Briefing

The Alternative Fuels Infrastructure Regulation for Shipping

How to make European ports future-proof in the next review

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Summary

The maritime sector accounts for 3% of the EU's total CO_2 emissions, amounting to 145.2 million tonnes of CO_2 in 2024. Under current policies, maritime emissions could represent one-third of all transport emissions in 2050. Between 5-7% of these emissions - or 6.5 million tonnes of CO_2 - happen in ports, degrading air quality, worsening climate change and impacting port residents and workers' health. In 2023, European ferries emitted 6848 tonnes of SOx, 64,486 tonnes of NOx and 2367 tonnes of PM2.5 in ports, while in 2022 Europe's 218 cruise ships emitted as much sulphur oxides (SOx) as 1 billion cars.

The Alternative Fuels Infrastructure Regulation is essential to reduce these emissions. It requires that ports provide shoreside electricity to specific vessels by 2030, and that sufficient alternative fuel bunkering infrastructure is available across European waters. However, both mandates fall short of enabling a complete decarbonisation, as the electrification mandate only targets a portion of all ships, and the fuel mandate only mentions (fossil) gas infrastructure.

T&E welcomes the Commission's call for evidence and its commitment to accelerate the deployment of alternative fuels infrastructure, including electrification, for shipping. The current review is therefore an opportunity to send a clear regulatory signal, in line with the Port Strategy and Europe's climate objectives, that ports will be key green energy hubs. A more comprehensive and ambitious regulation is needed to systematically cut down in-port emissions, improve air quality in EU ports, and protect local communities' health. Beyond the immediate climate and health benefits, it will support the development of electrification and clean fuels technologies, improve seafarers working conditions, and strengthen Europe's energy security in an increasingly unstable world.

Recommendations

01 **Expand the mandate to include vessels between 400 and 5000 GT**, focusing on segments already regulated, to reduce emissions and increase the infrastructure utilisation rate.

02 **Progressively include all ship types** to cover all in-port emissions and support a long-term planning perspective for ports and OPS developers.

03 **Introduce battery charging infrastructure requirements**, to support European ships' electrification and ensure that battery-electric vessels have access to the necessary charging infrastructure.

04 **Clarify responsibilities** to ensure that all port stakeholders contribute to the investment and development of onshore power supply infrastructure.

05 **Assess the future demand for marine green fuels** in maritime ports through a comprehensive Alternative Fuel Bunkering Assessment covering demand for different e-fuels, suitable locations, key safety and spatial constraints, and measures to support market uptake.

06 **Develop Europe's e-fuels bunkering network** by requiring Member States to jointly establish a limited number of strategically located renewable hydrogen and e-fuel bunkering hubs across the TEN-T maritime network through cross-border coordination and a shared hub approach.

07 **Remove the liquefied methane infrastructure requirement**, as continued support for LNG infrastructure risks prolonging fossil fuel dependence, increasing methane-related climate harm, while delaying investment in genuinely zero-emission solutions.

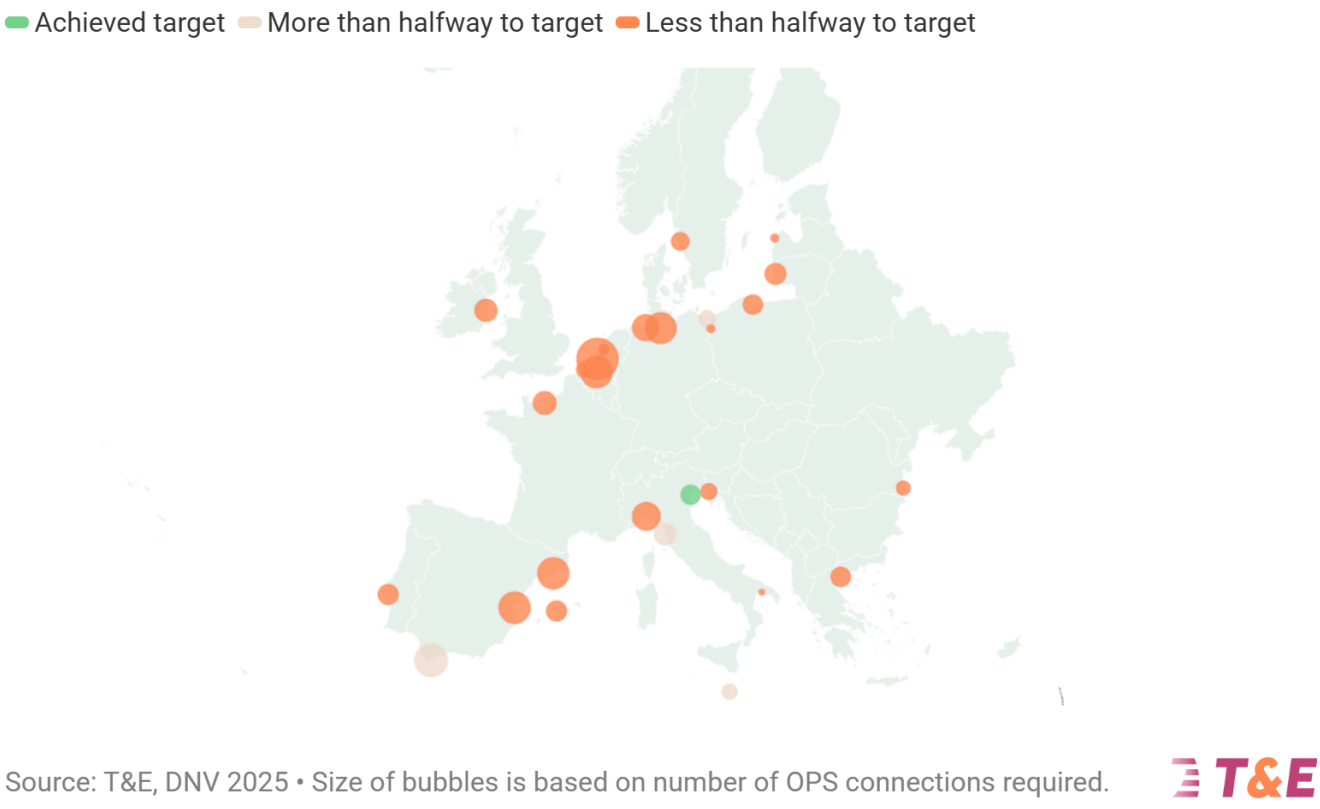
Gradually electrify all port stays

Within ports, between 70-80% of greenhouse gas and air pollutant emissions come from ships at berth. The most efficient way to cut these emissions is to electrify ships' calls via onshore power supply (OPS). It is therefore a central piece of the port decarbonisation puzzle.

Yet while the technology has been known for years, the current state of play of OPS deployment for seagoing vessels across Europe shows that the rollout remains slow. In May 2025, only 20% of all the required OPS connections were contracted or installed in 31 EU ports, mostly covering passenger and cruise ships and leaving container ships behind. While there is still time to install OPS before the 2030 mandate, the long lead time - 3 to 5 years - necessary to upgrade grids and deploy OPS make it likely that many ports will be late.

More efforts are needed to equip ports with Onshore Power Supply

The majority of ports examined are not on track to meet their targets



Source: T&E, DNV 2025 • Size of bubbles is based on number of OPS connections required.

In addition to slow deployment, the current OPS mandate is incomplete, as it includes only the largest container, passenger and cruise ships. As a result, 54% of in-port emissions will remain unaddressed in 2030, even if all regulated vessels connect in time.

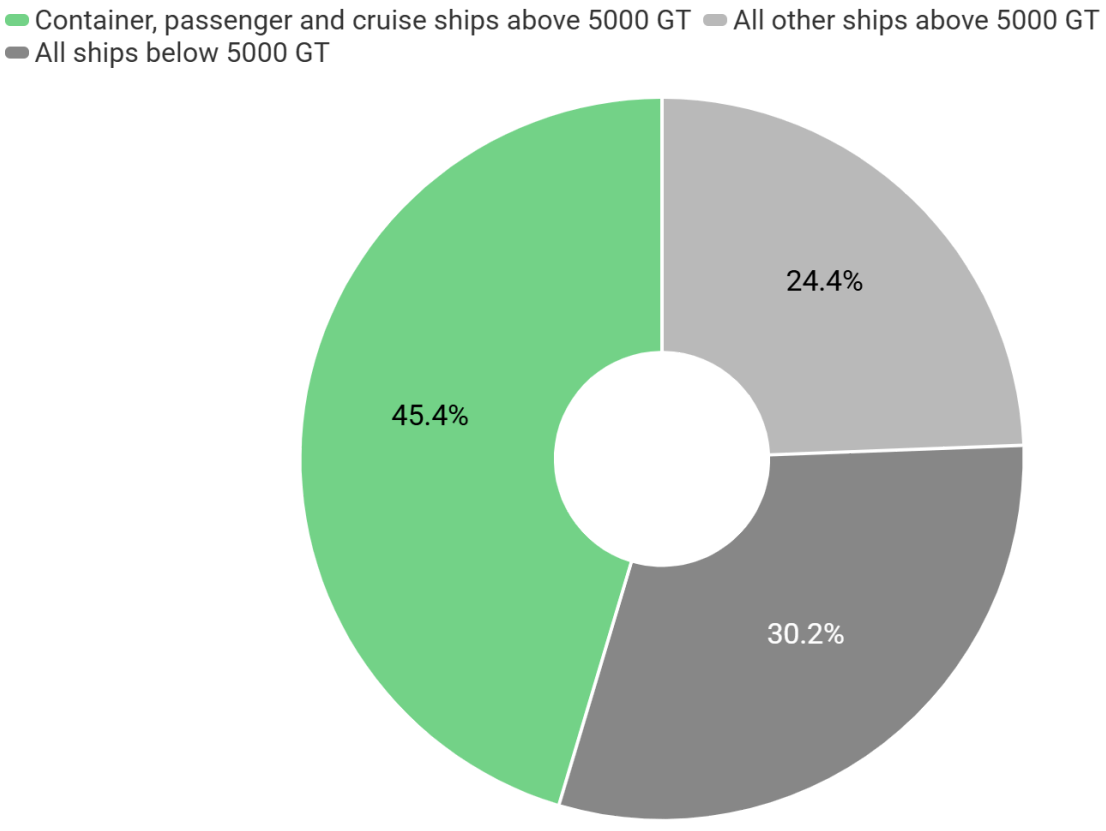
Expanding the targets to systematically electrify every port call will not only reduce emissions and improve air quality. It will also make EU ports more competitive and resilient by reducing their reliance on imported fossil fuels, and will strengthen the business case for shoreside electricity by optimising infrastructure investments and provide long-term investment clarity. Importantly, systematically electrifying port calls will greatly improve the working conditions of the seafarers who still work in the fumes of diesel engines when in ports.

2.1.1 Expand the OPS mandate to ships between 400 and 5000 GT

Ships below 5000 GT typically operate on short sea and coastal routes, which are characterised by shorter distances and more predictable operational patterns. Their more frequent port calls, combined with lower energy and power requirements, reduce both the scale and cost of the necessary infrastructure investments. Despite requiring less power than their larger counterparts and representing 30% of all in-port emissions, small ships are excluded from the regulation.

The OPS mandate leaves over half of in-port emissions unregulated

Share of in-port emissions



Source: T&E, DNV 2025 • Based on energy demand estimation in the 31 analysed ports, across all ship types and size. Ships having more than 1 MW power requirement are assumed to be > 5000GT.

In many ports, OPS is being deployed to serve large vessels with high power demand (i.e. cruise ships), which often call on a seasonal basis. This can result in infrastructure that is designed for peak demand but remains underutilised for long periods. It may also lead to inefficient investment decisions, with ports prioritising high-capacity installations without fully leveraging more flexible uses.

In addition to overlooking a large share of emissions that could be removed at low cost, targeting only the largest ships risks delaying decarbonisation in segments that are already well-suited to electrification. When feasible (i.e. when small vessels stop at the same berths as large ones), enabling them to connect to the OPS-equipped berths would increase the utilisation rate of existing infrastructure, improve the return on investment, and contribute to a more efficient power management at the port level.

The upcoming revision of AFIR should therefore expand the mandate to include vessels between 400 and 5000 GT, prioritising segments that are already covered by the regulation and for which infrastructure is already planned or in place.

2.1.2 Progressively include all ship types in the OPS mandate

The current regulation requires that shoreside electricity is available only for container ships, passenger ships and cruise ships above 5000 GT. While these segments represent the highest emissions per ship and operate in the most densely populated areas, excluding other large ships means that almost 25% of in-port emissions will not be addressed.

While some vessel types (e.g. oil tankers) are technically difficult to electrify due to technical constraints and safety issues, key segments like Ro-ros, cargo or offshore vessels could already be electrified. Ro-ro vessels typically operate on short sea, have predictable operations and make frequent stops, which qualifies them as good candidates for shoreside electricity. Furthermore, some of the most progressive ports - like the port of Rotterdam - are already planning for the deployment of OPS for Ro-ros, paving the way for an inclusion in the AFIR.

Beyond expansion, it is important to provide a clear long-term perspective on the gradual inclusion of additional ship types, so ports can anticipate and plan for the infrastructure accordingly. A staged approach will ensure that by 2040, all ships are required to connect while at berth, permanently removing the thousands of tonnes of air pollutants and GHGs that are currently emitted in ports each year, and enabling ports to plan accordingly.

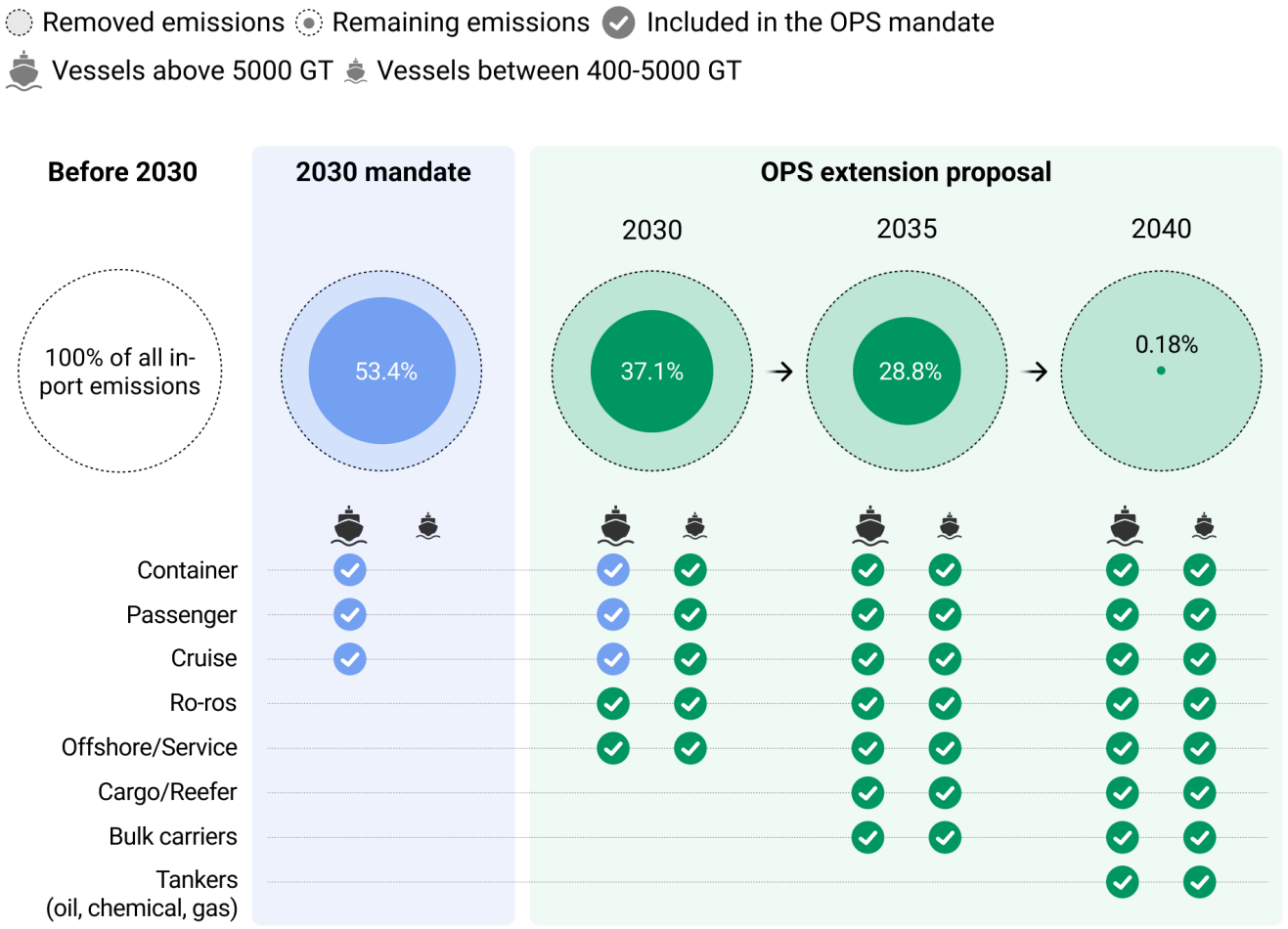
AFIR should progressively expand its scope to include all ship types, and provide a timeline to help ports plan ahead. This expansion is needed to address the full range of in-port emissions while accounting for technical specificities. Such an approach must remain incremental, allowing time to adapt infrastructure and avoid undue pressure on electricity systems.

The expansion should begin with the inclusion of Ro-ros, service and offshore vessels in 2030. Bulk carriers and other general cargo ships should follow in 2035, as no major technical barriers are preventing their connection to the grid. Tankers - that represent around 30% of in-port

emissions - would complete the transition by 2040, reflecting their greater technical complexity and their strong reliance on boilers for in-port energy production.

Roadmap for Shore Power for European vessels

Timeline for including all ship types in the AFIR, and the corresponding in-port emissions remaining at each stage



Source: T&E, DNV 2025, MRV 2024. The % shows in-port GHG emissions not covered by the Alternative Fuels Infrastructure Regulation. The remaining 0.18% represents emissions from fishing vessels.

2.1.3 Include battery charging infrastructure in electrification requirements

While electrification is not yet technically feasible for large ocean-going vessels, a growing number of battery-electric vessels are populating Europe's short seas. As marine battery technology is improving rapidly, more and more vessels will be able to run on batteries when operating in the short-sea. Our ferry electrification report demonstrates that 52% of European ferries could be fully electrified by 2035 and still remain cost-competitive with fossil fuels. Given the recent technological advances and the continuous decrease in battery prices, the limited availability of charging infrastructure on the shore is becoming the main barrier to the scale-up of battery-electric vessels.

The inclusion of battery-charging infrastructure plans within the scope of AFIR is needed to support European ships' electrification and to ensure that battery-electric vessels have access to the necessary charging infrastructure. Without a clear long-term perspective, the infrastructure risks being designed on a case-by-case basis, which can lead to duplication and inefficiencies. Including battery charging infrastructure in the AFIR will therefore improve the predictability and provide a greater investment certainty for the development of electrification infrastructure, by promoting coordinated planning rather than fragmented approaches.

Most ports need to supply less than 5MW charging power

Energy/Power bin	0-2 GWh	2-5 GWh	5-10 GWh	10-50 GWh	50-100 GWh	100-400 GWh
0-2 MW	142	15	3	0	0	0
2-5 MW	67	30	17	6	0	0
5-10 MW	18	20	13	17	0	0
10-20 MW	13	5	13	21	0	6
20-30 MW	0	0	2	19	11	6

Source: T&E (2025) • Based on a 2035 start year. Power bins are based on required power to charge the battery. Energy bins are based on quantity of energy consumed by vessels on their main routes.

With relatively modest energy needs, including battery charging infrastructure in the regulation would help ports anticipate their future electricity needs and plan accordingly. It would also reduce the return on investment for grid upgrades by increasing the utilisation rate of electrical connections and by spreading costs across additional users.

The AFIR should explicitly include battery charging infrastructure in its port electrification requirements. Member States should be required to ensure that by 2030, ports and terminals that have sufficient traffic from battery-electric vessels can provide enough charging capacity to enable them to navigate across EU waters.

2.1.4 Clarify port and terminal responsibilities on OPS deployment

The AFIR creates an obligation for Member States to ensure that shoreside electricity is available in ports. However, while the recitals acknowledge the importance of terminals and recognise that charging infrastructure is ultimately deployed at the terminal level, the provisions do not clearly define the distribution of responsibilities for investing in and developing onshore power supply.

This omission creates uncertainty and can delay deployment, as it leads to a diffusion of responsibilities among stakeholders. Terminals are the fundamental operational units within a

port, where ships first dock and where most port operations happen. They thus have privileged access to key operational data and patterns, and their role as an essential actor for the development and implementation of OPS must be recognised.

The AFIR should therefore provide greater clarity on roles and promote a coordinated participation of all the relevant port stakeholders involved in shoreside electricity deployment. While overly prescriptive mandates would not be appropriate given the diversity of port governance models across the EU, terminal operators should be explicitly recognised in the provisions as stakeholders that could contribute to the development of OPS.

The review of the AFIR should introduce a definition of port terminals, and specify that port authorities and terminals shall cooperate, when relevant, to achieve the set targets. Member States should in turn facilitate the coordination and provide support where necessary.

End LNG lock-in and plan for e-fuels

In addition to electrification and efficiency improvements, shipping's energy transition requires the adoption of green fuels, especially for ocean-going ships that may not electrify. The EU Ports Strategy recognises that maritime decarbonisation depends not only on demand-side rules such as FuelEU Maritime, but also on the availability of sustainable fuels in ports. The review of AFIR is an opportunity to strengthen Member States' planning obligations for maritime alternative fuels infrastructure by moving beyond a loose overview of planned measures toward a more concrete and coordinated planning framework. It is also the opportunity to remove outdated liquefied methane infrastructure requirements that facilitate LNG lock-in

2.1 Support the development Europe's e-fuel bunkering network

The rollout of e-fuels and hydrogen-derived fuels raises specific operational and safety challenges that go well beyond generic infrastructure planning. These fuels require new dedicated storage, handling, safety and bunkering infrastructure in ports. The EU Commission underlines the need for harmonised bunkering rules and guidance on the safe handling of alternative fuels in ports in the EU Ports Strategy.

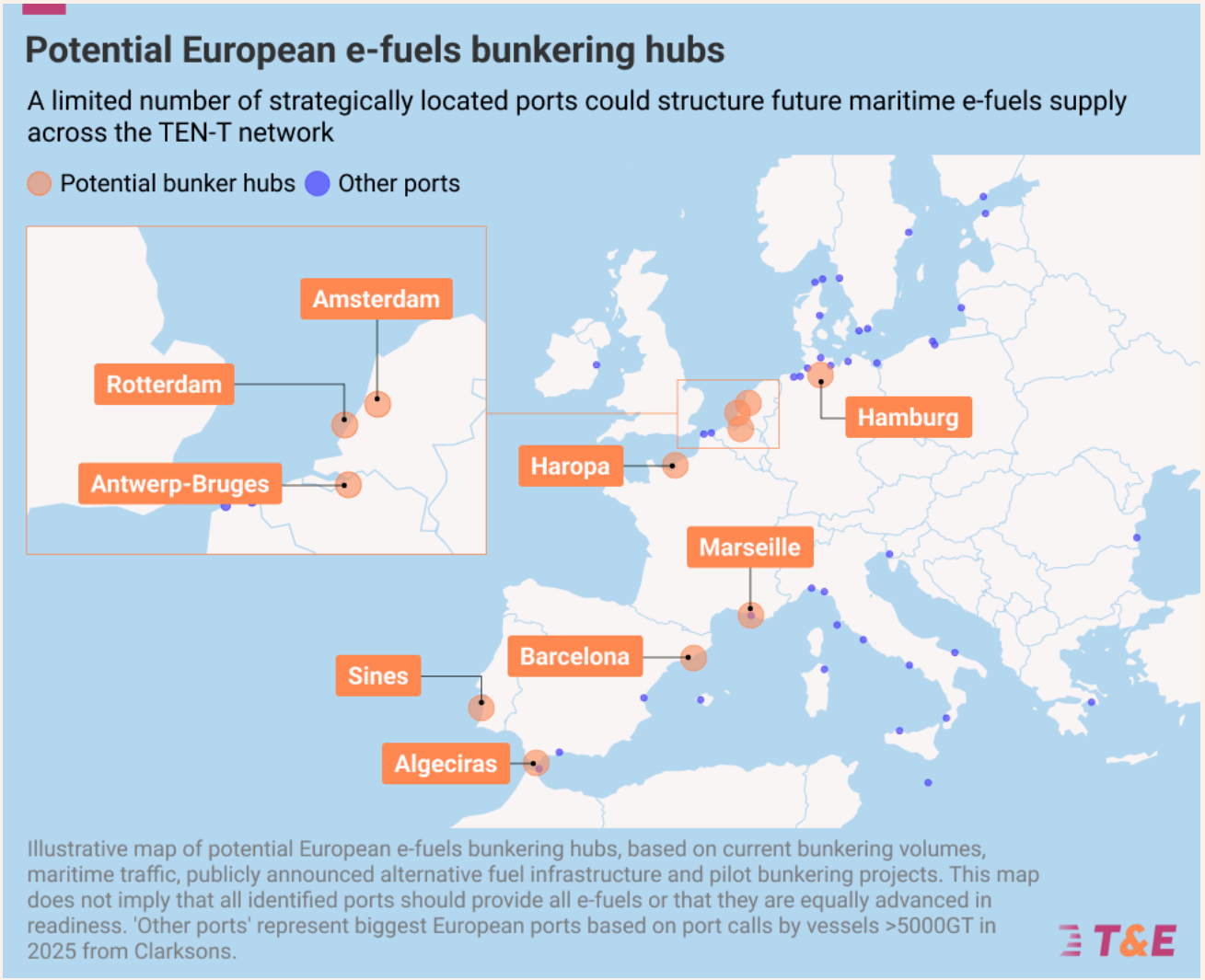
To help prepare ports for this transition, Member States cannot rely on vague, non-binding references in their national policy frameworks as currently stated in the regulation Article 14, 2 (k). They should be required to **carry out a comprehensive Alternative Fuel Bunkering assessment for maritime ports, including the expected demand for different e-fuels, suitable port locations, key safety and spatial constraints, and measures to support market uptake.**

This does not mean that every port should be required to provide every alternative fuel. **The objective should instead be to develop a limited number of strategically located bunkering hubs** across the TEN-T maritime network. This reflects the likely development of early markets, whereby industrial port clusters and trade corridors would offer multiple alternative fuels.

Front-runner ports are preparing for e-fuel bunkering

Some ports are already moving beyond abstract planning by putting in place the procedures, partnerships and safety frameworks needed for future fuels.

The port of Rotterdam carried out an ammonia bunkering procedure between two vessels in April 2025, enabling ammonia bunkering on a project basis. The bunkering procedures for ammonia in the port of Antwerp-Bruges are also underway. Both Rotterdam and Antwerp-Bruges offer regular methanol bunkering. The Commission needs to ensure that these initiatives are supported and scaled, and that frontrunners are incentivised and not penalised.



Finally, AFIR should require **harmonised reporting on alternative fuel bunkering infrastructure in ports**, so that shipowners, ports, fuel suppliers and public authorities can make informed investment decisions. Data should be submitted by infrastructure operators and competent national authorities through national channels and consolidated at the EU level in the TENtec system.

2.2 Remove the liquefied methane infrastructure requirement

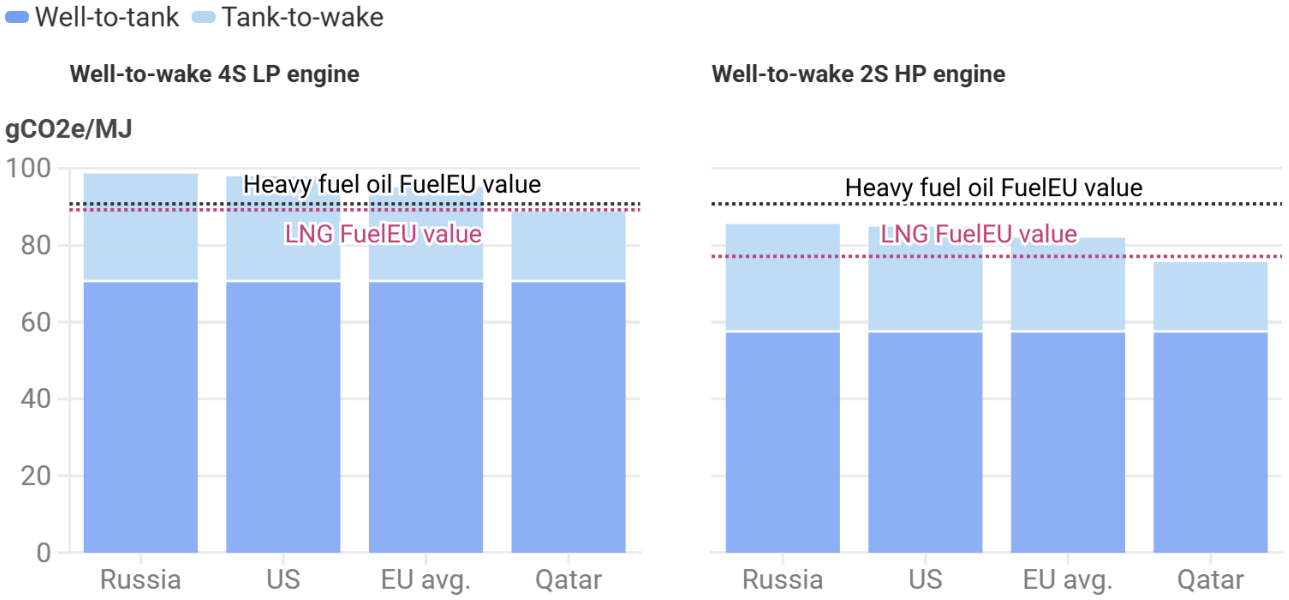
Article 11 of AFIR mandates core TEN-T ports to provide sufficient liquefied methane bunkering infrastructure by 2025. These bunkering infrastructures are for now mainly used for fossil liquefied natural gas (LNG), a fuel often framed as transitional due to its lower air pollutant and CO_2 emissions. But LNG comes with major climate risk, making it a counterproductive choice for the future. LNG is primarily made up of methane, a greenhouse gas around 80 times more potent than CO_2 in the short term, which leaks along the LNG value chain and significantly degrades LNG's climate performance. Once these emissions are taken into account, LNG becomes little better, and in some cases worse than traditional fuel oil from a climate perspective. The most

widely used four-stroke LNG engines continue to grow in market share, while independent measurements find methane slip of 6.4% - more than twice the level assumed under FuelEU Maritime.

Beyond its poor climate performance, LNG also weakens Europe's energy sovereignty by prolonging dependence on fossil fuel suppliers such as Russia and the US. Crises and wars, including in Ukraine and the Middle East, and the resulting volatility in fossil fuel availability and prices, show why Europe should avoid new fossil infrastructure that creates technological lock-in and perpetuates dependence.

GHG emissions from LNG production & supply chain vary significantly

Depending on the type of engine, LNG-powered ship's GHG emissions could be higher than those from fossil fuel oil



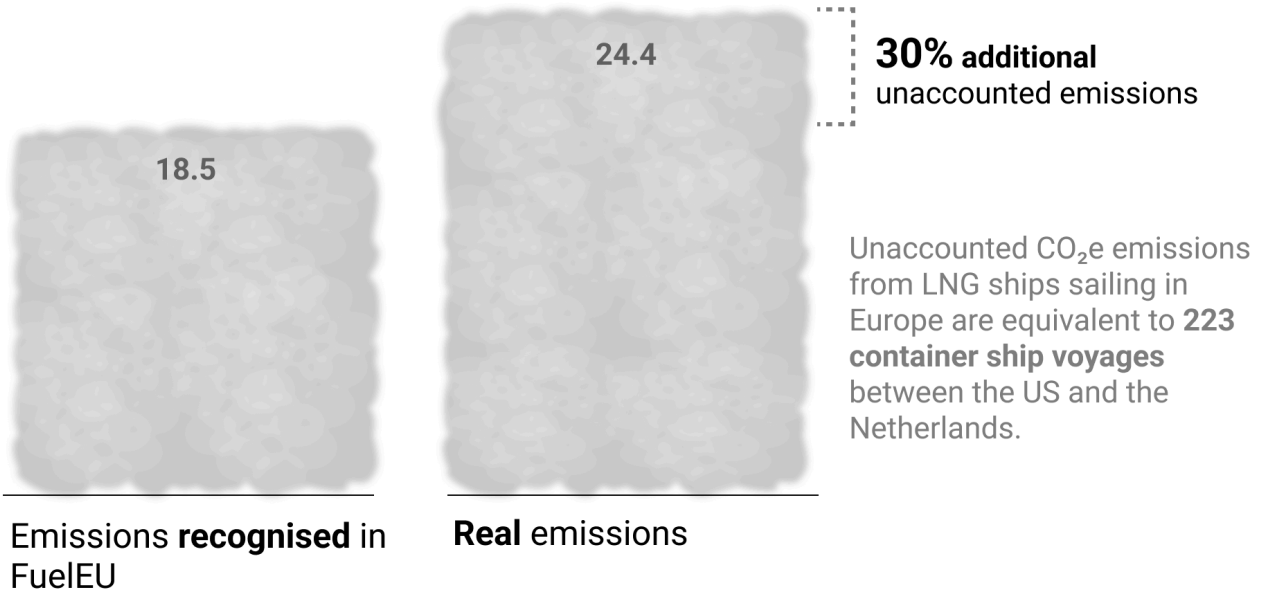
Source: Transport & Environment and EERA analysis (2024). • Notes: Scenario compares 2-stroke high-pressure and 4-stoke low-pressure LNG engines. TTW and WTW values from FuelEU Maritime Annex II.

The risk of LNG lock-in is reinforced by the design of FuelEU Maritime. This fossil fuel is likely to remain compliant in many cases until 2030 and potentially beyond, partly because the regulation gives LNG a favourable (albeit unrealistic) emissions abatement treatment.

A common argument in favour of the continued investment in liquefied methane bunkering infrastructure is that it could later be used for bio- or e-methane. While bio-LNG or e-methane may reduce lifecycle CO_2 emissions, methane leakage remains a critical climate risk across all methane pathways. Claims that methane slip will be reduced through technological progress should also be treated with caution. Ships have long lifetimes, and improved engine designs will take years to be deployed at scale and independently validated under real operating conditions.

Upstream emissions from Europe's LNG supplies are 30% bigger than the laws project

Upstream emissions intensity of the EU's imported LNG (gCO_2e/MJ)



Source:Analysis based on EERA analysis (2024) and T&E SEA model. Emissions calculated for OOCL ASIA containership voyage between Port Charleston in the US and the port of Rotterdam in the Netherlands.

Support for renewable methane in shipping may not displace fossil LNG in practice. Under the current EU mass-balancing system, biomethane and e-methane can be injected into the gas grid and claimed by grid-connected users, whereas maritime transport requires renewable methane to be physically liquefied and supplied as a marine fuel. Given the additional cost and infrastructure requirements, much of the available renewable methane is likely to be absorbed by land-based sectors such as heating and industry, while shipping may continue relying largely on fossil LNG.

In the longer term, the purchase of biomethane and e-methane credits could further prolong LNG use. Support for greener methane alternatives, therefore, risks doing something other than enabling a future synthetic fuel option: it may also strengthen the business case for continued fossil LNG infrastructure, delay the shift to genuinely zero-emission solutions, and lock shipping into methane-based technologies for decades.

Overall, liquid methane infrastructure for shipping does not need additional support. LNG already benefits from a mature market. The number of LNG-powered ships is growing strongly, and by 2030, a quarter of the energy used by European ships could come from fossil gas. LNG-fuelled vessels lead the non-conventional fuel market across all ship types in 2025, representing 31% of total GT. With 890 LNG-powered ships already in operation and 343 in the order books, **liquid methane infrastructure for shipping does not need additional support. T&E therefore calls for this mandate to be removed from AFIR.**

Further information

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