BRIEFING - July 2025

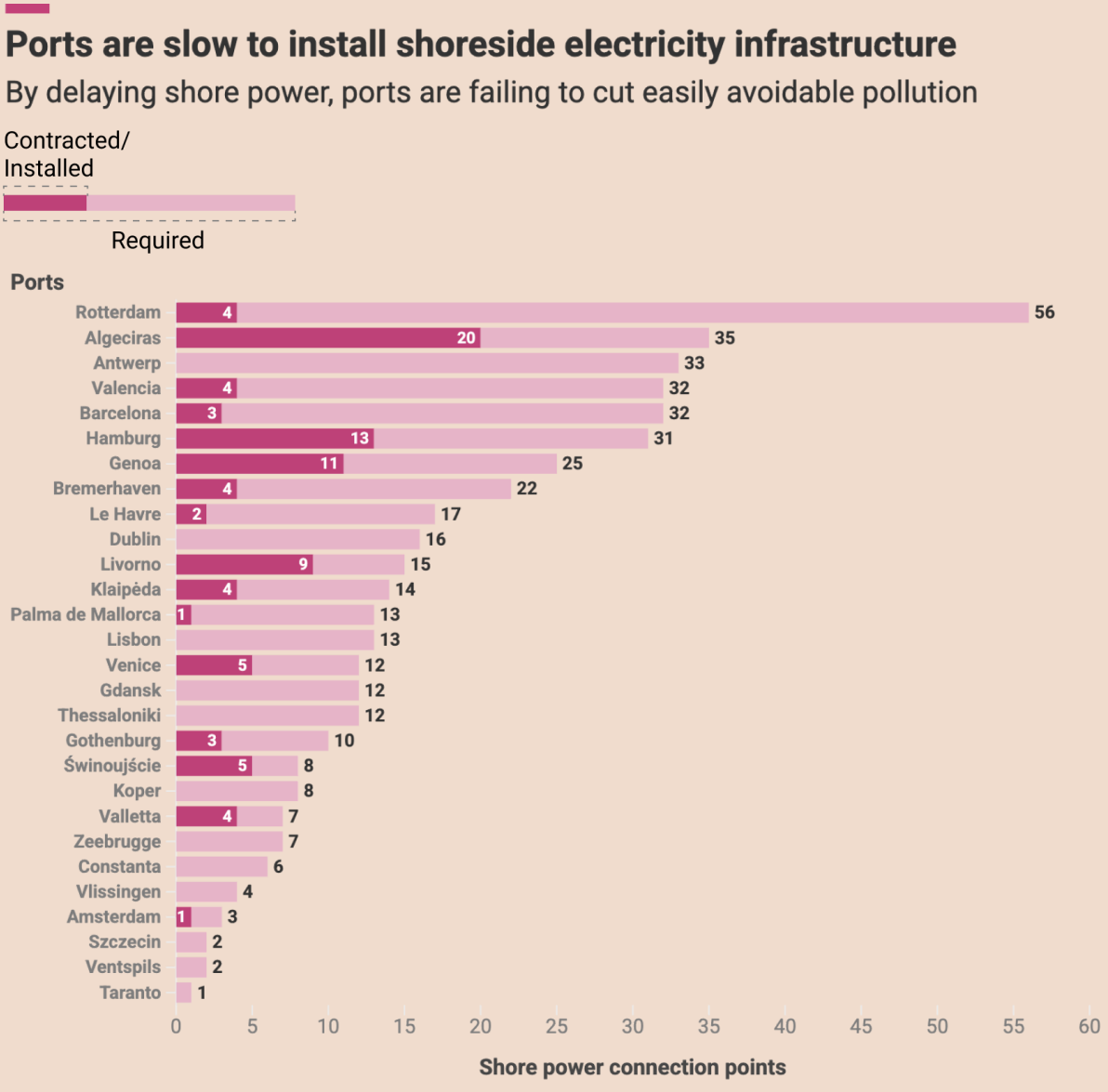
European ports unplugged: The state of shore power deployment

Assessing EU ports' readiness for shore power requirements

Summary

Shipping activity is concentrated in ports, and so are its emissions and pollution. Over 6% of Europe's maritime GHG emissions occur during port operations, alongside high levels of air pollutants such as sulphur oxides and fine particles. Cutting these emissions is critical to improving urban air quality and protecting public health.

To help address this, the EU has introduced a mandate requiring ports to provide onshore power supply (OPS) by 2030. This measure will enable ships to connect to the local electricity grid while docked, replacing the use of fossil-fuel auxiliary engines and reducing harmful emissions.



To evaluate the progress of port installations of OPS, T&E commissioned a study from DNV covering 31 European ports. The study was conducted in April 2024, and the data were updated in May 2025. **Findings show that only one in five required onshore power supply (OPS) connections is currently installed or contracted, with slow uptake across most ports**. Of the 31 ports studied, only 4 have installed or contracted more than half of the connections required by 2030.

The study also reveals clear disparities between the different ship types covered by the mandate. While 38% of required OPS connections are already covered for cruise and passenger ships, container ships remain largely underserved, with only 34 OPS connections guaranteed (operational or contracted) out of the 294 required, or 11%.

Among the three ship types concerned, cruise ships stand out as the highest-impact segment, with average emissions in port over six times higher than the average container ship. Given their regular and predictable routes and the proximity of cruise passenger terminals to busy city centres, cruise ships should be prioritised for earlier OPS deployment and uptake.

Current EU laws fail to regulate the full scope of at-berth emissions. Key sources of pollution from smaller vessels and unregulated ship types remain unaddressed. Based on these findings, we recommend:

- **Advance EU shore power requirements for cruise terminals and cruise ships to 2028**, reflecting the segment's high proportion of at berth emissions and relatively advanced OPS readiness.
- **Integrate shoreside electricity into the Renewable Energy Directive (RED III) electricity crediting mechanism** as part of national transposition, to enhance investment viability and accelerate port decarbonisation.
- **Earmark dedicated EU funding for OPS and port grid expansion** under the next Multiannual Financial Framework (MFF), including continued support through the Alternative Fuels Infrastructure Facility (AFIF).
- **Expand shore power requirements to a broader range of ships at berth,** including currently excluded ship types and smaller vessels, as part of future revisions to Alternative Fuels Infrastructure and FuelEU Maritime regulations.

Ports are uniquely positioned to lead the green shipping transition. The 2030 mandate presents an opportunity not only to meet the regulatory requirements, but also to actively cut pollution and emissions, improve public health and enhance energy resilience. With only limited progress to date, ports should step up and accelerate OPS deployment.

1. Electrifying ports - how and why

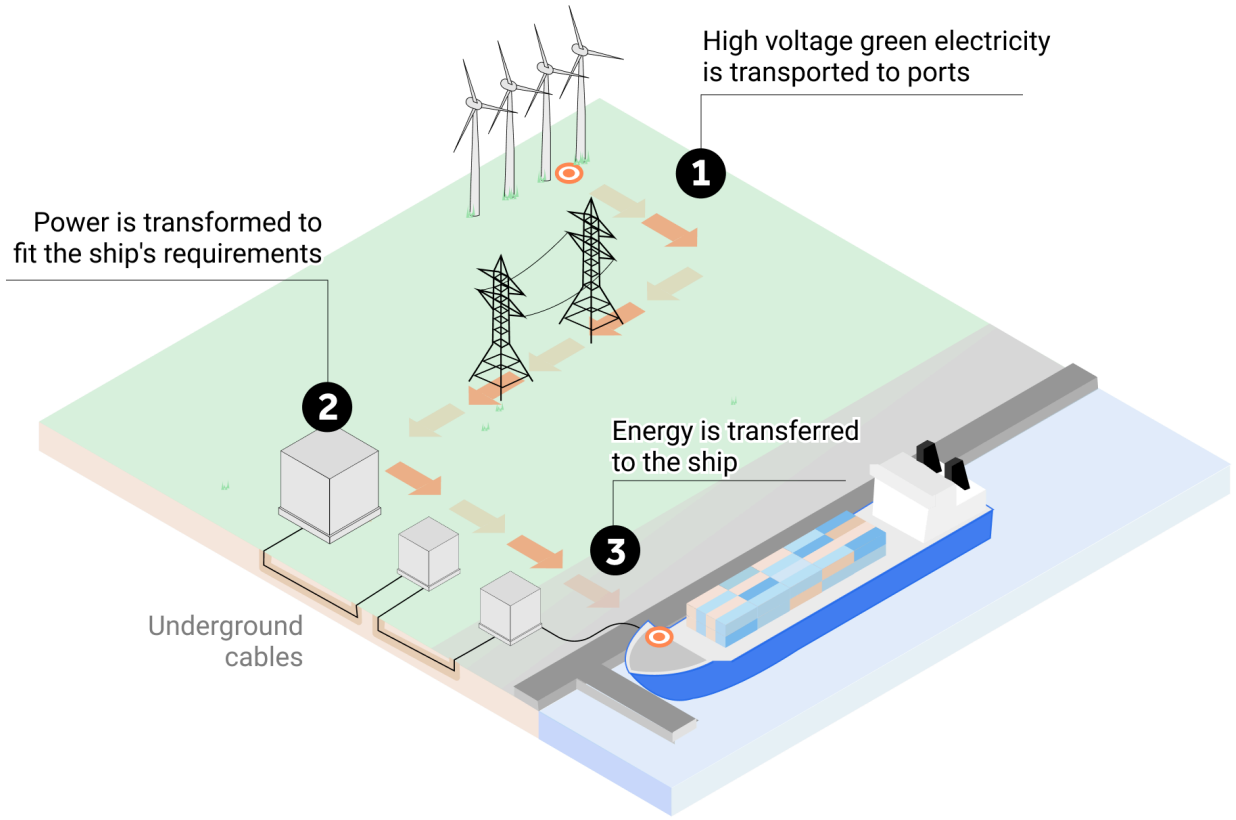
In Europe, the maritime sector accounts for 12.7% of all transport CO_2 emissions, which amounted to 131.9 million tonnes of CO_2 in 2023. Under current policies, maritime emissions could represent one-third of total transport emissions in 2050.

According to our analysis, ships at berth emitted 8.3 million tonnes of CO_2 in European ports in 2023, accounting for 6.4% of total European shipping emissions. This share rises to 15% for cruise ships, which have high energy demands while docked. In addition to CO_2, ships emit harmful air pollutants such as sulphur oxides (SOx), nitrogen oxides (NOx), and fine particulate matter (PM). In 2022, Europe's cruise fleet emitted more sulphur oxides than 1 billion cars. These pollutants are linked to cardiovascular and respiratory illnesses and directly affect the health of port workers and nearby communities.

Given ports' direct influence over infrastructure and energy supply, they have a critical role in cutting down these pollutants and greenhouse gas (GHG) emissions, and enabling the decarbonisation of the shipping sector.

1.1. What is onshore power supply?

Onshore power supply allows ships to connect to the local grid



Source: T&E

While at berth, ships consume energy to support activities like loading, heating, or lighting. Usually, this power is provided by auxiliary engines and boilers that emit greenhouse gases like CO_2 and air pollutants. Onshore power supply (OPS) allows ships at berth to replace onboard fossil-based energy production with electricity. When docked in port, ships can connect to the local grid and turn off auxiliary engines.

1.2. How the EU regulates onshore power supply

To reduce pollution and GHG emissions, the EU has set requirements for the provision and use of OPS in EU ports as part of the Fit-for-55 package.

The Alternative Fuels Infrastructure Regulation (AFIR) mandates trans-European transport network (TEN-T) maritime ports to be ready to provide OPS for at least 90% of their port calls by 2030. It also requires core inland waterway ports to deploy at least one OPS connection by 2025. FuelEU Maritime Regulation (FEUM) mirrors AFIR by setting a similar obligation for vessels. Both regulations cover the same three ship types - passenger ferries, cruise, and container ships above 5,000 gross tonnage (GT).

A few exemptions exist: ships do not have to connect during unscheduled or very short port calls, if OPS is not available, or if the electricity grid is at risk. They can also use an alternative zero-emissions technology when at berth, such as onboard batteries or hydrogen fuel cells. Only ports that have significant annual traffic, i.e. more than 100 port calls by container ships, 40 by passenger ferries and 25 by cruise ships, are subject to the maritime OPS mandate.

In light of these upcoming regulatory requirements, T&E commissioned a study from DNV to assess the progress of 31 European ports in deploying OPS. The study was conducted in April 2024, and the data were updated in May 2025. A separate study examines the progress of OPS installations in UK ports.

1.3. Benefits of OPS

Shore-side electricity delivers direct climate benefits by lowering GHG emissions, while also reducing noise and air pollution. Using OPS at berth cuts down emissions, including SOx, NOx and PM, allowing ports to improve air quality and protect the health of port workers and local residents.

Additionally, EU regulations promote the use and scale-up of electricity by counting it as a zero-emission technology. As ships are increasingly incentivised to electrify to reduce their emissions under ETS and FuelEU Maritime obligations, ports equipped with OPS will grow increasingly attractive.

1.4. Obstacles to OPS development

Shore power installation costs vary significantly, ranging from hundreds of thousands to millions of dollars per berth, depending on ship power requirements and additional grid reinforcement required.

Between 2021 and 2025, the EU's Connecting Europe Facility (CEF) and Alternative Fuels Infrastructure Facility (AFIF) funds supported OPS deployment with approximately €267 million. This has played a crucial role in enabling OPS installations across a number of ports; however, the continuity of this funding in the next MFF remains uncertain, potentially slowing down the pace of OPS deployment.

Additionally, OPS-generated electricity is not automatically recognised under the RED III credit mechanism, limiting its financial appeal. However, Member States have the option to address this in their national transpositions of RED III by recognising OPS as a renewable energy input. This would allow ports and operators to generate tradeable credits, improving the business case by helping to offset both installation and operational costs.

2. Results of the study

The DNV report assesses the state of OPS in 31 European ports. Based on the at berth energy demand and traffic patterns of vessels covered by EU legislation, DNV estimated the required number of OPS connection points in each port, for each ship segment. This number was then compared with the connection points that are already operational or contracted for operation by 2030.

The study focuses on the maritime OPS mandate and does not cover inland OPS requirements. Due to the low number of port calls from seagoing ships above 5,000 GT in the ports of Ghent, Rouen and Terneuzen, there is no estimated need for maritime OPS. They were therefore excluded from our analysis. The methodology of the study is detailed in Annex I.

2.1 Ports are not rushing to electrify

The study shows that ports are not rushing to tackle air pollution issues. To date, only 21% (93 out of 448) of all required connections are in place or under contract in these ports. The detailed list per port and ship segment is provided in Annex II.

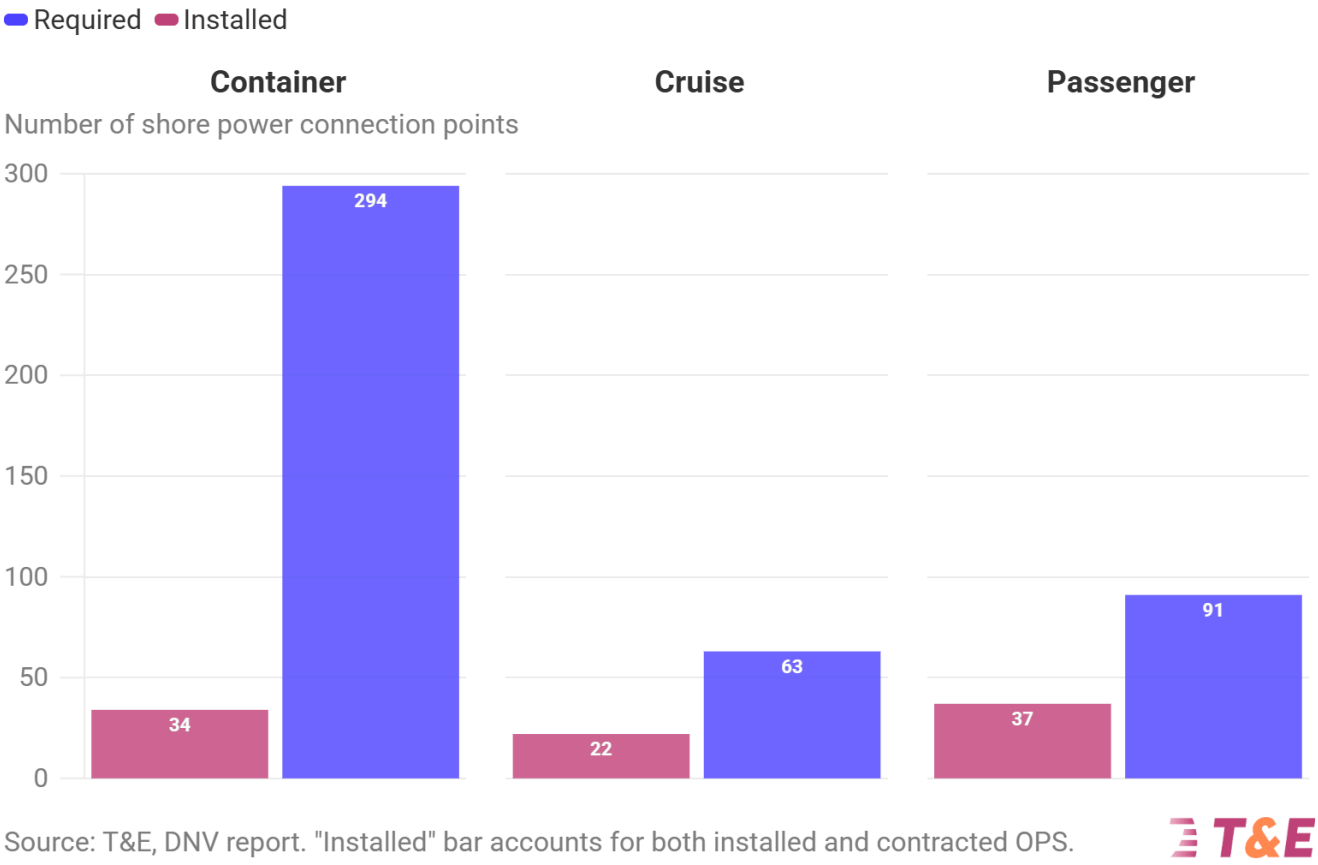
While many ports are preparing tenders or planning to contract OPS installations in the coming months, these future plans were excluded from our analysis due to the uncertainty surrounding their timeline and execution. They are documented in the accompanying DNV report.

Relying on unconfirmed plans is insufficient. OPS deployment can require several years of lead time, particularly where significant grid upgrades are needed. Delays in implementation allow ongoing pollution and increase the risk of non-compliance for both ports and vessels calling at them.

2.2. OPS shortage for container ships

While ports are making some progress with cruise ships and passenger ferries, the upgrading of container vessel OPS facilities is lagging, especially given that this segment represents 66% of all required OPS connections in the analysed ports.

Containership OPS lagging behind other segments



Source: T&E, DNV report. "Installed" bar accounts for both installed and contracted OPS.

Overall, only 11% of the required connection points for container ships are in place or under contract, compared to 41% for passenger ferries and 35% for cruise ships.

Outstanding port cases

While most ports are not yet taking significant steps to proactively implement shore power supply, a few have made notable progress.

The heavyweights

The ports of Algeciras and Hamburg account for a disproportionately large share of installed OPS connections. Algeciras alone makes up 29% of all installed OPS for passenger ferries, and both ports together account for over half (19 out of 34) of all installed container ship OPS connections.

The front-runners

The ports of Livorno, Valletta, Algeciras and Świnoujście are the only ports that have installed or contracted more than half of their required OPS installations.

The specialist

The port of Venice installed or contracted 18 passenger ferries OPS connection points, while only 2 are required based on DNV estimations of ship traffic. One of the possible reasons is that the majority of ferries calling in Venice are under the 5,000 GT threshold. If so, the port's decision to provide shore-side electricity to these vessels, despite not being required to, demonstrates that it is both feasible and desirable to extend the regulation's scope to smaller vessels.

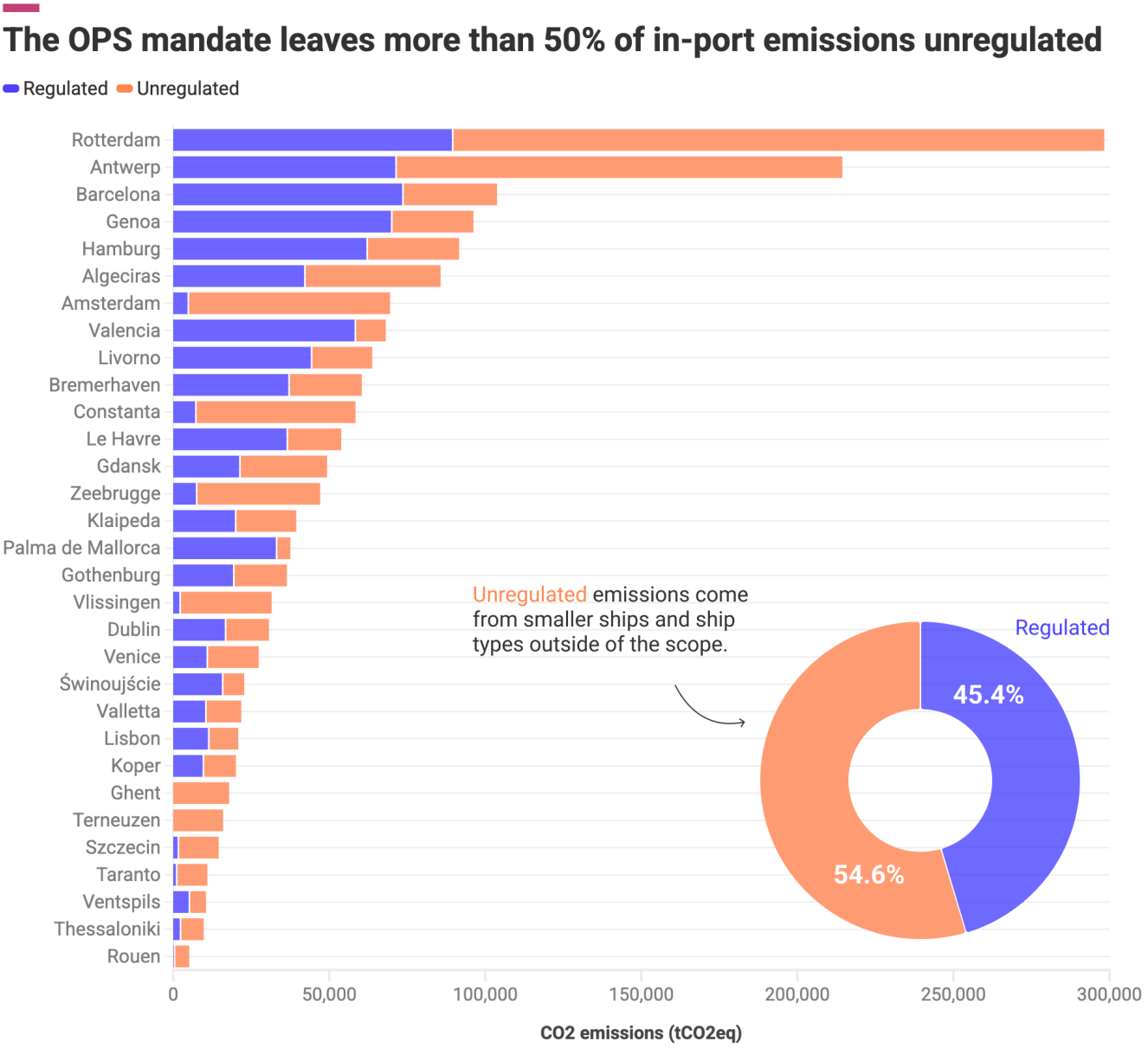
Image from Hamburg Port Authority.

2.3. A large share of emissions remains unaccounted for

Even if ports achieve full compliance with the current mandate, the current regulatory scope remains too narrow to address the majority of emissions at berth. Two major gaps stand out.

Firstly, the EU mandate only applies to three ship types: container, cruise, and passenger vessels above 5,000 GT. All other vessel types, such as bulk carriers or tankers, are currently excluded from shore power obligations, leaving 24% of at-berth pollution and emissions unregulated and unaddressed.

Secondly, the regulations exclude smaller vessels. Despite being the most suitable candidates for electrification due to lower energy demands, shorter routes, or simpler infrastructure needs, these vessels are not required to electrify. This leaves an additional estimated 30% of at-berth emissions unregulated. In total, around 55% of in-port emissions are not covered by the regulation.



Source: T&E, DNV. 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 > 5'000GT. Average carbon intensity of vessels in Europe is 91.20 gCO2e/MJ.

3. Zoom in on cruise OPS

3.1. Promising but insufficient coverage

As found in Chapter 2, coverage for cruise ships and passenger ferries is more advanced than for container ships. However, only 4 ports have already installed or contracted enough connection points for cruise ships: Hamburg, Le Havre, Valletta and Venice.

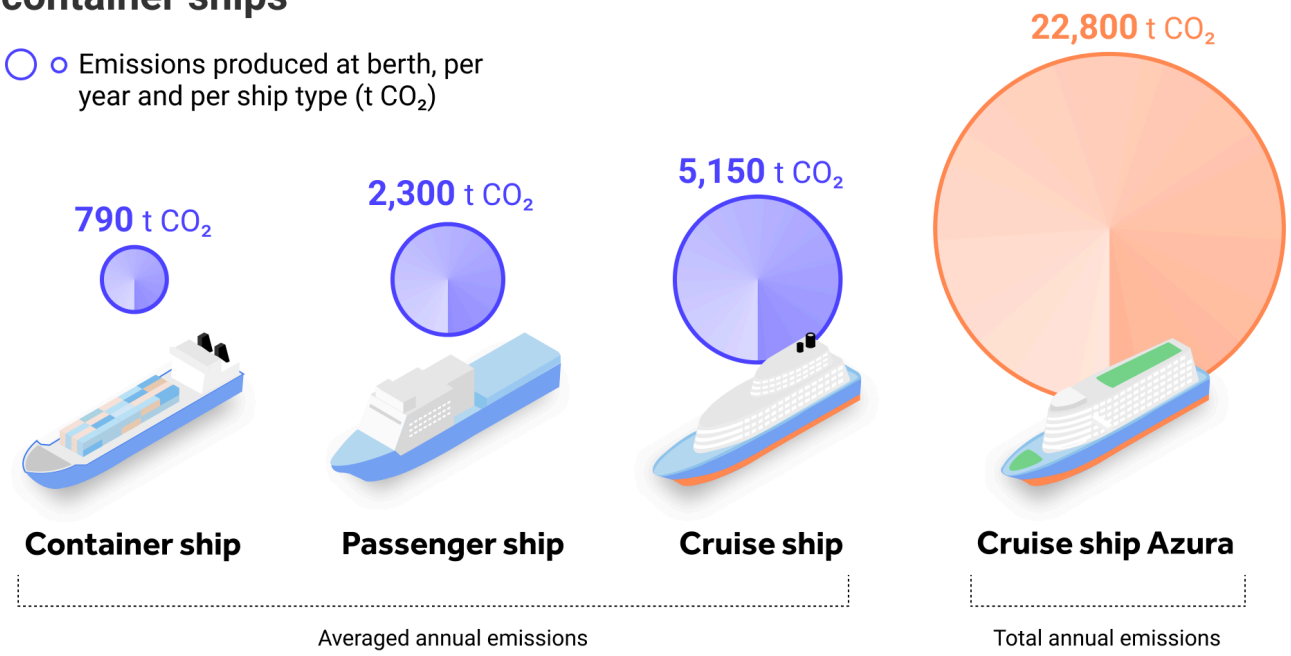
3.2. Cruise ships' OPS should be prioritised

Cruise ships spend considerably more time at berth than other ship types and require more auxiliary power than other ships to power the vessels' various amenities.

On average, each cruise ship emits 5,148 tonnes of CO_2 each year in EU ports. This is about 2.2 times higher than the average emissions of a passenger ferry, and more than 6.5 times higher than those of a container ship.

For the biggest cruise ships, emissions skyrocket. In 2023, the giant *Azura*, owned by the Carnival corporation and capable of carrying 3,500 passengers, emitted a staggering 22,800 tonnes of CO_2 in European ports in 2022, of which 19,600 tonnes came from its auxiliary engines. This represents 21% of its annual total CO_2 emissions that could be avoided by connecting to OPS.

Cruise ships at berth emissions are more than 6 times higher than container ships



Source: MRV 2023v42

In addition, cruise ships rely more heavily on their auxiliary engines compared to other ship types, making them particularly well-suited for OPS uptake. Around 80% of their at berth emissions (approximately 4,100 tonnes of CO_2 per year) come from auxiliary engine use, whereas the average across all ship types is only 47%. These emissions could be eliminated through the use of OPS connections.

Finally, T&E analysis has shown that cruise ships emit more sulphur oxides (SOx) in European seas than all of Europe's passenger vehicles, making it urgent to speed up the OPS deployment and eliminate SOx emissions from ships at berth.

Given the disproportionate share of at berth emissions cruise vessels are responsible for, moving to OPS for this segment should be a priority. Due to the relatively predictable nature of their routes and operations, investment in cruise ship OPS is also more likely to pay off sooner and deliver consistent benefits.

4. Conclusion & policy recommendations

By 2030, ports will need to provide shore-side electricity to at least 90% of their port calls in line with AFIR and FuelEU Maritime.

Beyond legal compliance, installing more shore power would bring immediate benefits, from pollution reduction in port areas to creating a new revenue stream for ports.

However, the vast majority of ports are slow to act. While they are not yet late in complying with the law, project lead times are long, and each year of delay prolongs avoidable emissions, public health risks, and foregone economic and environmental benefits.

The containership segment requires the largest share of new OPS installations. Cruise ship OPS must also be fast-tracked, as it offers the highest potential for reducing emissions and pollution.

Finally, our analysis shows that even if the current OPS mandate is fully met, the current EU regulations will leave over half of at berth emissions unaccounted for.

In light of these findings, we recommend to:

1. **Advance EU shore power requirements for cruise terminals and cruise ships to 2028**, reflecting the segment's high proportion of at berth emissions and relatively advanced OPS readiness. Member States should consider applying similar early requirements to other high-impact ship types based on national port profiles and emissions hotspots.
2. **Integrate shoreside electricity into the Renewable Energy Directive (RED III) electricity crediting mechanism** as part of national transposition, to enhance investment viability and accelerate port decarbonisation. Member States should adopt complementary incentives, such as tax exemptions on shore power or streamlined permitting for OPS deployment and grid upgrades.
3. **Earmark dedicated EU funding for OPS and port grid expansion** under the next Multiannual Financial Framework (MFF), including continued support through the Alternative Fuels Infrastructure Facility (AFIF). Prioritise funding access for countries that commit to pre-2030 OPS deployment.
4. **Expand shore power requirements to a broader range of ships at berth,** including currently excluded ship types and smaller vessels, as part of future revisions to AFIR and FuelEU Maritime.

Annex I. Methodology

OPS deployment in ports

31 European TEN-T ports were selected for this study based on three criteria: volume of ship traffic, geographical distribution, and the willingness of port authorities to share relevant data.

Each port's readiness to meet the 2030 OPS maritime mandate was assessed through the following steps:

- **Traffic and energy demand analysis**: The time spent and energy consumed by ships in each selected port were calculated using AIS data from 2023. The analysis was differentiated by vessel type and size category. Geographical boundaries of the ports were defined using DNV's internal analytical framework.

- **OPS connection needs**: Based on the traffic patterns, daily for cruise and container ships and hourly for ferries, energy demand was converted into the required number of OPS connection points. This estimate was calculated specifically for the three ship types regulated under the EU mandate: container ships, passenger ships, and cruise ships over 5,000 GT.

- **Port OPS data**: Information on existing OPS infrastructure, signed contracts, and future installation plans was gathered through structured questionnaires and interviews with port representatives. Interviews were conducted during March and April 2024. Ports were approached for updates in April 2025, and the information was updated where necessary/available. In some Italian ports, data was not available and has been provided by the Italian Ports Association.

- **Benchmarking readiness**: The number of installed and contracted OPS connection points was compared with the estimated number required and broken down by vessel segment and voltage levels.

- **Scope and limitations:** Only ships under the current scope of the AFIR and FuelEU mandate (container, passenger, and cruise ships ≥ 5,000 GT) were included. Inland port OPS requirements are excluded.

In-port and total emissions of CO_2

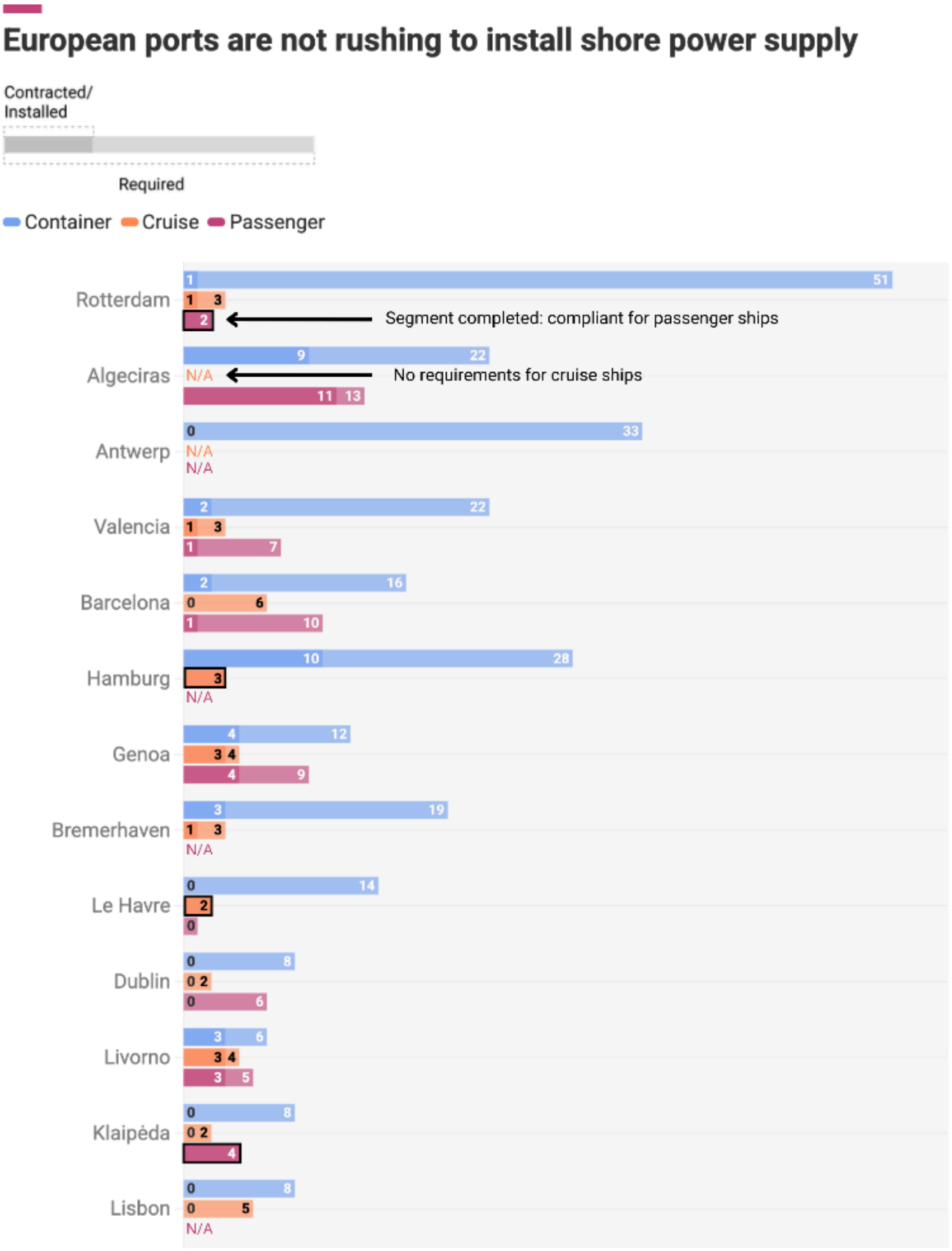
In-port and total emissions for vessels are calculated based on MRV data for 2023. As per MRV definition, cruise ships are classified as "Passenger ship" and "Passenger ship (Cruise Passenger ship)", container ships as "Container ship" and passenger ferries as "Ro-pax ship".

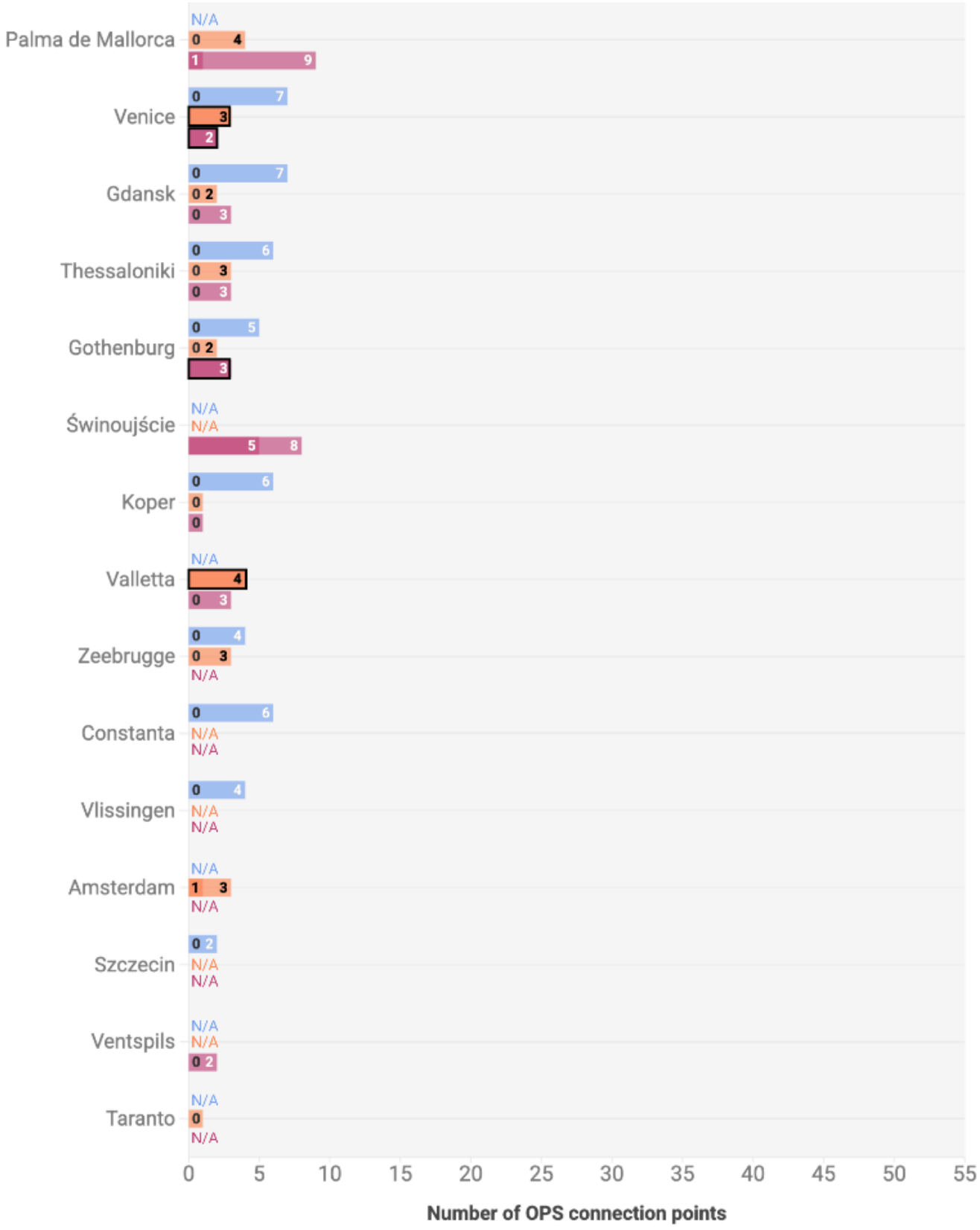
At berth emissions were split between auxiliary engines and boilers emissions using data from the Fourth IMO GHG study. We assigned a power output and a specific fuel consumption (SFC)

factor for each vessel in the MRV database. Based on those factors, we re-calculated emissions from auxiliary engines and boilers.

Power demand and SFC factors were extracted from Tables 17 and 19 of Section 2.2.5 of the IMO 4th GHG study. The method to calculate auxiliary engines and boilers' emissions is detailed in Section 2.2.5 as well.

Annex II. Detailed overview of European ports' readiness for OPS mandate





Source: DNV report. Three ports (Ghent, Rouen and Terneuzen) were removed from the list as they are not mandated to install maritime shore power. The number of installed/contracted OPS is capped at maximum required when ports installed more OPS than strictly required by the regulation.

Further information

Eloi Nordé

Shipping Policy Intern

T&E

eloi.norde@transportenvironment.org

Inesa Ulichina

Shipping Policy Officer

T&E

inesa.ulichina@transportenvironment.org

Mobile: +32 491 37 89 49