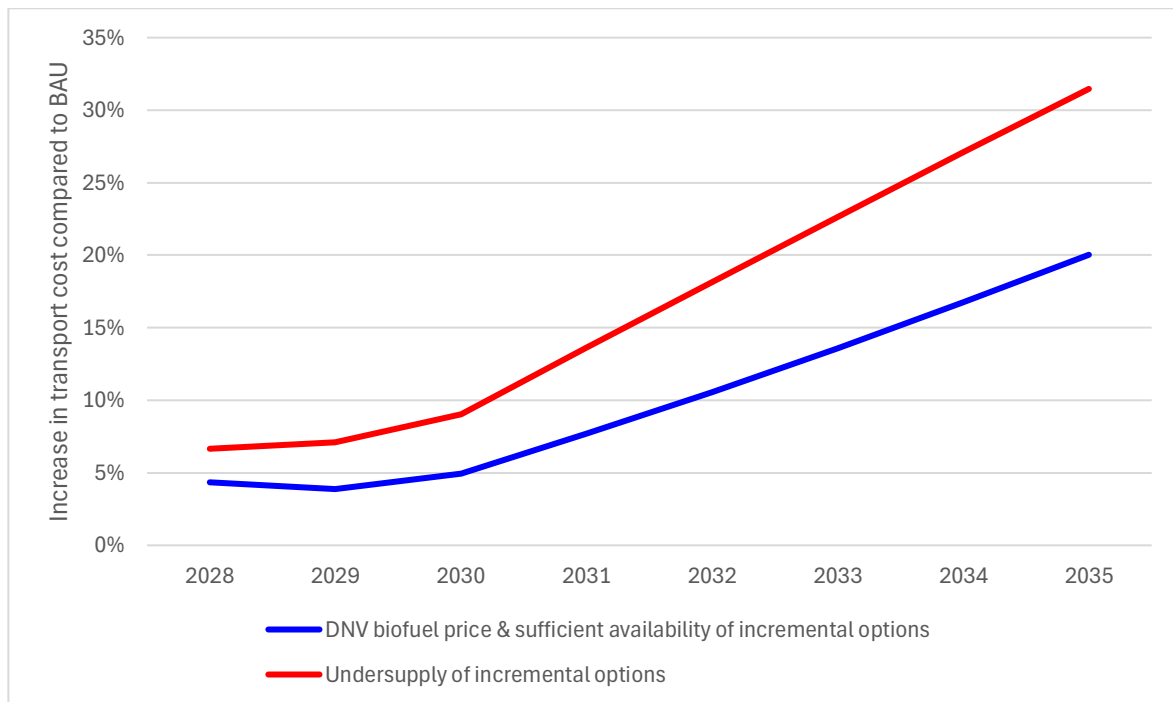


Figure 3: Modelled impact on transport cost compared to BAU

- Based on the method described²
- The blue line corresponds to a scenario where sufficient incremental options, either as drop-in or traded in SU (biofuels, LNG, wind) are available for the fleet to operate on the base trajectory or buy SU up to the base trajectory. We use DNV biofuel price as UMAS biofuel prices are higher than the upper RU price.
- The red line corresponds to a scenario where the incremental options are in undersupply. The marginal cost of abatement and the SU price would then increase to their ceiling, i.e. the upper RU price, and many ships would likely be undercompliant and pay for the upper RU price.

² <https://www.shippingandoceans.com/post/effectively-promoting-the-energy-transition-and-contributing-to-a-just-and-equitable-transition>

ucl.ac.uk/bartlett/energy/research/shipping

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