



IEAGHG Information Paper: 2016-IP26; Health and Climate Impacts of International Shipping

A recently published study in the Journal Nature Climate Change has highlighted environmental issues that relate to the growth in shipping in East Asia in the last decade.

As background, every household must have noticed when they look at a utensil or product they buy that invariably it has “Made in China” written on it. The amount of goods shipped by sea from that region has increased and as a result:

- More shipping containers go through Shanghai than any other port in the world,
- Most of the world's 10 busiest ports are in China,
- Asian ports loaded or unloaded almost 50 percent of shipped goods in 2013, according to the UN.

The study has attempted to undertake the first full evaluation of the effects of shipping emissions in the East Asian region on climate change impacts and on health impacts.

Some of the key points drawn from the study include:

- Emissions from shipping and ports include both greenhouses gases, Short lived climate Pollutants and pollutants i.e. CO₂, CH₄, N₂O, SO₂, NO_x, and particulate matter
- Emissions from shipping in the East Asia region accounted for 16 percent of global shipping carbon dioxide emissions in 2013, sharply up from to 4 percent to 7 percent in 2002-2005. Note the International Maritime Organisation (IMO) in 2014 estimated global CO₂ emissions from international emissions to be of the order 800 Mt/y and a further 816 MtCO₂e from other greenhouse gases (CH₄ and N₂O etc.). In total these represent 4% of total global greenhouse gas emissions.
- Container carriers and bulk carriers are the main contributors to greenhouse gas emissions, with the exception of CH₄. Both contribute about 24-27% of the total emissions, the rest comes from tankers, roll on roll off cargo and general cargo vessels. The main contributor to CH₄ emissions are tankers. Note the role of passenger ships in East Asia is currently low, about 2%, compared to 11% globally and 29% in Europe.
- The study shows that the majority of the emissions are generated within 400km (216 nautical miles) of the shore. In the case of CO₂, 60% of emissions are generated within 20 nautical miles or 37km off the coast
- The research suggests that the global mean radiative forcing from East Asian shipping is initially negative, but would become positive after approximately eight years for constant current emissions. The reasons for this are the emissions of sulphate aerosols and ozone that initially mask the long term warming effects of greenhouse gases like CO₂. For further reference see our earlier Information Paper on the Air Pollution-Climate Change Conundrum.
- Modelling of the health impacts of these shipping emissions in East Asia has indicated they could lead to large adverse health impacts, with 14,500–37,500 premature deaths per year.
- The study notes that a large fraction of vessels that are transiting the East Asia region are not registered in the region and, as a consequence, joint efforts are needed to reduce emissions and mitigate the climate and health impacts of shipping in the region.

Building on the last point of the study; the EU at COP21 launched a call for action on emissions and shipping and aviation. The EU concerns stem from predictions that shipping emissions could increase by between 50% and 250% by 2050. The EU feels that such an increase in emissions is not in keeping with the COP21 goal of keeping global temperature increase to below 2°C. However, the EU is called for action through the IMO and, in January 2016, agreed to support financially an IMO Energy



Efficiency project. The aim of the project will be to help beneficiary countries limit and reduce greenhouse gas (GHG) emissions from their shipping sectors through technical assistance and capacity building. It will encourage the uptake of innovative energy-efficiency technologies among a large number of users through the widespread dissemination of technical information and know-how. The four-year project will target five regions - Africa, Asia, the Caribbean, Latin America and the Pacific.

In 2015 the EU adopted a Monitoring, Reporting and Verification Regulation that created an EU-wide legal framework for the monitoring, reporting and verification of CO₂ emissions from maritime transport. It also helps the EU generate momentum for the best possible outcome in the international discussions. The Regulation will require large ships (over 5 000 gross tonnes) calling at EU ports from 1 January 2018 to collect and later publish verified annual data on CO₂ emissions and other relevant information. This grand sounding scheme, however, is only estimated to cut CO₂ emissions from the journeys covered by up to 2% compared with a 'business as usual' situation according to the Commission's impact assessment.

The International Convention for the Prevention of Pollution from Ships (MARPOL) is the main international convention covering prevention of pollution of the marine environment by ships from operational or accidental causes. The MARPOL Protocol entered into force on 2 October 1983. In 1997, a Protocol was adopted to amend the Convention and a new Annex VI was added which entered into force on 19 May 2005. Annex VI covers the Prevention of Air Pollution from Ships of the IMO/MARPOL. Annex VI sets limits on sulphur oxide and nitrogen oxide emissions from ship exhausts and prohibits deliberate emissions of ozone depleting substances; designated emission control areas set more stringent standards for SO_x, NO_x and particulate matter.

In 2011, IMO adopted a suite of technical and operational measures which together provide an energy efficiency framework for ships. These mandatory measures entered into force as a 'package' on 1 January 2013, under Annex VI. These cover technical and operational energy efficiency measures aimed at reducing greenhouse gas emissions from ships. These measures address ship types responsible for approximately 85% of CO₂ emissions from international shipping and, together, they represent the first-ever, mandatory global regime for CO₂ emission reduction in an entire industry sector.

New tightened amendments on SO₂ and NO_x emissions under Annex VI come into force as of September 2015. The revised measures include setting a lower limit of 0.1% (down from 1.5%) on the sulphur contents of fuels that can be used in all vessels in Environmental Control Areas by 2020. For all other areas the sulphur contents of fuels will drop from 3.5% to 0.5% by 2020. NO_x emission limits for engines were also tightened and use of ozone depleting chemical in refrigerator's banned in line with the Montreal Protocol. The SO_x and NO_x measures expected to have a significant beneficial impact on the atmospheric environment and on human health, particularly for those people living in port cities and coastal communities.

On the effectiveness of MARPOL:

- As of April 2016, 154 states, representing 98.7 per cent of the world's shipping tonnage, are state parties to the convention. All ships flagged under countries that are signatories to MARPOL are subject to its requirements, regardless of where they sail and member nations are responsible for vessels registered under their respective nationalities.
- Currently, MARPOL Annex VI has 77 Parties, representing 94.77% of world merchant shipping tonnage.
- MARPOL, since its inception in 1973, is credited with achieving a 60% reduction in oil entering the sea by 1990 and significantly reducing the amount of tar on beaches around the world.



The IMO monitors Greenhouse Gas Emissions from shipping and has produced a series of greenhouse gas inventory analyses, the latest the Third IMO Greenhouse Gas Study was published in 2014, the previous was in 2009. So we can expect a further update in 2019. The report contains an analysis of all greenhouse gas emissions from shipping over the period 2007 to 2012, compares the results with the previous study and makes projections for future emissions. The main conclusions on CO₂ emissions are that:

- The largest emitters of CO₂ are container ships, bulk carriers and oil tankers emitting 255, 166 and 124 Mt in 2012 respectively. Note: These three categories of ships also consume the most fuel of the total shipping fleet.
- Oil tanker CO₂ emissions over the period 2007-2012 dropped by about 40Mt, where container ships showed little or no change and bulk carriers only a modest decrease. The decrease in oil tanker emissions could be attributed to changes in operating practice such as slow steaming.
- Future Projections for maritime transport suggest significant growth in the movement of dry cargo goods up to 2050, with the exception of coal and oil which are projected to decrease because of the impact of adoption of the UNFCCC climate goals. Note: these projections were made before COP21 and the decision to go below 2 degrees C.
- Maritime CO₂ emissions are also projected to increase significantly. Depending on future economic and energy developments, increases of between 50% and 250% in the period up to 2050. These projections include current IMO policies to improve energy efficiency by 20% by 2020. Further action on efficiency and emissions could however mitigate emissions growth.
- Projections for other emissions suggest CH₄ emissions could increase rapidly (albeit from a very low base) if there is a big switch to the use of LNG from oil. Emissions of sulphurous oxides, nitrogen oxides and particulate matter increase at a lower rate than CO₂ emissions. This is driven by MARPOL Annex VI requirements on the sulphur content of fuels (which also impact PM emissions) and the NO_x technical code.

Summary

The IP again reinforces the strong linkage between greenhouse gas emissions and other pollutants and their twin effects on both climate change and human health. Equally measures that reduce emissions of CO₂, SO_x and pollutants are a win-win solution as highlighted in the recent IEA report on Energy and Air Pollution.

At present as far as global greenhouse gas emissions are concerned maritime shipping only represents a small component (~2%) of global CO₂ emissions. However, if projections on shipping growth are correct this area will become more significant in the period up to 2050, which runs counter to the Paris Agreement of reducing emissions to get to below 2°C over the same period.

The IMO and the MARPOL Convention are the twin pillars that are responsible for regulating emissions growth in the maritime shipping area. Measures are in place to reduce CO₂ emissions by improving energy efficiency in engines and to reduce SO_x emissions and ozone depleting substances. Whether energy efficiency the measures in place are sufficient to significantly reduce CO₂ emissions in this sector remains to be seen.

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