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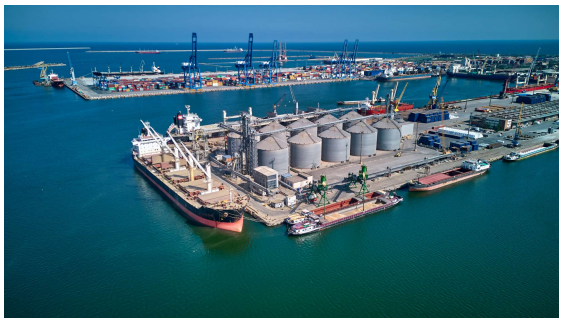
Carbon Intensity Indicator (CII): Exploring the potential for an at port metric



This policy briefing explores the feasibility of improving the International Maritime Organization's Carbon Intensity Indicator through developing a separate at port metric. It suggests that determining an appropriate at port metric would need to reflect the wide range of activities and conditions experienced by different vessel types and in different locations. This could be mainly achieved through consideration of an appropriate "useful work" definition.

HIGHLIGHTS:

- **The cargo-carrying capacity and distance travelled used in CII do not reflect vessels' at port activities**
- **Contracts between shipowners, operators, and charterers may not support CII rating improvements**
- **At port CII metric potentially valuable but limited by practical complexities**
- **Develop at sea CII metric first and further research how the at port part could work**
- **A review of the "useful work" definition should be undertaken for the various at port activities by vessel type**
- **As low(er) carbon fuels are adopted, other emissions – such as methane and nitrous oxide – and on a whole life cycle ("well-to-wake") basis should be included in CII**

Background

Our previous Policy Briefing [1] argued that the International Maritime Organization's (IMO) Carbon Intensity Indicator (CII) is currently insufficient for accurately capturing emissions at sea and at port and incentivising emissions reduction. We recommended revision of the CII to use separate metrics for at sea and at port emissions.

Here, we explore the potential for an at port metric. In the sections that follow, we first explain why an at port metric is valuable and then discuss the concept of "useful work" when at or near port. Discussions of other aspects such as data and legal contracts, particularly for container shipping, follow. Finally, we provide policy recommendations that are summarised in the Highlights box.

These findings reflect a review of the related academic literature (analysed in the previous Policy Briefing) and exploratory discussions with maritime stakeholders that included maritime consultant, government agency, ship fleet manager, shipping company, insurer, maritime lawyer, port manager, and cruise ship association.

Arguments for an at port metric

At port emissions are a significant share of overall shipping emissions (10-20% of the overall total [1]) and directly affect air quality and public health in the areas surrounding the port. For cruise ships, this is closer to 50% of

their annual carbon dioxide (CO_2) emissions while at or near ports [1]. For the purposes of this paper, the definition of at port is given in Box.1.

Box. 1. Definition of at port emissions
The Fourth IMO GHG Study (2020) uses an at berth definition for ships stationary less than or equal to 1 nautical mile (nm) of a port. For liquid tankers (chemical, liquified gas, oil and other liquids), this is within 5nm of a port.

Note that there are similar concepts with different definitions in other regulations: For example, "not underway" for the Ship Energy Efficiency Management Plan (SEEMP), and "port of call" for the EU Emissions Trading Scheme (ETS).

In line with this evidence, various stakeholders – including from the insurance and cruise sectors as well as cargo ship operators – see it as inequitable to regulate only at sea performance, or to retain a blended CII metric (as currently) that obscures where emissions actually arise. It was stressed that the current, single CII metric inappropriately handles ship emissions while at port. For instance, delays due to congestion, tides, pilotage or port equipment failures worsen the rating without necessarily increasing emissions. Furthermore, many of these factors lie outside the ship operator's control.

A separate at port metric can address these shortcomings by:

- Appropriately accounting for the emissions arising from hotel load, cargo handling, etc. at port – i.e. where the ship's auxiliary engines are used.
- Allowing different at port activities (shore power, berth allocation, cargo handling practices, etc.), to be targeted rather than only those used to improve at sea performance.

Useful work at port

The current CII formula is given in Box. 2.

Box. 2. CII formula

$$CII = \frac{CO_2}{Transport\ capacity \times Distance}$$

The formula is the ratio of CO_2 emissions to the product of vessel capacity and distance travelled. This product (i.e. the denominator) aims to represent the "transport work" produced by a ship and, thus, CII aims to estimate emissions per transport work.

The existing academic literature [1] and the exploratory discussions with maritime stakeholders agree that a single metric cannot simultaneously capture at sea and at port performance in a fair and consistent way. They also agree that separating these can provide clearer signals about a ship's performance and reduce reliance on complex correction factors.

Useful work by vessel type

Useful work at port is intrinsically different from useful work at sea and therefore requires a different CII metric. It is also different across vessel types since port-related activities vary accordingly. To that end, an at port CII metric could have the general form given in Box. 3.

Box. 3. Proposal for at port CII formula

$$CII_at_port = \frac{CO_2}{Useful\ work\ at\ port}$$

Where useful work at port depends on the type of vessel.

For instance, for cruise and passenger ships, energy demand is strongly linked to hotel load for passengers (lighting; heating, ventilation, and air conditioning [HVAC]; catering; leisure facilities).

To that end, the Cruise Lines International Association (CLIA) have proposed, at IMO negotiations, a CII improvement that aims to reflect this. Namely, they suggest that useful work for cruise ships should equal gross tonnage multiplied by hours at port [2].

For dry bulk, tanker, container, and other general cargo ships, at port activities may be significantly different. Auxiliary power use at port scales with cranes, pumps, winches, and cargo conditioning, so linking emissions to handled cargo and core operations avoids rewarding "doing nothing while idling."

For Pure Car Carriers (PCCs), Roll-on/Roll-off ships (RoRos), and passenger ferries, a metric accounting for e.g. vehicles handled per hour in port, to capture cargo movements and ramp operations, may be appropriate.

For specialised ships (e.g. offshore, dredgers), useful work could be linked to mission-specific activity (e.g. cubic metres dredged), where that work plausibly explains power demand.

This vessel-type specific denominator can be codified through IMO guidelines, similar to how different ship types already have different CII reference lines (and Energy Efficiency Design Index [EEDI]/Energy Efficiency Existing Ship Index [EEXI] requirements). Divergent options risk over-complication as well as geographic and business biases. For instance, a vessel that (regularly) operates within ports with no shore power facilities might be worse rated compared to a similar vessel that operates within ports with shore power facilities. The introduction of an at port metric will need further research and piloting.

Some stakeholders have stressed the need to map what is realistic to control for and optimise

as a ship operator while at port, so that the metric rewards efficient, controllable actions rather than punishing ships for e.g. port owners'/port operators' decisions.

Boundaries and data

To remain administratively feasible, the at port CII metric should build on accepted definitions:

- Use the same "at berth" or "within port" boundaries as the Fourth IMO GHG Study [3] e.g. stationary within 1 nm of berth, or berth-to-berth time see Box.1., while making clear that the at port metric focuses on time at berth plus essential manoeuvring, hotel load, and further useful work while at port, not entire coastal voyages.
- Collect data via existing systems (Automatic Identification System [AIS] and the IMO Data Collection System), with additional fields only for the relevant at port useful work (i.e. tonnes of cargo handled, passenger counts, etc.).

Automated data collection and near-real-time tracking are already being piloted in the context of CII, and stakeholders recognise that these tools can support an at port metric without excessive extra burden, if carefully implemented.

At port metric challenges

A key challenge for any at port CII metric is that port-related emissions are shaped by a wide range of factors that are not fully under the control of shipowners or operators. Discussions with stakeholders have highlighted that port geography, berth configuration, channel depth, tidal constraints, weather exposure, congestion, and local infrastructure can all materially affect a vessel's time at port. These factors then impact on energy consumption at port and therefore emissions.

This creates a major difficulty for an at port metric design because vessels calling at different ports may face significantly different operating conditions even when undertaking similar activities. For example, ships serving ports with narrow channels, tidal windows, longer pilotage requirements, or limited shore power access may appear less CII-efficient than ships undertaking similar operations but in more favourable locations. A metric that does not account for these exogenous factors risks penalising vessels for port-specific conditions rather than for controllable emissions-related behaviour.

Contract implications and allocation of responsibility: Shipowner-operator split (contractual) incentives

Stakeholder discussions highlighted serious misalignment between the party that takes operational decisions and the one that is penalised under CII. For example:

- The ship operator/charterer chooses the vessel's speed and fuel, but the shipowner carries the CII rating on the vessel's records.
- Traditional charterparty language ("utmost dispatch" – sail as fast as possible) conflicts with slow steaming and just-in-time arrival practices that can improve CII.

To make an at port metric workable, contracts could be amended to:

- Require operators/charterers to return the vessel with at least its original CII rating or to share costs if the rating deteriorates, as some shipowners/operators already practise.
- Clarify in the charter contract which party is responsible for at port operational decisions (e.g. whether to plug into shore power, and how cargo-handling equipment is used) and how any at port rating affects vessel's hire, bonuses or penalties.
- Move away, where feasible, from rigid "utmost dispatch" clauses towards energy efficiency performance-based language that aligns with CII ratings, including at port.

Insurers and legal experts involved in Baltic and International Maritime Council's (BIMCO) drafting efforts noted that better metrics tend to generate better clauses. Hence a clear, well-bounded at port metric should, over time, be reflected in standard charterparty provisions, particularly for long-term charters.

Long-term port–shipowner arrangements

On the port side, the main concern is the "chicken-and-egg" problem: ports are reluctant to invest in expensive shore power or green(er) fuel bunkering without guaranteed demand, while shipowners hesitate to commit to green(er) fuels without confidence in availability and at reasonable cost.

An at port metric can help unlock this by:

- Creating a material performance signal that improves if vessels plug into shore power or use low carbon energy while berthed.
- Motivating long-term contracts between shipowners/operators and ports for the use of shore power or green(er) fuels, as the benefit becomes visible in a regulated metric.

Port stakeholders indicated that, where demurrage (compensation to shipowner where (un)loading time exceeds charterparty agreement) is paid today, the financial incentives still do not fully support emissions reduction. A well-designed at port CII metric could justify new tariff structures, rebates or penalties to encourage port decarbonisation.

Other key design principles and practical considerations

Drawing from discussions with stakeholders and from a review of the academic literature, the following elements are important for the feasibility of the broader CII metric (i.e. both at sea and at port).

Phase sequencing

- Fix and strengthen the at sea CII metric first (e.g. denominator to capture actual cargo transported), then introduce the at port metric, with a defined pilot period (e.g. 2–3 years) before full enforcement.
- Avoid running two overlapping, inconsistent CII systems (e.g. the current CII metric and an at sea CII metric), as administrations and industry have limited capacity to absorb frequent changes.

Fairness and responsibility

- Clearly delineate which port-related emissions are under the ship operator's control (fuel choice, onboard auxiliary management, voluntary use of shore power, voluntary use of onboard cranes) and which are not (berth allocation, channel depth, weather delays, uncontrollable delays in using port cranes/other port infrastructure). Only the former should affect the at port rating, with transparent correction factors for uncontrollable events. This, however, will increase the complexity of such metric.
- Provide differentiated treatment or exemptions for ice class ships, emergency salvage, and rare extreme events, since stakeholders reported significant rating distortions under the current CII metric in such cases.

Minimum reliance on correction factors

- Stakeholders have warned that excessive correction factors, as already seen in the current CII metric, make the system opaque and invite lobbying and gaming.
- The at port metric should, therefore, use as few and simple correction factors as possible.

Vessel type pilot exercises

- We suggest starting with vessel types where operations are more predictable and controllable, and data is richer, such as container/RoRo vessels and cruise ships and then extend to other sectors as experience grows.
- These pilots can then be used to refine useful work definitions, verify data availability, and test how contractual incentives change behaviour in practice.

Interaction with UK ETS

- The UK Emissions Trading Scheme (ETS), which will include domestic maritime from 1 July 2026, offers a practical testbed for piloting a potential at port CII metric. The pilot could include using the reported port emissions data from ships ≥5,000 gross tonnage (GT) calling at UK ports, and testing 'useful work' formulas. This can also enable actual comparison tests across UK ports (e.g. Liverpool tides vs. Felixstowe scale), capturing simplification and data lessons.
- However, scaling this to an international (IMO) level faces hurdles. For instance, voluntary participation from ports may limit the scope while UK trade patterns and port conditions and capabilities may differ from global ones.

Interaction with other regional measures

- The at port metric should be designed so that it is aligned with EU ETS and FuelEU Maritime regulation requirements for shore power use and GHG intensity, rather than pushing ships towards perverse choices (e.g. detours that improve CII but raise ETS costs).
- Measuring CII-related emissions on a whole life cycle "well-to-wake" GHG basis would assist with avoiding carbon leakage from ship to shore and support long-term

alignment with potential further greenhouse gas reduction measures.

Strengthening SEEMP and governance

- The Ship Energy Efficiency Management Plan (SEEMP) could be used as the vehicle for ship-specific, port-activity focused continuous improvement: mandatory internal review cycles, documented implementation of at port measures, and periodic audits that can also check at port emissions data.
- Explore the potential to shift at port regulation to SEEMP as an alternative to a separate at port CII metric.
- Build capacity in flag and port state control and relevant auditors so that compliance checks are consistent and credible across regions.

Conclusions

While a separate at port CII metric, based on emissions per useful work and vessel-type differentiation, is promising as a concept, its implementation faces significant challenges summarised below.

CHALLENGES

- The intrinsic complexity of defining 'useful work' across diverse vessel types and ports.
- Persistent contractual misalignments between owners, operators, and charterers.
- Non-controllable factors like port geography (tidal windows, channel depths, congestion) and port infrastructure that risk penalising ships for conditions beyond their influence.

These issues – which were also echoed in discussions with stakeholders – could render the metric unfair, administratively burdensome, and prone to gaming.

An at port metric may ultimately prove ineffective for broad decarbonisation, as port emissions often stem from shared responsibilities and infrastructure gaps rather than ship operations alone. There is consensus in academic research and industry views that strengthening the at sea CII part first (e.g. accounting for the actual cargo carried) should be prioritised.

Other options include integrating port data into existing SEEMP frameworks, and leveraging the data collected under the UK ETS for low-risk domestic pilots to test useful work definitions and simplifications.

Taken together, while an at port metric could theoretically align technical design with commercial incentives and enhance port-community health, its complexity demands careful and sequenced action before further consideration at national and international levels. This approach aligns with our previous policy briefing recommendations, recognising that, while separate metrics remain the most effective means of improving the CII, the complexity and additional research requirement for an at port metric means it may only be feasible in the longer term.

ENDNOTES

[1] I. Moutzouris, Y. Shi, and C. Copeland, 'IMO Short-term Measures: A Review of the Carbon Intensity Indicator (CII)', Clean Maritime Research Hub, Policy Briefing, Jan. 2026. [Online]. Available: https://www.clean-maritime-research-hub.org/news/resource/imo-short-term-measures-a-review-of-the-carbon-intensity-indicator-cii/

[2] CLIA, 'Energy Efficiency of Ships: Development of a revised CII calculation method for cruise passenger ships', in *Agenda item 6*, Jul. 2024.

[3] IMO, 'Fourth IMO GHG Study', 2020. [Online]. Available: https://www.imo.org/en/ourwork/environment/pages/fourth-imo-greenhouse-gas-study-2020.aspx

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