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FuelEU Maritime: Proposed Modification for the Non-Compliance Penalty Calculation

The European Union (EU) has implemented a tougher than IMO emission intensity indicator requirement for shipping. Under the FuelEU Maritime regulations a penalty applies where vessels are non-compliant to set greenhouse gas emission limits. In this Policy Briefing we outline why the penalty calculation is problematic – that it introduces distortions and undermines regulation objectives.

SUMMARY

FuelEU Maritime penalty calculation for non-compliance is problematic.

The current formula calculates a penalty that is weaker for higher emitters, causes unequal treatment of the same deficit, and complicates the pooling mechanism.

Proposed modification is to replace Actual GHG Intensity with *Target GHG Intensity* in the penalty calculation formula.

For the UK Government, in the expected fuel standard consultation and implementation, we recommend that such distorting effects are avoided rather than harmonising with the EU.

BACKGROUND

In the absence of an internationally agreed decarbonisation framework to remove greenhouse gas (GHG) emissions from the shipping sector, the European Union (EU) have introduced regulations effective from 1 January 2025 called "FuelEU Maritime" (Regulation (EU) 2023/1805). These require commercial ships operating in the EU/EEA (European Economic Area) to monitor the whole lifecycle (referred to as "Well-to-Wake", or WtW) GHG emissions of the fuels they consume over a calendar year. This is used to calculate each vessel's GHG Intensity Indicator.

This year (2026) is the first in which vessels will be required to calculate their GHG Intensity Indicator for fuels consumed in 2025.

GHG INTENSITY INDICATOR

To comply, it must be demonstrated that a vessel's GHG intensity is below limits specified in the FuelEU Maritime regulations. These limits become progressively tougher over time and the reductions applied are in Table 1.

Table 1. GHG Intensity Indicator Limits

Period	2025-2029	2030-2034	2035-2039
Reduction	2%	6%	14.5%
Period	2040-2044	2045-2049	2050+
Reduction	31%	62%	80%

The Target GHG Intensity limits are based on a reference value for the conventional fuel Very Low Sulphur Fuel Oil (VLSFO) of 91.16gCO_2eq/MJ[1]. For example, the Target GHG Intensity limit in the period 2025-2029 is 91.16x0.98= 89.34gCO_2eq/MJ.

The greenhouse gas emissions that are included in intensity calculations are carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O) on a Well-to-Wake (WtW) basis. This extends the basis for the IMO's short term measure the Carbon Intensity Indicator (CII). CII considers only CO_2 and only for fuel consumed on board the vessel (referred to as "Tank-to-Wake" or TtW).

The calculation of a vessel's Actual GHG Intensity is broadly straightforward. It is the ratio of total greenhouse gas emissions measured in CO_2 equivalents (100-year CO_2 equivalent factors for CH_4 and N_2O are 25 and 298

[1] gCO2eq/MJ = grammes of carbon dioxide equivalent per megajoule

respectively), to the fuels consumed over a calendar year measured in joules of energy.

Reward factors apply for the use of Renewable Fuel with No Biological Origin (RFNBOs) e.g. electro-fuels like green hydrogen and ammonia, and Wind Assisted Propulsion Systems (WAPS).

This policy briefing, however, questions the calculation of the penalty payments under the FuelEU Maritime regulations.

PENALTY PAYMENT

Calculation

Vessels are deemed non-compliant when the Actual GHG Intensity exceeds Target GHG Intensity. The penalty for non-compliance is 2,400 euros per tonne of Very Low Sulphur Fuel Oil (VLSFO) equivalent with an energy density value of 41 MJ/kg.

The penalty formula is shown in Equation 1.

Equation 1. Penalty Calculation

$$\text{Penalty[EUR]} = \frac{|Compliance\ Balance|}{Actual\ GHG\ Intensity} \times \frac{2{,}400\ EUR/tfuel}{41{,}000\ MJ/tfuel}$$

Compliance Balance is the difference between the Target GHG Intensity and the Actual GHG Intensity times the energy used. The negative sign is removed in the penalty calculation.

The Problem

The aim of Equation 1 is to calculate the penalty in terms of benchmark VLSFO equivalence, since VLSFO is used to set the GHG Intensity Indicator limits.

We argue that the use of the **Actual GHG Intensity** in the calculation is problematic and introduces distortions.

The existing formula penalises the non-compliance balance in terms of the vessel's actual energy rather than the compliant energy. This will create inconsistent penalties for vessels with different fuel consumption types. The dirtier the vessel, the cheaper each excess tonne of CO_2 becomes in penalty payment terms. The mechanism for pooling vessels for the purpose of calculating compliance becomes overcomplicated too. Overall, it weakens the objectives of the FuelEU Maritime regulation.

Modification

We propose instead that the **Target GHG Intensity** is used in the denominator of the penalty calculation.

The proposed penalty calculation is shown in Equation 2.

Equation 2. Proposed Penalty Calculation

$$\text{Penalty[EUR]} = \frac{|Compliance\ Balance|}{\boldsymbol{Target\ GHG\ Intensity}} \times \frac{2{,}400\ EUR/tfuel}{41{,}000\ MJ/tfuel}$$

Replace the denominator in the left-hand part of the penalty calculation with the **Target GHG Intensity**.

Justification:

- If non-compliant then the Actual GHG Intensity will be greater than Target GHG Intensity and Equation 1 results in calculating a penalty that is too low
- Using the Target GHG Intensity ensures consistency across vessels so that the same deficit will incur the same penalty, avoiding weaker penalties for high emitters
- The pooling mechanism can function more simply without the requirement "*The total pool compliance balance must be positive or zero*"
- More appropriately calculate the compliance deficit against VLSFO equivalence and improve the transparency in FuelEU Maritime surcharges.

It should be noted too that as the targets tighten in subsequent 5 yearly periods insufficient levels of penalty payment on the current basis will worsen over time.

WORKED EXAMPLES

Case 1. Single Vessel

For the year 2030 FuelEU Maritime sets a target GHG intensity reduction of 6% from the baseline of 91.16 gCO_2eq/MJ i.e. 85.69gCO_2eq/MJ of fuel consumed. If a vessel's actual GHG intensity reduction compared with VSLO is less than 6% a non-compliance penalty is incurred.

We provide an illustration of a comparison between the existing penalty calculation, Equation 1, and the proposed penalty calculation, Equation 2.

This is based on an annual fuel consumption for 2030 of 193,500,000 MJ, as used in the European Commission's guidance document. We consider a range of achieved reduction in GHG intensities between 1% and 5%. The resulting non-compliance penalties are shown in Table 2.

Table 2. Non-Compliance Penalty Comparison between existing (Eqn 1) & proposed (Eqn 2)

Reduction	Eqn 1 (€)	Eqn 2 (€)	Diff. (€)
5%	119,230	120,498	1,268
4%	235,976	240,996	5,020
3%	350,314	361,495	11,181
2%	462,319	481,993	19,674
1%	572,062	602,491	30,429

Table 2 reveals two key characteristics of the existing penalty calculation (Equation 1):

- consistently results in an underpayment of the non-compliance penalty
- underpayment increases as the vessel's actual GHG intensity rises

The marginal penalty for each 1% improvement increases under Equation 1. It is €109,743 for an achieved GHG intensity reduction of 1% to 2% compared with €119,230 for the better achieved GHG intensity reduction of 5% to 6%.

In contrast, the marginal penalty remains constant at €120,498 under the proposed penalty calculation (Equation 2) as shown in Table 3.

Table 3. Inter-Reduction % Penalty Increase Existing (Eqn 1) & Proposed (Eqn 2)

Inter- Redn	Eqn. 1 (€)	Eqn. 2 (€)
5-6%	119,230	120,498
4-5%	116,746	120,498
3-4%	114,339	120,498
2-3%	112,005	120,498
1-2%	109,743	120,498

Case 1 shows that higher emitting vessels pay proportionately less penalty than those with a smaller non-compliance balance under the existing penalty payment calculation (Equation 1). Arguably the increasing marginal penalty provides a disincentive to pursuing improvements.

Case 2. Multiple Vessels

As in Case 1, this example uses year 2030, where the FuelEU Maritime regulation has set a 6% GHG intensity reduction target from a baseline of 91.16 gCO_2eq/MJ. Here we show the effect of the penalty calculation under Equations 1 and 2 in a scenario where there is more than one vessel.

Consider two shipping companies, each operating two vessels with an annual energy consumption of 193,500,000 MJ per vessel. All four vessels fail to achieve the target GHG intensity reduction of 6% over the VSLO baseline. Company A's vessels each achieve a 3% reduction. Company B's vessels achieve 1% and 5% reductions, respectively.

The non-compliance balance is the difference between the Actual GHG Intensity and Target GHG Intensity (where actual exceeds the target) multiplied by the annual fuel consumption. The non-compliance balance for each vessel in both companies is shown in Table 4.

Table 4. Case 2 Non-Compliance Balance

	Redn	AGHGI	Balance (€)
Company A			
Vessel A.1	3%	88.43	529,183,800
Vessel A.2	3%	88.43	529,183,800
			1,058,367,600
Company B			
Vessel B.1	1%	90.25	881,973,000
Vessel B.2	5%	86.60	176,394,600
			1,058,367,600

AGHGI = Actual GHG Intensity

Company A and Company B have identical non-compliance balances (€1,058,367,600) but they receive different penalties under the existing formula.

The existing formula for penalty payment calculates €700,629 for Company A and €691,292 for Company B.

In contrast, the proposed penalty payment calculation applies a consistent penalty of €722,989 to both companies as shown in Table 5.

Table 5. Penalties for Companies A and B

Penalty	Existing (€)	Proposed (€)
Company A		
Vessel A.1	350,314	361,495
Vessel A.2	350,314	361,495
	700,628	722,990
Company B		
Vessel B.1	572,062	602,491
Vessel B.2	119,230	120,499
	691,292	722,990

Case 2 demonstrates that companies with identical GHG deficits can have unequal penalties with the existing penalty payment calculation (Equation 1).

MITIGATION STRATEGIES

FuelEU Maritime permits several strategies as alternatives to penalty payments for non-compliance. These are:

1. Pooling mechanism
2. Borrow from next year (with 10% interest)
3. Purchase from other vessels in compliance surplus

Under the pooling mechanism an agreement is made with other vessel(s) that have a compliance surplus(es) so that the collective compliance balance is zero or in surplus. Alternatively, a vessel in compliance deficit can borrow from the next year subject to 10% interest. The third option is where a compliance deficit is mitigated by buying compliance surplus from others.

While all options relate to the compliance balance options 1 and 3 are indirectly impacted by the penalty calculation. For these mitigation options to be attractive, any financial settlements involved would need to be less than the penalty payment.

As we have demonstrated, the current penalty calculation undervalues the extent of non-compliance. This would reduce any financial incentive for pooling arrangements and depresses market value of compliance surpluses.

The current penalty formula therefore indirectly penalises compliant vessels.

POLICY RECOMMENDATIONS

We recommend that Regulation (EU) 2023/1805 is amended so that penalty calculations appropriately and proportionately penalise the worst emitting vessels.

Replacing the Actual GHG Intensity with Target GHG Intensity in the penalty calculation would:

- Prevent under-penalisation
- Ensure a uniform marginal penalty
- Increase regulatory effectiveness by removing distortions
- Simplify the pooling mechanism
- Better reflect vessels fuel consumption in VLSFO equivalence
- Reduce potential disputes between carriers and shippers when carriers set associated surcharges

The use of Actual GHG Intensity in the penalty calculation introduces inconsistencies: companies with identical GHG deficits have different penalties (Case 2) and higher emitting vessels are penalised proportionately less (Case 1).

For the UK Government's forthcoming fuel standard consultation (in their Maritime Decarbonisation Strategy (2025)), we recommend avoiding these distortions rather than harmonising with the EU.

References

Regulation (EU) 2023/1805 of the European Parliament and of the Council of 13 September 2023 on the use of renewable and low-carbon fuels in maritime transport and amending Directive 2009/16/EC.

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