BRIEFING - December 2025

CRUISE CONTROL:

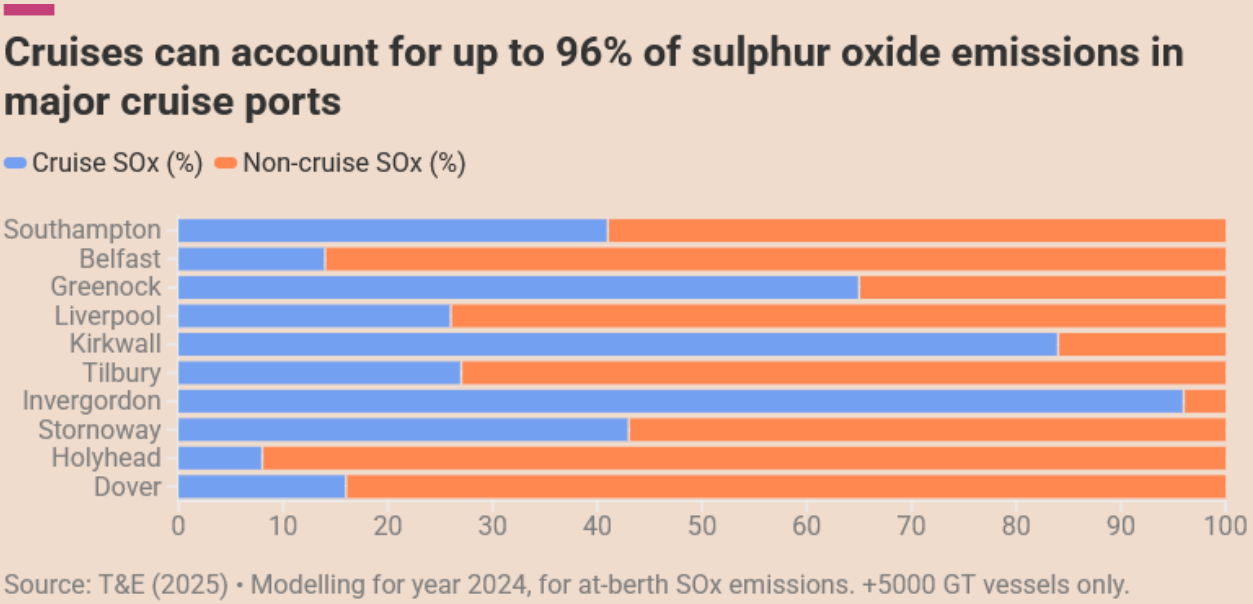
The Cruise Growth Plan will worsen air pollution in coastal communities.

Without the right policies, the government's Cruise Growth Plan risks worsening air pollution that is harming coastal communities.

Summary

Without policies supporting onshore power, the UK Cruise Growth Plan risks worsening air pollution, threatening the health and environment of coastal communities.

T&E analysis of cruise pollution at UK ports found that cruise ships already have a large impact on air quality in ports and can be responsible for between 8% and 96% of toxic sulphur oxide (SO_x) pollution at the UK's busiest cruise terminals significantly burdening coastal communities.



In Southampton in 2022, the UK's busiest and most polluted cruise port, just 46 cruise ships, making up just 6% of vessel port calls, produced more SO_x than 200 containerships and accounted for over 50% of the port's NO_x and $PM_{2.5}$ emissions, due to the extended amount of time they spend in port. These pollutants contribute to respiratory disease, cardiovascular disease and lead to premature death.

Southampton and Belfast which each received 468 and 125 port calls from cruise ships in 2024 are the first and second most polluted ports in terms of sulphur oxides, nitrous oxides and particulate matter.

Now the UK Government's recently published Cruise Growth Plan, developed jointly with the cruise industry, risks further worsening pollution in some of the UK's busiest port towns including Southampton, Belfast, and Liverpool. The Plan's focus is on expanding the UK

cruise sector, to match the UK's ambition to increase inbound tourism to 50 million people by 2030, a significant rise from 41 million inbound tourists before the pandemic in 2019.

However, the Plan fails to consider and propose policies to mitigate against the disproportionate impact that cruise ships have on air quality, particularly due to the extended periods they spend at berth burning dirty fuels to power their extensive energy needs.

This risks creating an unfair burden on the UK's coastal communities. To manage cruise growth without increasing negative environmental and health impacts on local coastal communities, the government must rapidly and decisively implement policies outlined in its Maritime Decarbonisation Strategy published earlier this year. As a priority this should include:

1. **Mandating the roll out and use of onshore power supply** infrastructure at major cruise ports in the UK to allow ships to plug into power while docked. Allowing cruises to run on clean, home grown renewables rather than burning fossil fuels at berth.

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2. **Designating ports as having Critical National Priority Status** and fast-tracking and **prioritising grid connections** for ports seeking to install onshore power to allow the rapid roll out of this pollution cutting technology. At the moment even the few connections which currently exist cannot be fully utilised due to grid constraints.

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3. **Progressing with extending the UK ETS to cover international emissions as announced as part of the UK-EU reset in May and for vessels above 400 GT** to raise revenues to fund investments into emissions reduction technologies, including onshore power roll out and e-fuel production. Today all of the sector's climate pollution is untaxed and there is no fuel duty on fuel used by cruises. T&E analysis shows that fairly taxing the shipping sector for its climate impact could raise £1 billion annually.

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4. **Mandating the uptake of green hydrogen based fuels (e-fuels)** for the shipping sector to reduce climate emissions and set the sector on a path to decarbonisation. This should include both international and domestic voyages as the majority of cruise emissions are considered international.

5. **Introducing GHG Intensity Standards for shipping to drive the use of** green fuels and the roll out of efficiency measures.

1. Growth in the UK's cruise sector risks worsening air pollution in coastal communities

Today, ships at berth in the UK rely almost exclusively on burning fossil fuels for onboard energy, a significant source of the shipping sector's emissions and a major contributor to air pollution for nearby coastal communities. Air pollution from shipping, particularly in port towns, poses serious health risks, including respiratory and cardiovascular disease, for dock workers and residents.

Whilst cruise ships represent a small fraction of the global fleet (only 515 vessels), their impact on coastal communities is substantial because they spend considerable time at port. This results in them releasing significant amounts of harmful air pollutants directly into port towns, often 24 hours a day. The health costs associated with shipping's contribution to just one type of pollution, toxic particulate matter ($PM_{2.5}$), are estimated at £1.5 billion per year (in 2017 price). Ships also produce toxic nitrous oxides (NO_x) and sulphur oxides (SO_x).

T&E analysis from 2022 showed that Europe's 218 cruise ships emitted more SO_x than 1 billion cars, or 4.4 times more than all of Europe's cars combined. T&E found that by 2024, in Southampton, the UK's busiest cruise port, 46 cruise ships produced more SO_x than 200 containerships and accounted for over 50% of the port's NO_x and $PM_{2.5}$ emissions due to the extended amount of time they spend in port. The cruise sector is also rapidly expanding, with passenger numbers currently around 20% higher than pre-pandemic levels in the UK. The global fleet is also growing in both number and size, resulting in cruises emitting more greenhouse gases and air pollutants than ever before.

The Department for Transport recently released the UK Cruise Growth Plan on September 16th 2025. The Plan was developed jointly between the government and the UK Cruise and Shipping Industry. Its primary focus is on expanding the UK cruise sector, to match the UK's ambition to increase inbound tourism to 50 million people by 2030, a significant rise from 41 million inbound tourists before the pandemic in 2019. While the Plan outlines several joint growth and people-focused commitments concerning economic impact, skills, and safety, the only commitment related to the environment is focused on addressing the skills gap for the green transition.

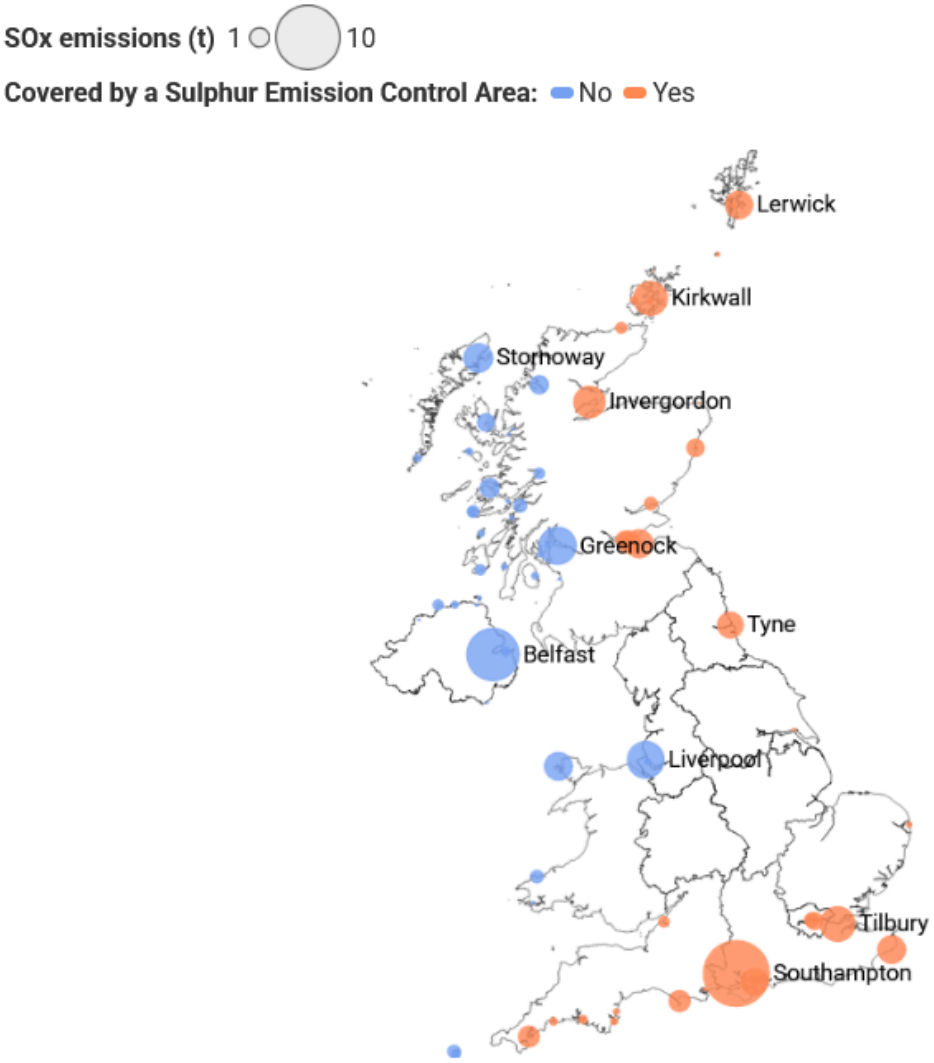
The Plan fails to assess the increased impact that growth in cruise ship passengers will have on air quality and the climate. It also fails to propose policies to mitigate against the negative

consequences of cruise pollution growth, risking further burdening coastal communities. This briefing assesses the air pollution burden imposed by the cruise sector on UK ports and their surrounding coastal communities and proposes key policies which can reduce the impact of the cruise sector on local communities and the environment.

1.1 The government's Cruise Growth Plan will increase pollution in ports

Analysis of 2024 data by T&E reveals that cruise ship air pollution at berth is concentrated primarily around the south-east of England and Scotland. A significant finding is that while major cities are featured in the top-10 most polluted cruise ports, a notable number of smaller towns are also disproportionately affected by high levels of cruise pollution.

South-east England and Scotland concentrate the majority of cruise air pollution



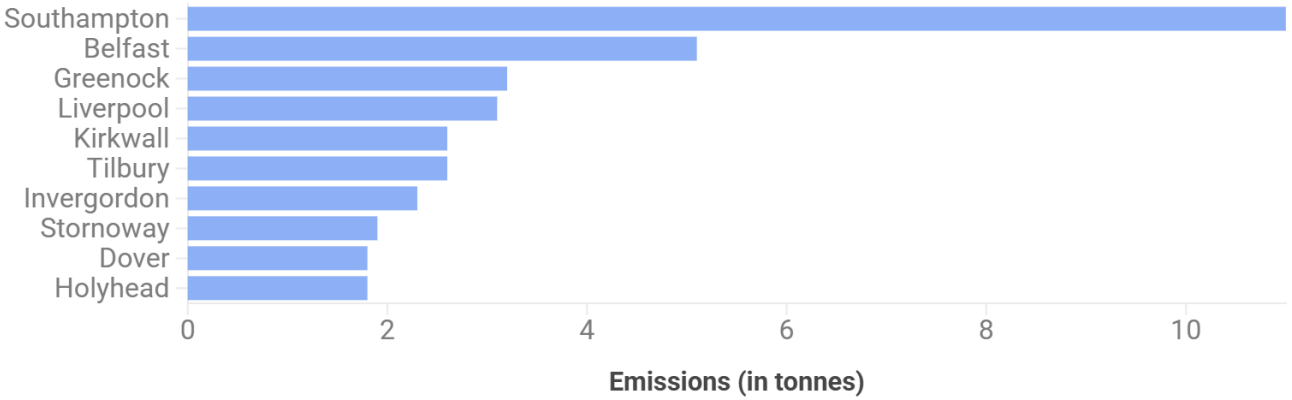
Source: T&E (2025) • SOx emissions at berth aggregated over the whole of 2024, for vessels of +5000 GT

T&E's analysis of cruise ships' contribution to air pollutants whilst in port focused on SO_x, NO_x and $PM_{2.5}$ due to their damaging impact on humans. SO_x and NO_x can contribute to respiratory diseases. $PM_{2.5}$ are particulates made of fine dust, soot and smoke which can be inhaled and contribute to cancer and cardiovascular diseases, also leading to premature death.

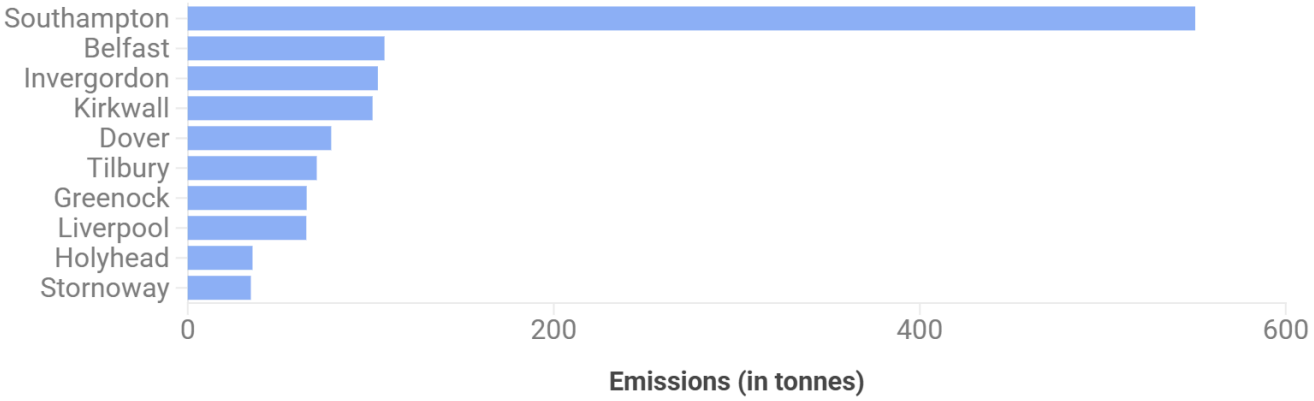
Southampton is the UK's most polluted cruise port for SO_x, NO_x, and $PM_{2.5}$ emissions. According to a 2024 T&E analysis, it ranks as the country's third most SO_x-polluted port and the first most polluted for NO_x and $PM_{2.5}$ overall. Belfast is the second most polluted cruise port in terms of SO_x, NO_x, and $PM_{2.5}$, and ranks fifth nationally for overall pollution from these three compounds. Ranking sixth in overall SO_x, NO_x and $PM_{2.5}$ port pollution, Liverpool is also among the most polluted cruise ports, ranking fourth for SO_x, ninth for NO_x, and seventh for $PM_{2.5}$. The list also features less expected ports topping the list, such as the Scottish locations of Invergordon, Kirkwall, Greenock, and Stornoway, which are all significant cruise pollution hotspots. Greenock, near Glasgow, ranks as the third most polluted port for SO_x pollutants. Invergordon, located in the Scottish Highlands close to Loch Ness, is the third most polluted port for both nitrous oxide and particulate matter pollution.

Southampton tops the list of UK's top 10 most-polluted cruise ports

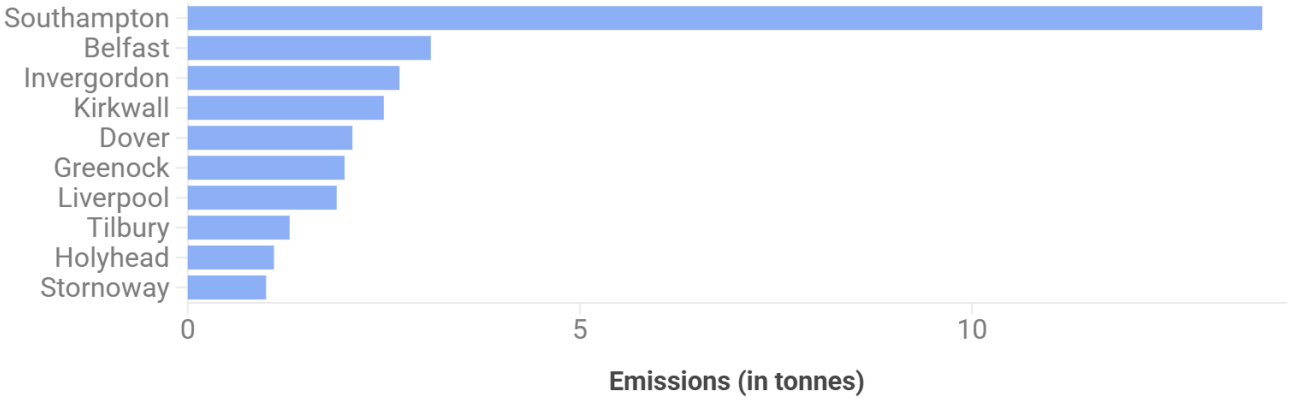
SOx



NOx



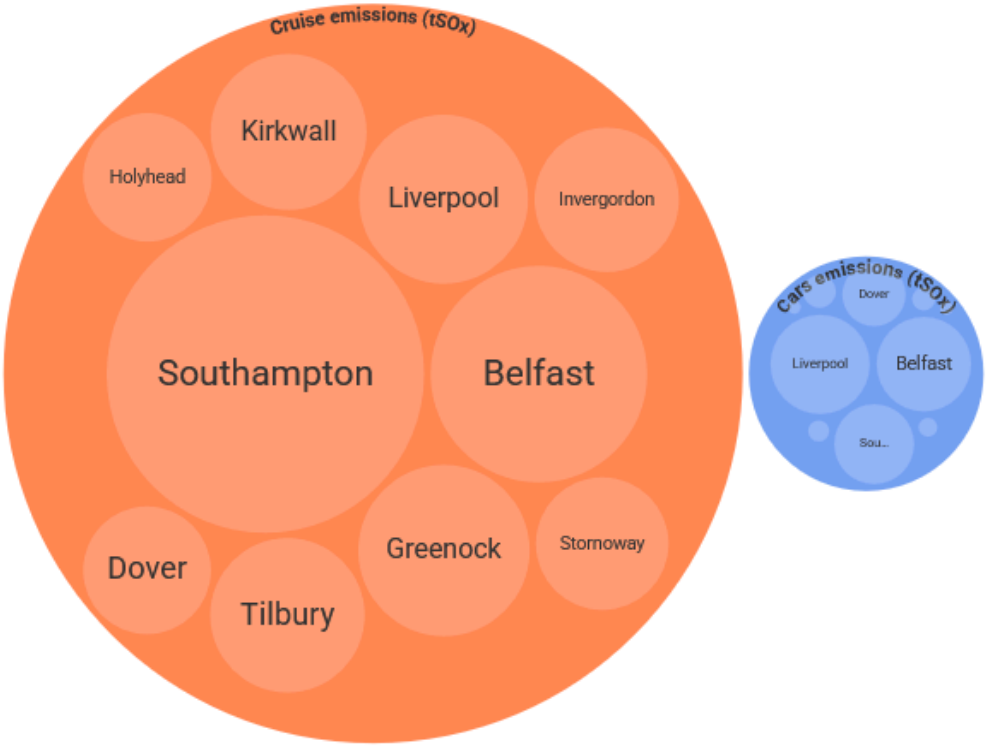
PM2.5



Source: T&E (2025) • Modelling for year 2024, aggregated over the whole year for at-berth emissions

The SO_x air pollution produced by cruise ships in these communities significantly outweighs the SO_x air pollution from local car traffic. In the small Scottish towns with some of the worst cruise air pollution, SO_x from cruise ships is between 25 and 130 times higher than the SO_x produced by cars in those towns. Furthermore, while England's population is around 11 times the size of Scotland's, the SO_x air pollution impact from cruises is only around 1.2 times greater than Scotland's, clearly demonstrating the disproportionate impact the cruise sector has on Scotland's coastal communities. The impact of cruises, whilst proportionately less than seen in Scotland, is still significant in English port towns. Cruise ship emissions of SO_x were significantly higher than those from cars in several English port towns: over 65 times greater in Tilbury, more than 15 times greater in Southampton, over 4 times greater in Dover, and over 2 times greater in Liverpool.

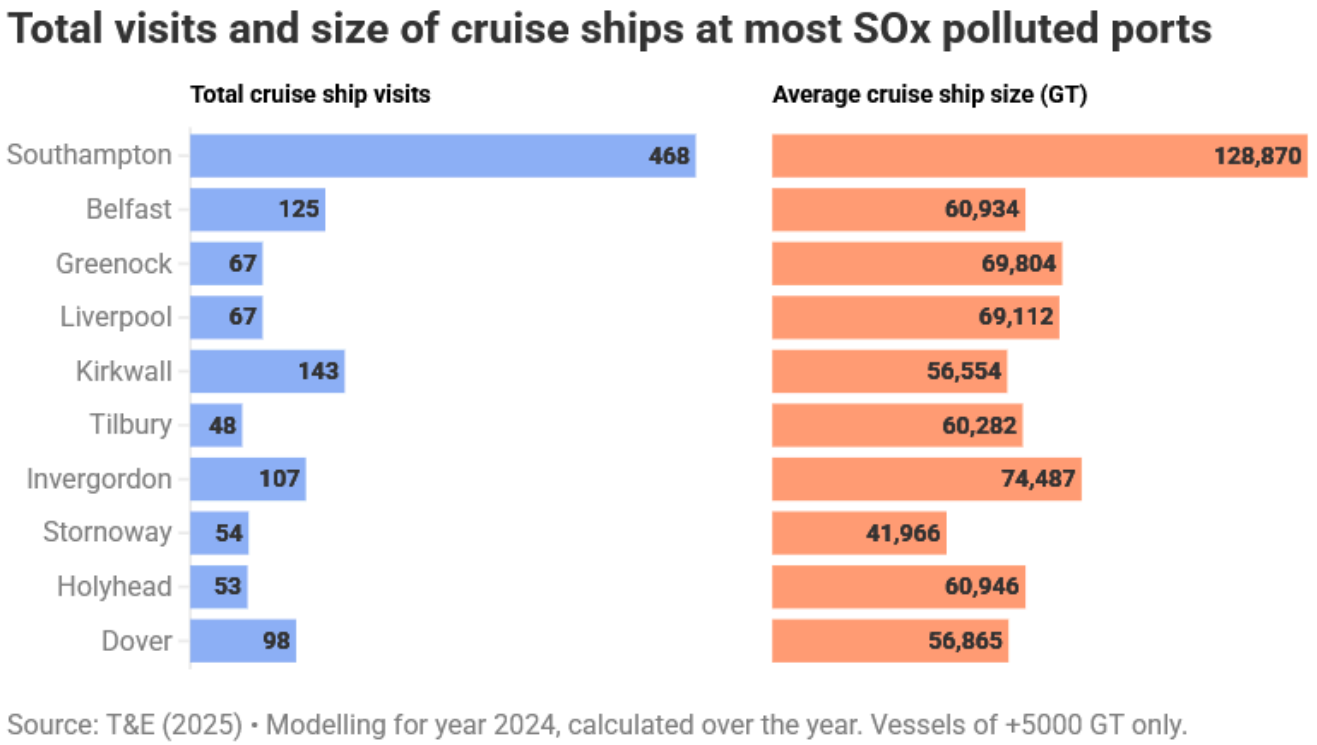
Cruises produce between 2.8 and 130 times more SOx than local cars in top 10 polluted cruise ports



Source: T&E (2025) • Modelling for year 2024, emissions summed over the year. +5000 GT vessels only.

The amount of pollution from cruise ships in ports is a result of multiple factors, including the size of cruise vessels, the number of visits, the length of visits, and whether the port is included in a Sulphur Emission Control Area (SECA). In Southampton, the number of cruise visits as well as the size of cruise vessels far exceeds that of any other port in the UK. This results in a significantly greater amount of pollution compared to other ports.

The experience in other cruise ports with high pollution levels is not uniform. Some ports have a large number of ship visits, but the total pollution impact is lessened by a smaller average vessel size. Conversely, other ports may have fewer visits but a higher average vessel size, resulting in a similar overall pollution total. However, it is still clear that despite different uses of ports, air pollutants remain significant and need to be tackled in all scenarios.



Source: T&E (2025) • Modelling for year 2024, calculated over the year. Vessels of +5000 GT only.

The impact of cruise ships is already significant for coastal communities, many of which are already economically disadvantaged. The government's Cruise Growth Plan risks exacerbating this problem due to the Plan's focus on growth without a corresponding commitment to implementing robust emissions and air pollutant mitigation and reduction policies. Therefore, without urgent and comprehensive policy intervention, the economic benefits of increased cruise ship tourism risk being overshadowed by escalating environmental and public health costs for coastal populations.

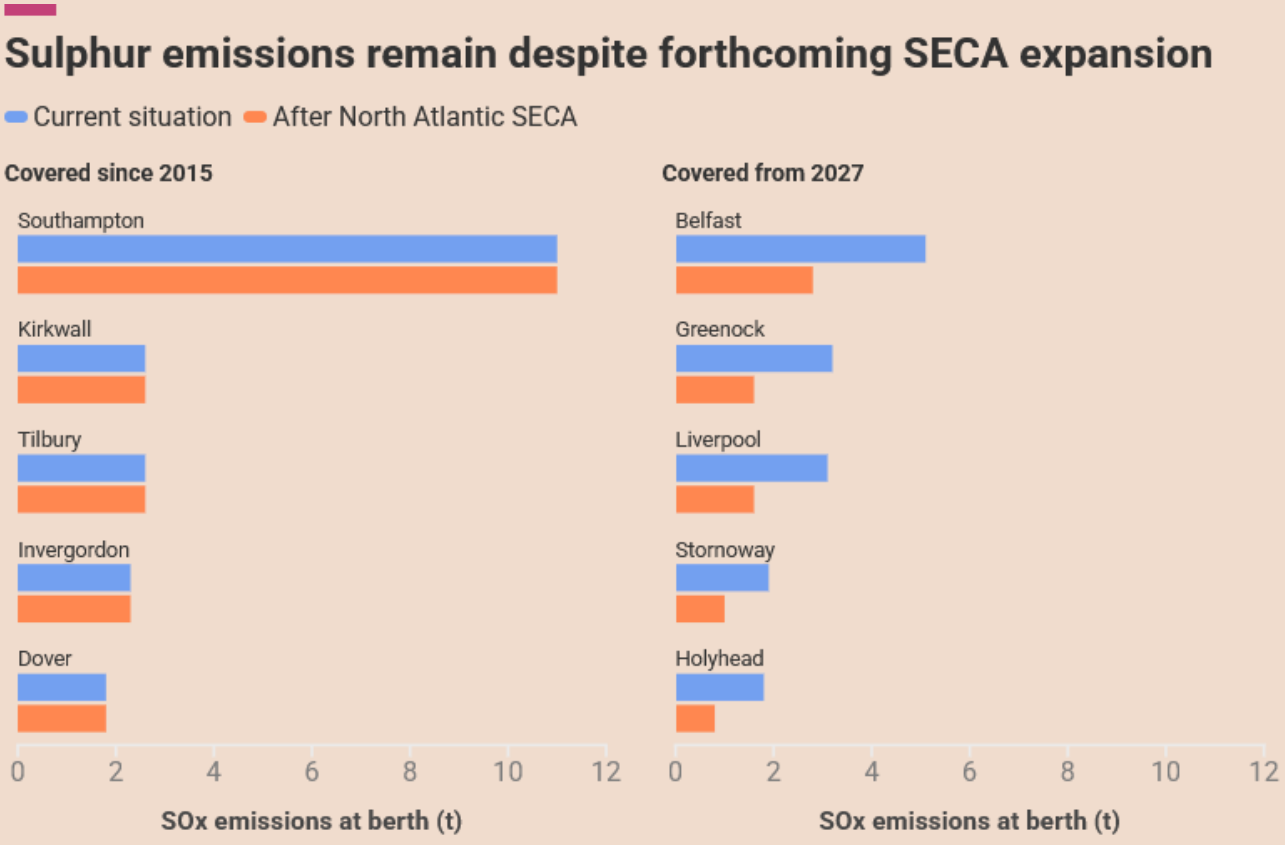
Extending Sulphur Emission Control Areas is insufficient to mitigate against cruise pollution

Sulphur Emission Control Areas (SECA), which oblige ships to use fuels with low sulphur content limits, have been present in the North Sea and the Channel since 2015. SECA applies sulphur limits in the fuel used in the area it covers to 0.10% m/m (mass by mass), a reduction from the global limit of 0.50% m/m.

In ports that have been covered by SECA since 2015, SO_x emissions remain high despite the sulphur content limit. This can be seen in Southampton, where cruise ships produce 15 times the amount of SO_x emissions compared to the city's cars.

From 2028, a new SECA will be enacted in the North East Atlantic, notably covering the Irish Sea. This expansion will result in ships calling at the ports on the west coast and in Northern Ireland being obligated to meet fuel sulphur limits.

Ports such as Belfast, Liverpool, and Holyhead will be covered for the first time. This will reduce SO_x emissions for newly-covered ports compared to today's emissions by an average of 48%, however, it does not eliminate SO_x pollution.



Source: T&E (2025) • Based on 2024 data, showing the 2024 status-quo and air pollution after implementation of the North Atlantic SECA

2. A strong UK policy framework independent of the International Maritime Organization is urgently needed

There is another way. If the government wants to promote cruise growth that doesn't exacerbate negative environmental and health impacts on local coastal communities, it should act quickly and decisively to enact the policies it has outlined in the Maritime Decarbonisation Strategy, crucially prioritising at-berth measures, fuel regulation and extending the ETS, the importance of which is discussed in this section. However, it should go further by finally tackling international shipping emissions via domestic regulation.

Policy certainty is key for the sector to invest in emission-reducing port infrastructure, vessels, and green e-fuel manufacturing facilities. Both car, van and aviation policies have shown that until a regulatory pathway is established to transition to green zero-emission technologies, the sector will not invest in them at the scale required. Electric cars have taken off at scale, now at almost a quarter of UK sales, due to a clear long-term policy driving their supply. The same is needed for the shipping sector.

Current policy uncertainty in the sector, as seen with the delay in voting on a Net Zero Framework at the International Maritime Organization (IMO), risks delaying the transition. Since cruise ships travel internationally, it is also crucial that not just domestic air pollution and carbon emissions but also international carbon emissions from the sector are tackled promptly by appropriate policies to ensure emissions are reduced in line with the UK's carbon targets and do not continue to increase as the sector expands.

So far, the UK has relied on the IMO to regulate international shipping emissions. However, the delay of the voting on the Net Zero Framework to reduce international shipping emissions to next year has stalled progress on decarbonising international shipping emissions. With opposition led by the U.S. Administration, it is highly unlikely that an agreement will be reached until after the next U.S. election, so not before 2029 at the earliest.

The UK's cruise industry, as well as the shipping industry as a whole, cannot wait until 2029 for clarity on decarbonisation of the sector. The longer the UK delays regulation to slash international emissions, the more green jobs and growth are captured by first movers outside of the UK. Therefore, it is crucial that the UK Government progresses policy measures for both domestic and international emissions. As the UK Government stated in the Maritime Decarbonisation Strategy, "should multilateral action through the IMO be delayed or prove insufficient, the UK will develop bespoke domestic measures to address our share of these international emissions, in line with our legal commitment to net zero." Now is the time to take that action.

At present, the sector does not pay tax on any of the fuel it uses, and only domestic emissions will be covered from mid-2026 within the UK ETS. Therefore, as a priority, the UK needs to expand the UK Emissions Trading Scheme (ETS) to cover the UK's fair share of international

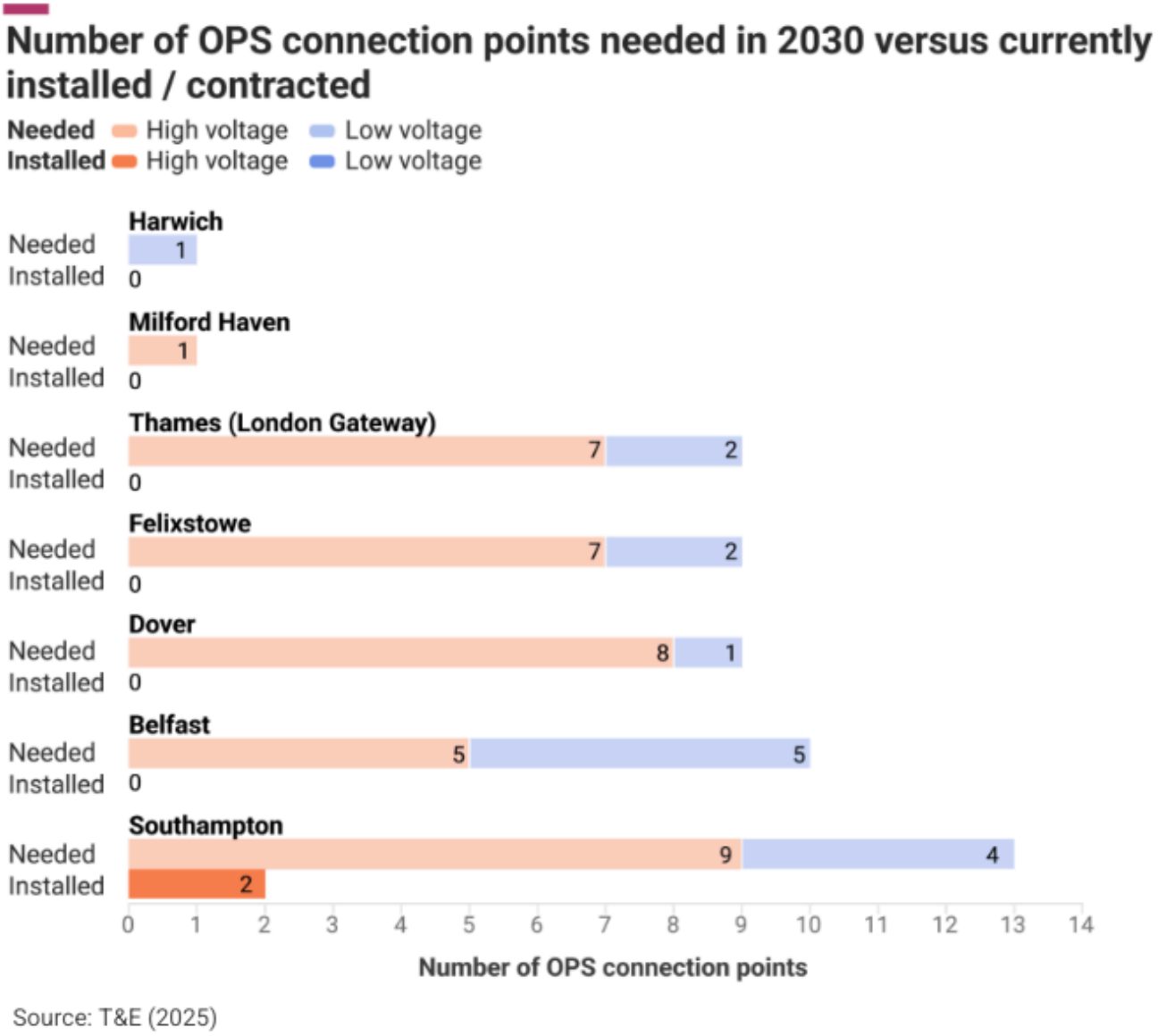
shipping emissions as announced in the UK and EU reset in May 2025. An expanded ETS could raise £1 billion a year in revenue for the Exchequer. If invested through the National Wealth Fund, leveraging private sector investment, the revenues could provide the funding to improve the rollout of critical infrastructure, such as Onshore Power Supply (OPS) or the production of green fuels. This is further explored in section 2.1.

As well as reducing emissions in ports, it is crucial that the sector reduces emissions when at sea. For that, fuel regulation is crucial to transition the sector to green zero-emission fuels. To stimulate the uptake of e-fuels and provide investment certainty, a clear regulatory roadmap in the form of an e-fuel mandate is necessary. This should be coupled with a greenhouse gas intensity standard to reduce green fuel demand, limiting decarbonisation costs for the sector. Furthermore, investment in the emerging e-fuels sector is needed, which could also be financed, in part, by revenues generated from the ETS. This is further explored in section 2.2.

2.1 Onshore power supply can help cut air pollutants that harm port cities

To limit the impact cruise growth has on local communities, the Plan needs to go alongside policy that supports the shipping sector to reduce air pollution in ports.

At-berth measures that mandate both the use and supply of onshore power are essential for reducing that pollution. Onshore power allows ships to plug into the electricity grid while at berth, enabling them to switch off their engines and use clean electricity instead of burning fossil fuels. This eliminates air pollution in port communities and significantly reduces emissions. However, policy intervention is needed to drive the rollout: the high cost of OPS infrastructure, long lead times for securing grid connections, and high energy prices combined with the absence of demand-side requirements mean the market cannot deliver large-scale OPS on its own. These measures must also be paired with action to accelerate grid connections, which are currently delaying deployment.



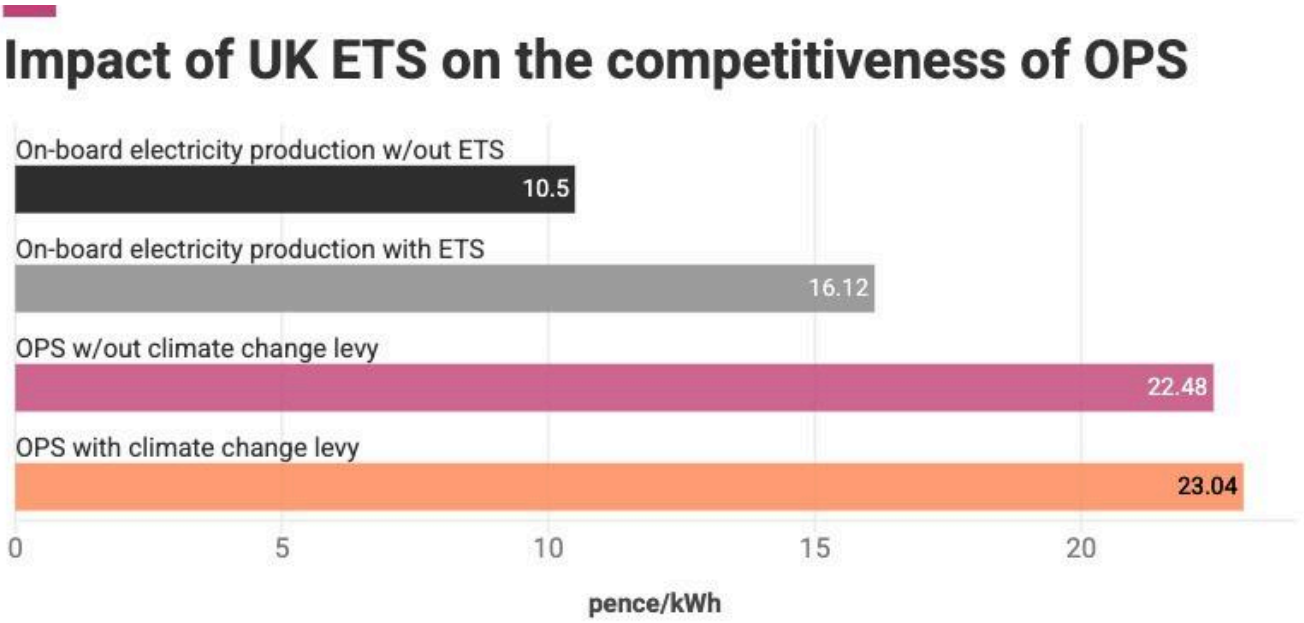
Source: T&E (2025)

A 2025 study commissioned by T&E shows the urgent need for government policy to roll out OPS in ports. The study shows that just 4% of the expected OPS connection demand in 2030 is currently met at seven major UK ports; major cruise terminals included in the study were Dover, Belfast and Southampton. Southampton, for example, has two OPS connections currently but will need 13 by 2030. At the time of the study, the ports assessed had not signed any contracts for additional OPS connections by 2030 (according to available information).

Given the slow rollout of OPS infrastructure to date, it is unlikely that significant progress will be made without policy intervention to mandate the rollout. This has already been recognised elsewhere. The EU already has legislation in place to require the rollout of OPS[1]. The legislation requires the use and supply of OPS at key EU ports for vessels above 5000 GT, with vessels needing to be OPS capable by 2030, which would cover all cruise vessels analysed in this study.

[1] FuelEU Maritime and Alternative Fuel Infrastructure Regulation

Aside from the regulation requiring the rollout of OPS, a policy is needed to require the use of the technology. As can be seen in the graph below, due to the lack of fuel duty on fuel used in the shipping sector and high UK electricity prices, there is a significant cost difference between generating electricity using fossil fuels and OPS. This cost difference is also increased when a climate change levy is applied, which is a tax charged on the energy that businesses use, intended to encourage energy efficiency. Without a policy requiring OPS use, many cruise ships will choose the cheapest option, which means continued fossil fuel burning in ports even when OPS infrastructure is available.



Source: T&E (2025) • Analysis assumes MGO use by auxiliary engines to produce on-board electricity. Assumed MGO price: USD 606.5/tonne with USD-GBP exchange rate of 0.8189.

An investigation by openDemocracy, in 2023, has underlined chronic under-usage of onshore power supply at Southampton port, with data showing that just one in ten cruise ships have plugged in since it became available in 2022. Of the ships that did plug, they plugged in on average for only 5.5 out of 12 hours whilst at port, with this being attributed to the increased cost compared to burning fuels whilst at port. T&E has also found that constraints to the grid meant that OPS could not deliver the required energy for more than one cruise ship at the same time, with no plan to expand capacity.

Long lead times for ports to obtain grid connections of five or more years and significant capital costs mean that it is unlikely a large-scale rollout of OPS prior to 2030 would occur without policy intervention. The following policies should be taken forward by the government to ensure that cruise growth does not result in increased pollution to coastal communities:

- **Mandating the roll out and use of onshore power supply** infrastructure at major cruise ports in the UK to allow ships to plug into power while docked. Allowing cruises to run on clean, home grown renewables rather than burning fossil fuels at berth.
- **Designating ports as having Critical National Priority Status** and fast-track and **prioritising grid connections** for ports seeking to install onshore power to allow the rapid roll out of this pollution cutting technology. At the moment even the few connections which currently exist cannot be fully utilised due to grid constraints.

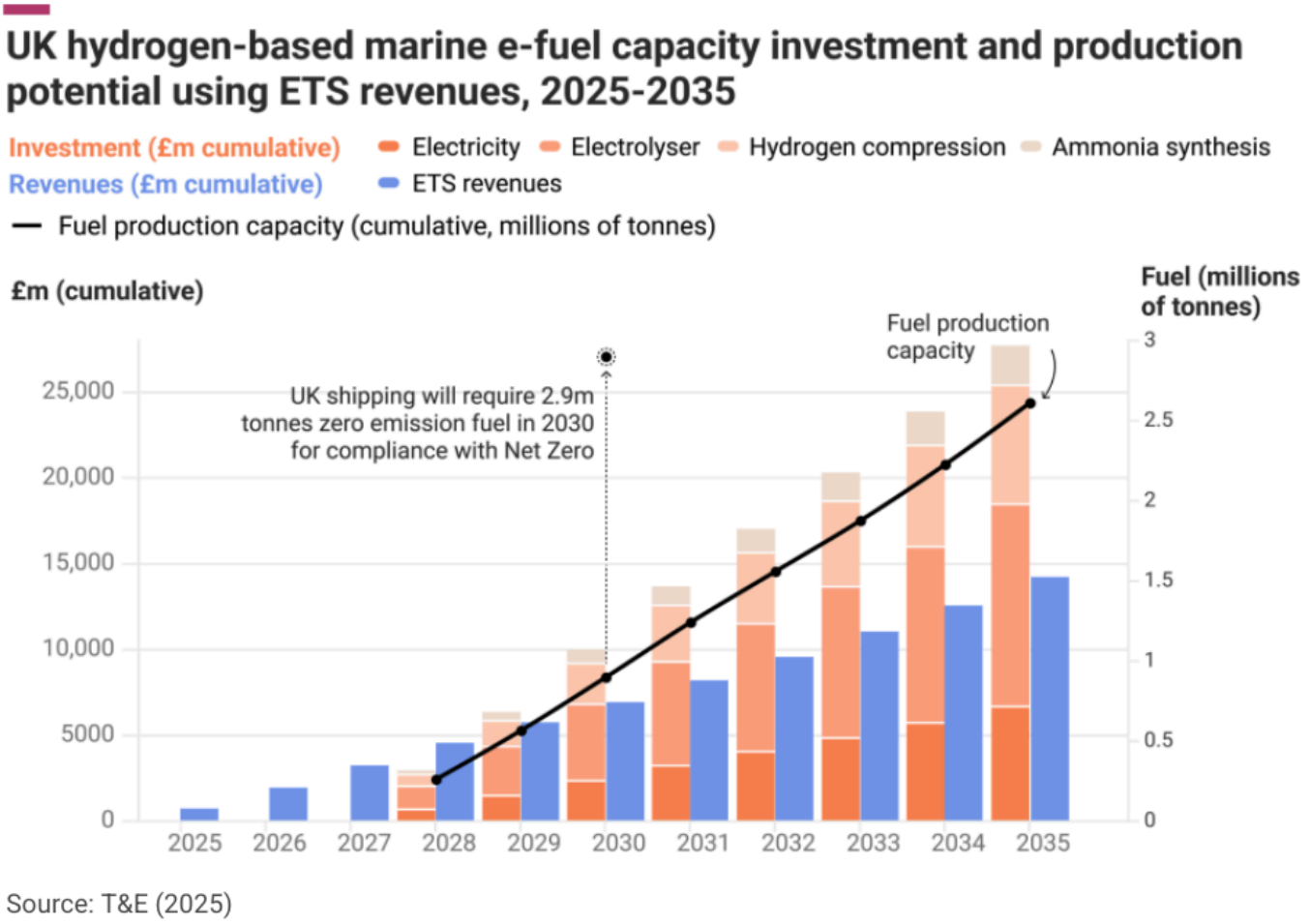
2.2 Policy and investment in e-fuel production can help support jobs and growth opportunities

The shipping sector currently remains almost entirely dependent on fossil fuels, which for shipping remain untaxed in the UK. Whilst from mid-2026 the UK's ETS will be extended to the domestic maritime sector, this will leave international emissions, the majority of the UK's shipping emissions, untaxed. During the UK-EU summit in May 2025, the intention to link the UK's and EU's ETS was announced. This would result in 50% of international emissions being covered under the UK ETS. This intention was recommitted to in the Carbon Budget and Growth Delivery Plan, and the release of the consultation on the "UK ETS: Scope expansion - emissions from international maritime voyages consultation".

Leaving international emissions untaxed is a lost revenue-generating opportunity for the UK. The inclusion of international emissions and the extension of the ETS to vessels above 400 GT has the potential to generate £1 billion for the Exchequer annually. This could provide the much-needed funds to invest in technology and infrastructure to reduce emissions and air pollutants from the shipping sector. The revenues could be invested through the National Wealth Fund, leveraging private sector capital, into OPS rollout in ports.

Another opportunity is investment in the scale of the nascent e-fuel sector. The shipping sector needs to switch to sustainable and scalable, green e-fuels in the long term to meet the UK's climate targets. Renewably produced hydrogen-based e-fuels such as e-ammonia or e-methanol are the most sustainable and scalable. They also offer strategic sovereignty as they could be produced in the UK, reducing some of the sector's reliance on imported fossil fuels. Since 95% of traded goods in the UK are moved by sea, having some capability to produce fuels needed by the sector would also provide the UK with strategic autonomy in the case of any future conflicts or global fuel constraints.

If the £1 billion generated from the ETS annually were invested into developing e-fuel capacity, the UK has the potential to develop sufficient domestic capacity to meet most of the demand of the UK shipping sector in the 2030s in line with the UK's climate targets.



Source: T&E (2025)

Growing the nascent green e-fuels sector and improving the rollout of OPS provides significant jobs and growth opportunities for the UK. These opportunities could help revitalise coastal communities and help improve the quality of life for the people living within them. This reindustrialisation opportunity could bring new business opportunities and support ports to thrive.

Widespread adoption of e-fuels in shipping requires more than just investment in production due to the significant price gap with fossil fuels. A regulatory mandate is essential to create market demand and overcome this price hurdle. A robust framework combining a fuel mandate with a GHG intensity standard is needed. These complementary measures would drive demand creating investor certainty and de-risking new technologies.The following policies should be taken forward by the government to ensure the adequate uptake and supply of e-fuels:

- **Progressing with extending the UK ETS to cover international emissions as announced as part of the UK-EU reset in May and for vessels above 400 GT** to raise revenues to fund investments into emissions reduction technologies, including onshore power roll out and e-fuel production. Today all of the sector's climate pollution is untaxed and there is no fuel duty on fuel used by cruises. T&E analysis shows that fairly taxing the shipping sector for its climate impact could raise £1 billion annually.

- **Mandating the uptake of green hydrogen based fuels (e-fuels)** for the shipping sector to reduce climate emissions and set the sector on a path to decarbonisation. This should include both international and domestic voyages as the majority of cruise emissions are considered international.
- **Introducing GHG Intensity Standards for shipping to drive the use of** green fuels and the roll out of efficiency measures.

3. Conclusions

Cruise growth without embedded policies to reduce air pollutants and emissions risks the health and environment of coastal communities. It does not need to be this way; technological solutions are commercially available to reduce air pollutants from ships whilst docked at ports. Onshore power can allow ships, including cruise ships, to use electricity rather than burning fossil fuels that release harmful pollutants with detrimental health impacts. Coastal communities are known to be falling behind the rest of the UK and in need of 'sustainable long-term investment' to unlock economic opportunities through green jobs that support both growth and climate goals. Investment in emissions reduction technologies is able to support the growth in economic opportunities that coastal communities need.

However, a strong policy framework that creates certainty is essential to promote confidence to invest in the rollout of these technologies. Due to the associated costs, large-scale rollout will not happen voluntarily. The policy framework must also address the climate impact of shipping, including providing necessary support like financial assistance and facilitating grid connections. Investment alone is insufficient to drive the shift from fossil fuels to e-fuels; policy is needed to overcome the price gap between e-fuels and their fossil fuel counterparts.

T&E therefore recommends that the government should:

1. **Mandating the roll out and use of onshore power supply** infrastructure at major cruise ports in the UK to allow ships to plug into power while docked. Allowing cruises to run on clean, home grown renewables rather than burning fossil fuels at berth.
2. **Designating ports as having Critical National Priority Status** and fast-track and **prioritising grid connections** for ports seeking to install onshore power to allow the rapid roll out of this pollution cutting technology. At the moment even the few connections which currently exist cannot be fully utilised due to grid constraints.
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4. **Mandating the uptake of green hydrogen based fuels (e-fuels)** for the shipping sector to reduce climate emissions and set the sector on a path to decarbonisation. This should include both international and domestic voyages as the majority of cruise emissions are considered international.
5. **Introducing GHG Intensity Standards for shipping to drive the use of** green fuels and the roll out of efficiency measures.

Further information

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Annex 1 - Methodology

Overview

This analysis examines air pollution linked to cruise ships, resulting from marine fuel composition and ship engine combustion. The specific pollutants assessed are SO_x, NO_x and $PM_{2.5}$. Scrubber wash water discharge was not evaluated due to lack of available data.

Scope

We analysed at-berth air pollution in the UK in 2024. Our initial sample is composed of 4083 vessels exceeding 5000 gross tonnage (GT) that called at UK ports in 2024 with Automatic Identification System (AIS) data of sufficient quality. From this sample, we isolate a subset consisting of 116 cruise ships. Air pollution data are drawn from this subset, unless specified.

Methodology

We followed the bottom-up methodology from the Fourth IMO Greenhouse Gas (GHG) Study to calculate ship emissions using AIS data and ship technical specifications.

SO_x emissions from light-duty vehicles are calculated based on total numbers of vehicles registered in each port municipality and SO_x emission factors for diesel and petrol vehicles.

Car data is available at the local authority level. For large ports, the municipality and the local authority are coterminous. For smaller ports, data is unavailable at the municipal level. We retrieved population data for each local council and municipality, and calculated car numbers at the municipal level based on the equation

$$N_{Car,\,municipality} = \frac{N_{Car,\,local\ authority}}{P_{local\ authority}} * P_{municipality}$$

The formula assumes the car to population ratio is the same at the local authority level and at the municipal level. Since municipalities without data tend to be smaller, we assumed there would not be a large difference in car ownership rates between the municipality and the local authority it is a part of.

Data Sources

Ship technical specifications: Purchased from IHS Markit and Clarksons' World Fleet Register (WFR), then pre-processed to fill data gaps.

AIS data: Purchased from Kpler, based on terrestrial and satellite AIS data, for the entire year of 2024 and for the entire world. AIS messages transmitted by ships contain timestamp, position, speed, and draught information. We removed erroneous entries, resampled data at 1-hour intervals, and infilled gaps in the time series.

ECA shapes: Retrieved from the IMO's website for the North Sea ECA and Circular Letter No.5005 for the North Atlantic ECA

Car-related data: Data to calculate SO_x emissions from cars are retrieved from the UK's government website. All data is from 2024, except car emission factors that are only available for 2023. All data is available for the entire UK, except average mileage by fuel type, for which only data for England is available. We assumed it did not vary significantly across the UK's constituent countries, and used the English average mileage data for Scotland, Wales and Northern Ireland as well.

Data field	Year	Scope	Source
Car number by fuel type and local authority	2024	UK	Department of Transport
Average mileage by fuel type	2024	England	Department of Transport
Car fleet proportion by Euro class	2024	UK	European Union Transport Roadmap Model
Car emission factors	2023	UK	NAEE
Council population	2024	UK	ONS

Analysis Steps

1. Allocation of hourly samples to UK Exclusive Economic Zone
2. Detection of port stops
3. Assignment of operational phases
4. Allocation of voyages and port stops
5. Calculation of vessel energy consumption and emissions at port

Key Assumptions

Shore-Side Electricity (SSE)

We assumed no shore-side electricity usage. While many UK ports provide low-voltage shore power for leisure boats, fishing vessels, and workboats, only three ports (Southampton, Orkney, and Montrose) offer high-capacity, commercial-scale SSE connections for large vessels or cruise ships. There is no requirement or incentive for ships to use SSE and usage data is unavailable. Moreover, one investigation has underlined chronic under-usage at Southampton, while T&E found that constraints to the grid meant that SSE could not deliver the required energy for more than one cruise ship at the same time, with no plan to expand capacity. For other large UK ports, the same T&E study finds no OPS connections installed.

Fuel Types

Dual-fuel LNG engines: Assumed to run exclusively on LNG due to lack of data on precise fuel mix.

Other vessels: Assumed to use heavy fuel oil (HFO), very low sulphur fuel oil (VLSFO), or marine gas oil (MGO), complying with relevant fuel sulphur standards in the North Sea ECA, North Atlantic ECA and UK's non-ECA zones:

- Ships in the North Sea ECA must use fuel with ≤0.1% sulphur content or use exhaust gas cleaning systems (scrubbers) to meet SO_x standards. By 2027, this obligation is extended to vessels in the North Atlantic ECA as well.
- Ships at berth or anchor within UK ports outside the North Sea ECA must follow the same rule after 2 hours in port. By 2027, all UK vessels at berth will be covered by an ECA.
- Since 1st January 2020, all ships outside ECAs must use residual fuels with ≤0.5% sulphur content per MARPOL Annex VI, or use approved equivalent methods such as scrubbers

Scrubber-Equipped Vessels

Using Clarksons' WFR, we identified scrubber-equipped ships and assumed they used 2.6% sulphur HFO with scrubber treatment when complying with 0.1% sulphur standards. In ports banning scrubber wash water discharge, we assumed 0.1% sulphur marine diesel oil (MDO)/MGO was used instead. We used ICCT analysis to estimate emission changes from scrubber use and their list of ports with scrubber restrictions.

Car types

For vehicles, we include the following types: *Light goods vehicles* and *Cars*

Emission Allocation

We aggregated emissions from vessels at berth. Following the Fourth IMO GHG Study, we identified vessels at berths if their speed-over-ground (SOG) is inferior or equal to 1 knot, and their distance to the port's coordinate is inferior or equal to 1 nautical mile. 95% of CO2 emissions within a 5 nautical mile radius occur within 1.5 nautical mile of the port, confirming that most vessels moor or anchor within this distance.

Port stays exceeding 120 hours (5 days) were excluded as they fall outside normal commercial activities. Dry dock stays were also excluded.

References

Faber, J., et al. (2020). Fourth IMO greenhouse gas study 2020. International Maritime Organization.

Comer, B., Georgeff, E., & Osipova, L. (2020). Air emissions and water pollution discharges from ships with scrubbers. International Council on Clean Transportation.

Carraro, Camilla. (2023). Global Update on Scrubber Bans and Restriction. International Council on Clean Transportation.

Open Democracy. (2023). Cruise ships' greenwashing: UK ports mislead tourists over shore power and diesel.

T&E (2024). Electrification of European Ports (UK). Status for onshore power supply in selected UK ports. Transport & Environment.

Department for Transport. (2024). *Extending the emission control area to all UK waters: Call for evidence*. UK Government.

Transport & Environment. (2024). *Cruisezilla*. Transport & Environment.

Transport & Environment. (2023). *The Return of the Cruise*. Transport & Environment.

Department for Transport. (2025). *UK cruise growth plan*. UK Government.

UK Government. (2025). *New ambition for 50 million annual visits to UK announced by tourism minister*. UK Government.

Coastal Communities Alliance. (2023). *Communities on the edge: Reports*. Coastal Communities Alliance.

UNESCO World Heritage Centre. (2021). *News release*. UNESCO.

Reuters. (2025). *Europe's busiest cruise port Barcelona to scale back amid overtourism concerns*. Reuters.

The Independent. (2024). *Ibiza introduces cruise ship limits amid overtourism concerns*. The Independent.

Scottish Government. (2024). *Cruise ship levy*. Scottish Government.

Transport & Environment. (2025). *US intimidation leaves future of shipping uncertain, but appetite for green future remains*. Transport & Environment.

Transport & Environment. (2025). *Last chance saloon: ETS briefing*. Transport & Environment.

Transport & Environment. (2025). *UK ports preparedness for OPS*. Transport & Environment.

Transport & Environment. (2025). *European Shipping into the Clean Industrial Era*. Transport & Environment.