How IMO can maximize the climate benefits of its EEDI carbon intensity standards

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Next month, IMO’s MEPC 79 is considering how to update its Energy Efficiency Design Index (EEDI) under “phase 4”, which will likely cover ships built ~2027–2030.

- EEDI phases 1-3 require new ships to emit less CO$_2$ over time but ignore other climate pollutants such as nitrous oxide (N$_2$O), methane (CH$_4$), and black carbon (BC).

- IMO aims to phase out GHGs from ships to help achieve the Paris Agreement temperature goals.

- Covering GHGs and BCs in EEDI phase 4 as “carbon dioxide equivalents” (CO$_2$e) can help achieve IMO’s climate goals.
Step 1. Estimated and compared the attained EEDI of a large container and cruise ships using different fuel and engine combinations.

<table>
<thead>
<tr>
<th>Ships</th>
<th>Engines</th>
<th>Fuels</th>
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<tbody>
<tr>
<td>Container</td>
<td>Low methane slip</td>
<td>Heavy fuel oil (HFO)</td>
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<tr>
<td>Cruise</td>
<td>Med methane slip</td>
<td>Marine gas oil (MGO)</td>
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<td></td>
<td>High methane slip</td>
<td>Liquefied natural gas (LNG)</td>
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<td>Methanol (MeOH)</td>
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Step 2. Explored how amending the EEDI could affect fuel and engine choice and associated tank-to-wake (TTW) and well-to-wake (WTW) CO$_2$e emissions using 100-year and 20-year global warming potentials for climate pollutants.

<table>
<thead>
<tr>
<th>Current Scope</th>
<th>Option 1: TTW</th>
<th>Option 2: WTW</th>
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</thead>
<tbody>
<tr>
<td>TTW CO$_2$</td>
<td>a. TTW CO$_2$e100</td>
<td>a. TTW CO$_2$e100</td>
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<td></td>
<td>b. TTW CO$_2$e20</td>
<td>b. TTW CO$_2$e20</td>
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</table>
Current Scope: 
LNG (bars) and MeOH (dots) all pass phase 3 (HFO and MGO fail)

Figure 2. Comparing estimated attained EEDI using LNG (stacked bars) and MeOH (dots) to required EEDI phase 3 using TTW CO$_2$e100 and CO$_2$e20 for three ship-engine combinations.
Option 1a: TTW CO$_2$e100
LNG: pass for low and med slip; fail high slip
MeOH: all pass

Figure 2. Comparing estimated attained EEDI using LNG (stacked bars) and MeOH (dots) to required EEDI phase 3 using TTW CO$_2$e100 and CO$_2$e20 for three ship-engine combinations.
Option 1b: TTW CO$_2$e20
LNG: pass for low methane slip only
MeOH: all pass

Figure 2. Comparing estimated attained EEDI using LNG (stacked bars) and MeOH (dots) to required EEDI phase 3 using TTW CO$_2$e100 and CO$_2$e20 for three ship-engine combinations.
Option 1b: TTW CO$_2$e20

We recommend this option because it encourages the use of LNG only in low methane slip engines, or the use of MeOH.

Figure 2. Comparing estimated attained EEDI using LNG (stacked bars) and MeOH (dots) to required EEDI phase 3 using TTW CO$_2$e100 and CO$_2$e20 for three ship-engine combinations.
Had all ships using LNG in 2019 used MeOH instead, their TTW (left) and WTW (right) CO$_2$e emissions would have been lower, despite higher CO$_2$.
Variability in well-to-tank (WTT) emissions can change whether a ship would pass (see figure).

WTT emissions vary based on a fuel’s feedstock and production process, even for the same kind of fuel, so the fuel source matters.

EEDI is a design standard, and the ship will buy fuel from many sources over its useful life.

Other regulations are better suited to control WTW emissions, such as an improved carbon intensity indicator (CII) or a low-GHG fuel standard (LGFS).

**Figure 4.** Potential attained EEDI of ships using LNG dual-fuel engines if EEDI were regulated on WTW CO$_2$e100, accounting for a range of WTT values for LNG.
The Existing Ship Energy Efficiency Index (EEXI) regulates the design TTW CO₂ intensity of existing ships beginning in 2023.

The Carbon Intensity Indicator (CII) ranks ships based on their operational TTW CO₂ intensity, beginning in 2023.

Both are up for revision no later than 1 Jan 2026. EEXI could be amended to cover TTW CO₂e20 and CII could cover WTW.
1. IMO delegates are now considering how to update EEDI for phase 4.
2. EEDI currently regulates the TTW CO₂ intensity of new ships, which rewards the use of LNG, even in high methane slip engines.
3. EEDI could be amended to cover CO₂e20 beginning in phase 4, which would encourage the use of low methane slip engines or methanol.
   a. Note for IMO delegates: MEPC 79/6/3 submitted by World Wildlife Fund, Pacific Environment, and Clean Shipping Coalition propose IMO agree to regulate TTW CO₂e20 in phase 4 and to establish a correspondence group to develop the method and timeline for doing so.

To sum up…
for new ships:
To sum up…

for existing ships:

1. EEXI and CII could be amended to cover TTW and WTW CO$_{2}$e20, respectively, in the 2026 review.

2. Looking ahead, a LGFS could regulate the WTW CO$_{2}$e20 intensity of marine fuels. This can be based on the mix of fuels each ship uses each year, as reported to IMO’s Data Collection System.
Ultimately, the IMO needs to begin regulating CO$_2$e, rather than CO$_2$. Limiting warming to no more than 1.5°C requires deep and immediate cuts in methane and black carbon, according to the IPCC. Regulating based on 20-year GWPs encourages fuels and engines with low methane and black carbon emissions.

Read the full study: [https://theicct.org/publication/marine-IMO-EEDI-oct22/](https://theicct.org/publication/marine-IMO-EEDI-oct22/)
Questions or comments?
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