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

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Key recommendation:
IMO should regulate all climate pollutants, not just CO_2

- 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_2O), 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_2e) can help achieve IMO's climate goals.

Image created by Bryan Comer in Dall-E 2

What we did

Step 1. Estimated and compared the attained EEDI of a large container and cruise ships using different fuel and engine combinations.

Ships	Engines	Fuels
• Container • Cruise	• Low methane slip • Med methane slip • High methane slip	• Heavy fuel oil (HFO) • Marine gas oil (MGO) • Liquefied natural gas (LNG) • Methanol (MeOH)

What we did

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_2e emissions using 100-year and 20-year global warming potentials for climate pollutants.

Current Scope	Option 1: TTW	Option 2: WTW
TTW CO_2	a.TTW CO_2e100 b.TTW CO_2e20	a.TTW CO_2e100 b.TTW CO_2e20

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_2e100 and CO_2e20 for three ship-engine combinations.

Option 1a: TTW CO_2e100
LNG: pass for low and med slip; fail high slip
MeOH: all pass

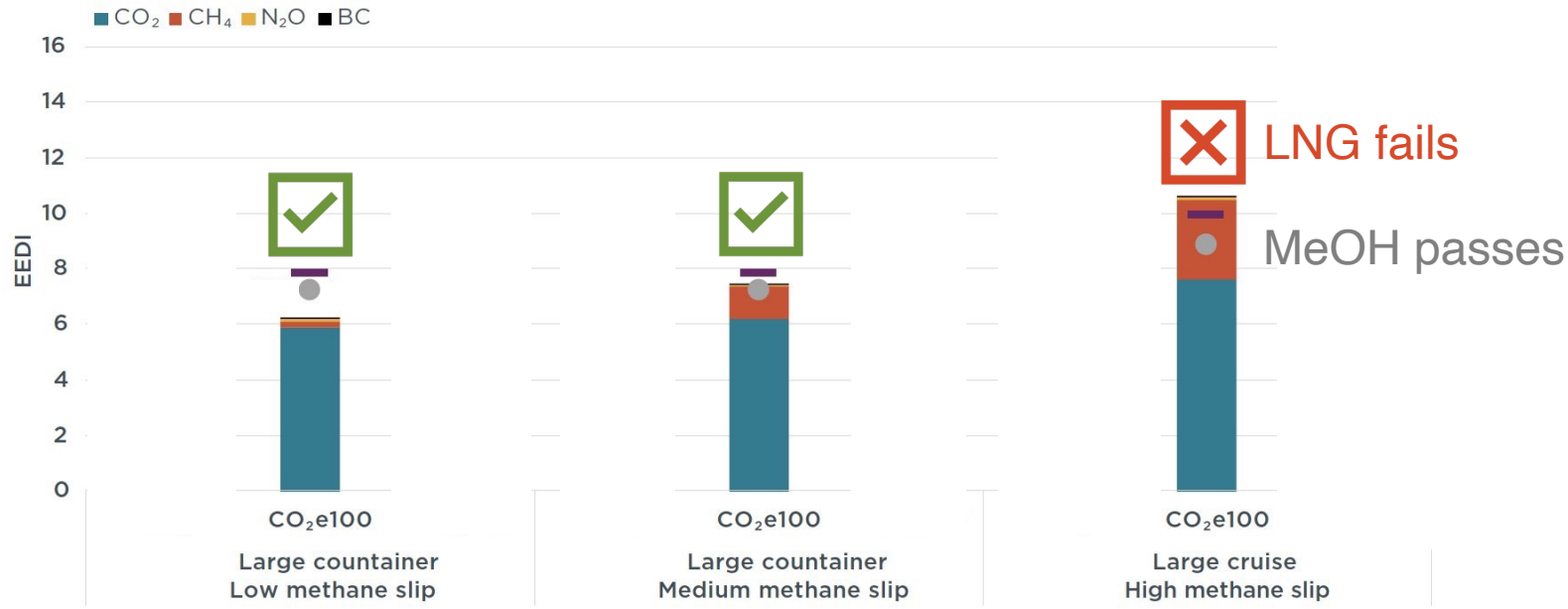

Figure 2. Comparing estimated attained EEDI using LNG (stacked bars) and MeOH (dots) to required EEDI phase 3 using TTW CO_2e100 and CO_2e20 for three ship-engine combinations.

Option 1b: TTW CO_2e20
LNG: pass for low methane slip only
MeOH: all pass

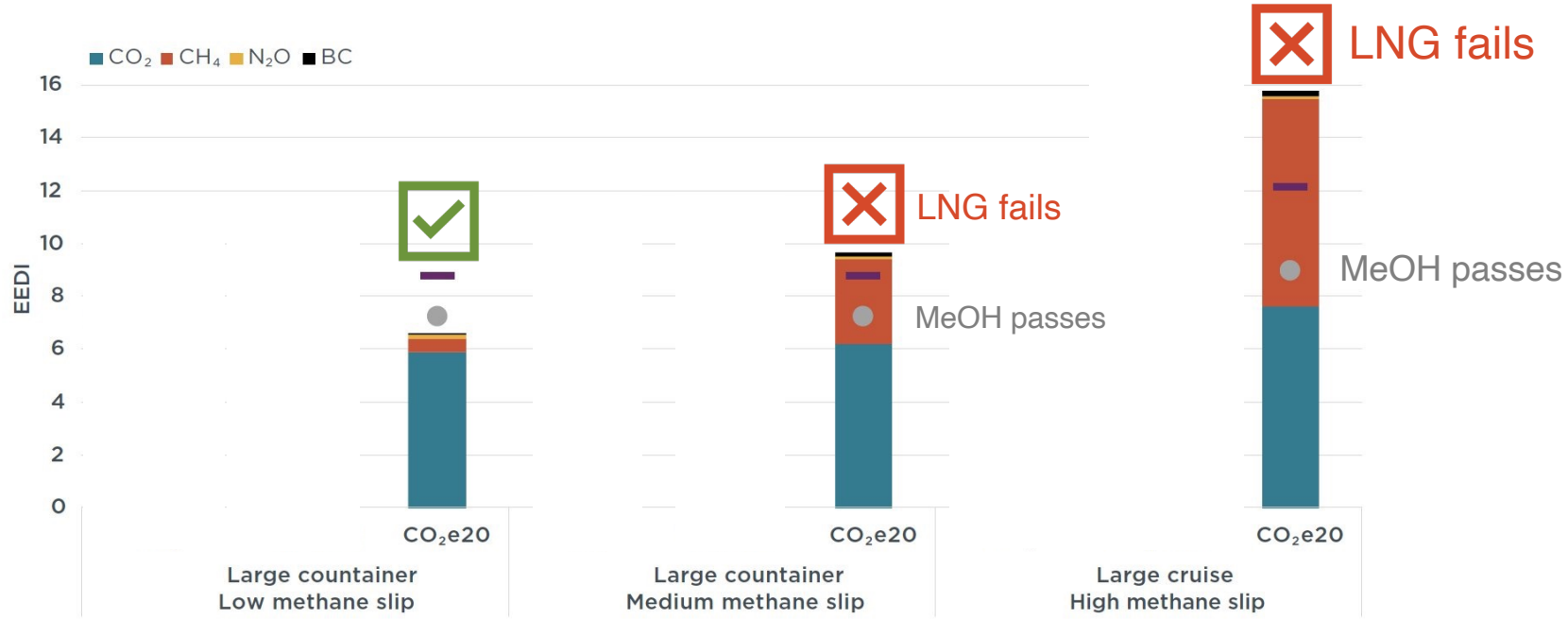

Figure 2. Comparing estimated attained EEDI using LNG (stacked bars) and MeOH (dots) to required EEDI phase 3 using TTW CO_2e100 and CO_2e20 for three ship-engine combinations.

Option 1b: TTW CO_2e20

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

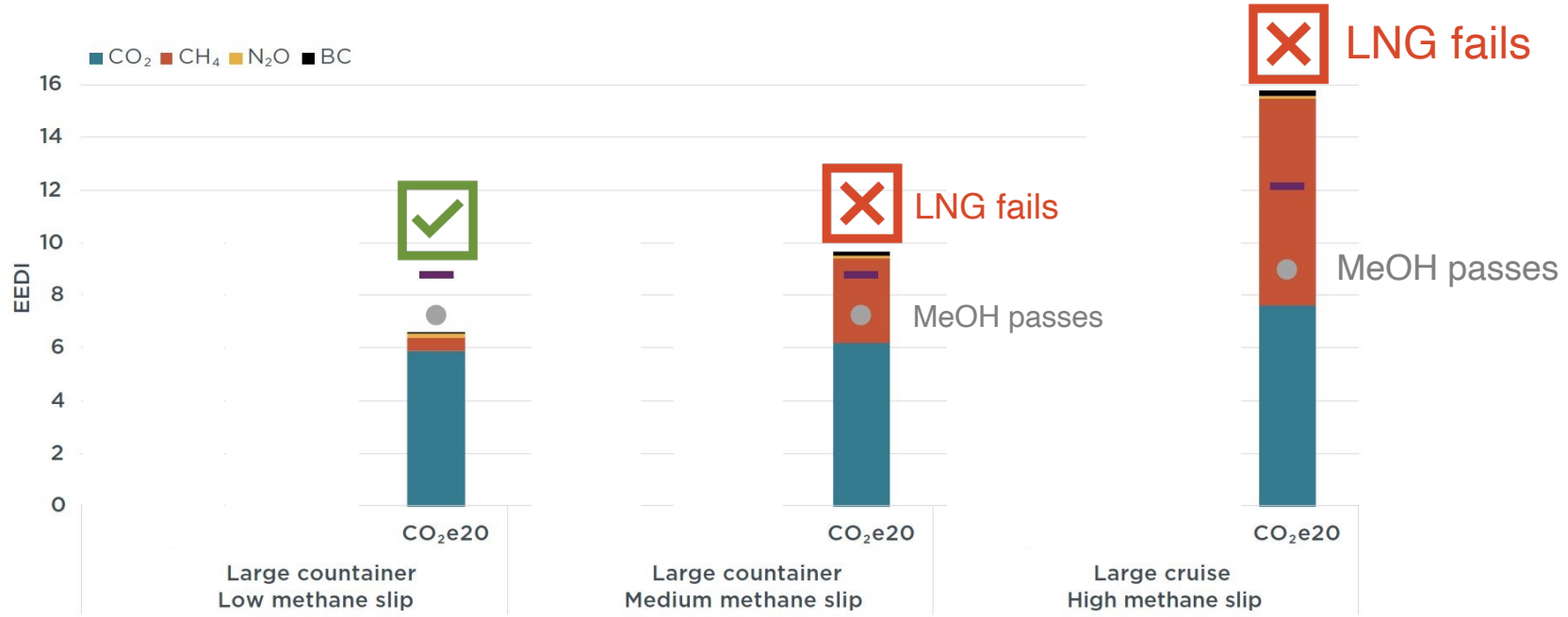

Figure 2. Comparing estimated attained EEDI using LNG (stacked bars) and MeOH (dots) to required EEDI phase 3 using TTW CO_2e100 and CO_2e20 for three ship-engine combinations.

Had all ships using LNG in 2019 used MeOH instead, their TTW (left) and WTW (right) CO_2e emissions would have been lower, despite higher CO_2

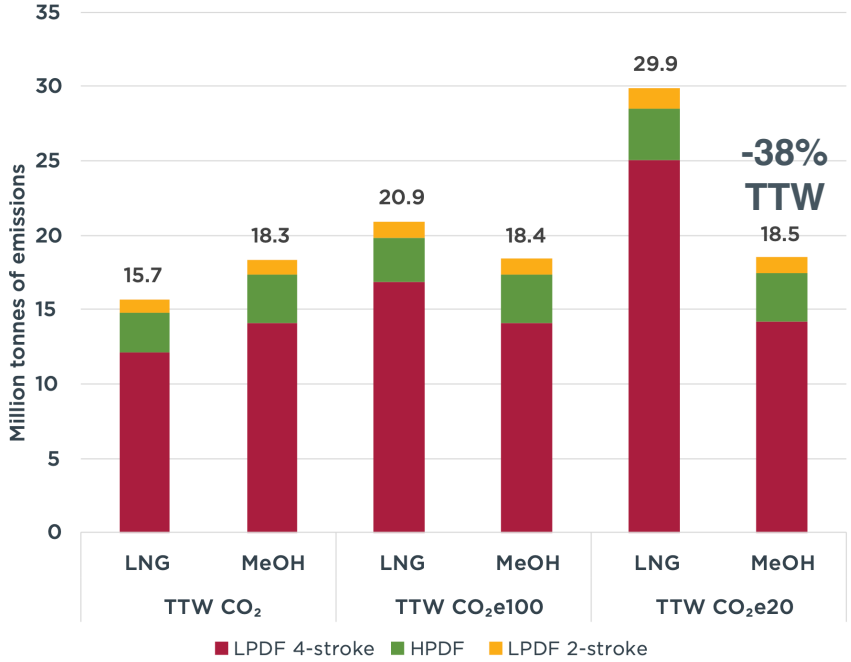

Figure 5. Comparing estimated 2019 TTW emissions from LNG-fueled ships using LPDF and HPDF engines to what they would had been if they had been fueled by methanol.

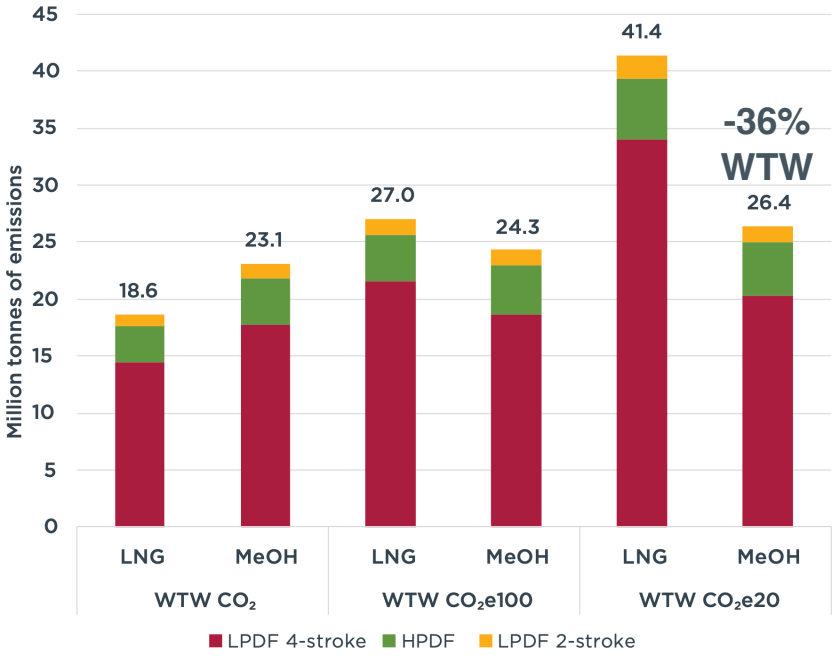

Figure 6. Comparing estimated 2019 WTW emissions from LNG-fueled ships using LPDF and HPDF engines to what they would had been if they had been fueled by methanol.

Why not regulate WTW (Option 2) under EEDI?

- 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)

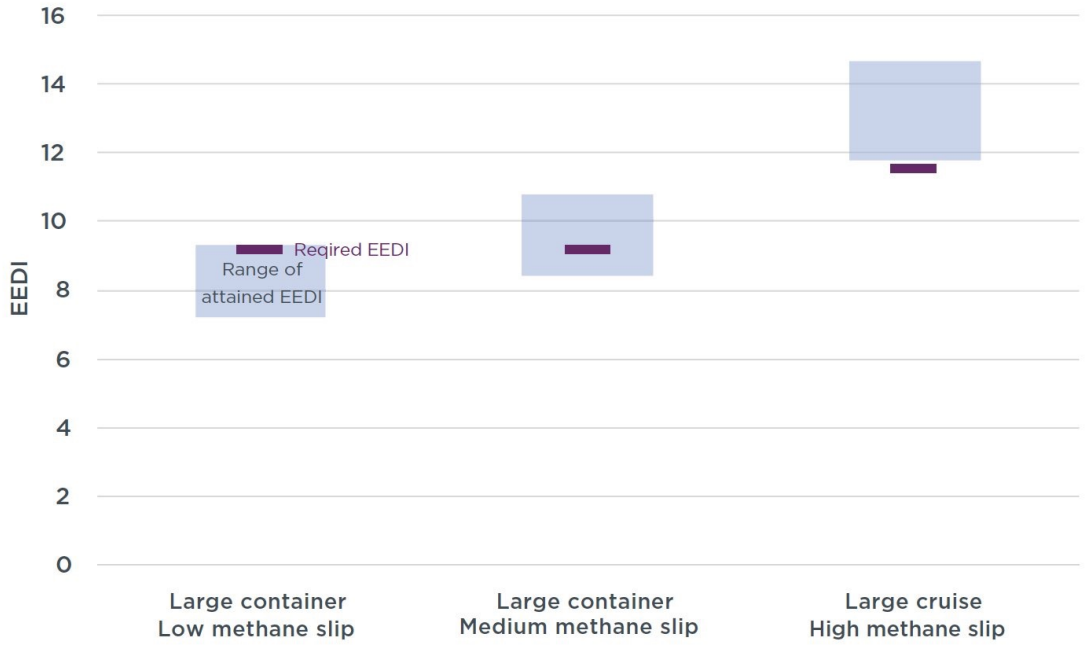

Figure 4. Potential attained EEDI of ships using LNG dual-fuel engines if EEDI were regulated on WTW CO_2e100, accounting for a range of WTT values for LNG.

What about existing ships?

The Existing Ship Energy Efficiency Index (EEXI) regulates the design TTW CO_2 intensity of existing ships beginning in 2023.

The Carbon Intensity Indicator (CII) ranks ships based on their operational TTW CO_2 intensity, beginning in 2023.

Both are up for revision no later than 1 Jan 2026. EEXI could be amended to cover TTW CO_2e20 and CII could cover WTW.

Image generated by Bryan Comer using Dall-E 2

To sum up…
for new ships:

1. IMO delegates are now considering how to update EEDI for phase 4.
2. EEDI currently regulates the TTW CO_2 intensity of new ships, which rewards the use of LNG, even in high methane slip engines.
3. EEDI could be amended to cover CO_2e20 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 CO_2e20 in phase 4 and to establish a correspondence group to develop the method and timeline for doing so.

To sum up…
for existing ships:

1. EEXI and CII could be amended to cover TTW and WTW CO_2e20, respectively, in the 2026 review.
2. Looking ahead, a LGFS could regulate the WTW CO_2e20 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.

Final thoughts

Ultimately, the IMO needs to begin regulating CO_2e, 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/

Questions or comments?

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