This article gives an overview of shipping emissions in ports in 2011 and the projected levels in 2050 per continent and ship type. Air emissions from shipping are considerable. Various studies have estimated CO₂ emissions from shipping to be around 2-3% of total global emissions, 5-10% for SO₂ emissions, and 17-31% for NOₓ emissions. These emissions have increased at a large pace over recent decades and are expected to increase rapidly in the future.

Ports are the places where the impacts of shipping emissions are most noticeable. NOₓ and CO₂ emissions in ports have been linked to bronchitic symptoms, whereas exposure to SO₂ emissions is associated with respiratory issues and premature births. Calculations suggest that shipping-related particulate matter emissions are responsible for approximately 60,000 cardiopulmonary and lung cancer deaths annually, with most deaths occurring near coastlines in Europe, East Asia and South Asia.

Surprisingly, little is known about ship emissions in ports, as there remains a scarcity of studies covering the topic. This article wants to fill this gap by providing a comprehensive overview of the subject. The ITF has calculated the extent of shipping emissions in ports using data from the Lloyd’s Marine Intelligence Unit on vessel movements in 2011. The database is replete with insight concerning information on the turnaround times of ships in ports and various ship characteristics. In these calculations, various policy measures implemented in ports to mitigate air emissions have been taken into account, such as the EU regulation to use low sulphur fuel at berth, shore power and various fuel switch programmes. Further information on methodology and the dataset used for the calculations is soon to be published by the ITF (please go to the ITF website to view the working paper).

According to ITF calculations, shipping emissions in ports are substantial and accounted for 18 million tonnes of CO₂ emissions, 0.4 million tonnes of NOₓ emissions and 0.03 million tonnes of PM₁₀⁻⁻. Around 85% of these emissions come from containerships and tankers, which is partly explained by their dominant presence in terms of port calls - around three quarters of all calls in ports are by containerships and tankers, and both emit more emissions than would be expected based on the number of port calls. For tankers this is due to their relatively long turnaround time in ports. However, this is not the case for containerships: their time in port is approximately 27% of the port time of vessels, whereas these represent 40% of the calls. So containerships have relatively short stays in ports, but have high emissions during these stays.

The reverse is the case for bulk carriers; they have long turnaround times, but have less emissions during their stay in port. Also, Roll-on/roll-off (Ro/Ro) ships are relatively clean; representing 8% of port calls and 5% of port time. They only represent 2% of the total shipping emissions in ports (see figure 1).

Shipping emissions in ports are concentrated in Asia and Europe, approximately three fifths of CO₂ emissions are found in these regions. This is logical if one considers Asia and Europe represent 70% of the world’s total port calls. However, both Asia and Europe have relatively time efficient ports considering that their calculated time for ships in port is considerably less than their share of
port calls. Moreover, European ports have much less emissions of SO_2, PM_{10} and PM_{2,5} than their share of port calls would suggest. This can be attributed to EU regulations which stipulate vessels must use low sulphur fuels at berth. Ports with high emissions relative to their port traffic can be found in Africa, the Middle East, Latin America, and – to a slightly lesser extent – North America (Figure 2).

Shipping emissions in ports have a large impact on the population of their cities: the ITF calculated that approximately 230 million people are directly exposed to the emissions that the top 100 world ports in terms of emissions generate. Around 40 million people are directly exposed to the ten ports with the largest SO_2 emissions, which concentrate 22% of the total shipping-related SO_2 emissions in ports. Shipping emissions also have considerable external costs in ports – around US$15 billion per year in the 50 largest ports in the OECD for NO_2, SO_2 and PM emissions; and that is based on conservative assumptions.

Shipping emissions in ports are expected to grow fourfold by 2050. This is the case for CH_4, CO, CO_2 and NO_2 emissions. This would bring CO_2 emissions from ships in ports to approximately 70 million tonnes by 2050, and NO_2 emissions up to 1.4 million tonnes. The level of PM_{10} and PM_{2,5} emissions from ships in ports remains at the level of the emissions in 2011, while SO_2 emissions are expected to decline slightly compared to that of 2011 (see figure 3).

Asia and Africa will see the sharpest increases in emissions due to their projected strong port traffic growth from now until 2050, as well as the lack of regional mitigation measures such as emission control areas. Asian port traffic is projected to reach half of the global total in 2050, which corresponds to the share of projected shipping emissions in Asian ports. European and North American ports show relative declines in emissions due to slower traffic growth and to stricter regulatory measures. For example, due to the emission control areas and the 0.1% maximally allowed sulphur content in these areas from 2015, SO_2 emissions in European and North American ports are projected to be 5% of the total SO_2 emissions in ports, whereas their total port traffic would account for 24% in 2050.

In order to reduce these projected emissions, strong policy responses will be needed. This could take the form of global regulation, such as more stringent rules on the sulphur content of ship fuel, or more emission control areas than the four that are currently in place. In addition, shipping could be included in global emissions trading schemes and climate finance schemes. A lot could also be gained by policy initiatives coming from ports themselves. Various ports have developed infrastructure, regulation and incentives that mitigate shipping emissions in ports. One example of an infrastructure project that reduces ship emissions is shore power facilities that allow ports to shut off their engines when berthing in a port. Port regulations have so far only covered vessel speed reductions in proximity of the port and mandatory fuel switches. Incentives applied by ports include lower tariffs for ships that use cleaner fuels, are more energy efficient, or reduce their speed when close to a port. In various cases, these instruments are combined or applied subsequently, such as when incentive schemes facilitate a transition to stricter regulation. The policy instruments would need wider application in order for ship emissions in ports to be significantly reduced, however.

About the author

Olaf Merk is Administrator, Ports and Shipping, at the ITF at the OECD. He has directed studies on ports, port-cities, port regulation, and governance. Olaf Merk is the author of various OECD books, most notably “The Competitiveness of Global Port-Cities”. He is also lecturer on the Governance of Port-Cities at the Institute for Political Science (Sciences Po) in Paris. Prior to working with the OECD he worked for the Netherlands Ministry of Finance. He holds a Master’s degree in Political Science from the University of Amsterdam.

About the organisation

The International Transport Forum at the Organisation for Economic Co-operation and Development is an intergovernmental organisation with 54 member countries. It acts as a strategic think tank for transport policy and organises an Annual Summit of Ministers. The next Annual Summit will take place 27-29 May 2015 in Leipzig, Germany.

Enquiries

ITF/OECD
2, rue André Pascal
75775 Paris Cedex 16
France
Tel: +33.1.45241660
Email: olaf.merk@oecd.org
twitter: @o_merk