Insights from a bottom-up approach to estimate shipping emissions and design mitigation measures

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Conclusions

• Our study shows the importance of comprehensive emission inventories to design effective measures to reduce emissions.

• International ferries and tourist cruises are the main contributors to total emissions from the Port of Oslo, and the highest emissions are obtained “at berth”.

• Different mitigation measures are designed and evaluated in closed cooperation with the Port Authorities; i) Sulphur content in marine fuel directive (<0.1%); ii) Shorepower; iii) Speed reduction zone; iv) Increase used of LNG.

• Shorepower and speed reduction zone are effective measure to reduce air pollutants and GHGs; The combination of measures is needed to develop effective mitigation strategy to reduce urban concentration levels.
Introduction - Motivation

2013

% Port Contribution to NO₂ annual concentration

2020

% Port Contribution to NO₂ annual concentration

Contribution from the Port at Hjortnes - 2013

Contribution from the Port at Hjortnes - 2020
Methodology

**Emissions:** NO\textsubscript{x}, PM\textsubscript{10}, SO\textsubscript{2}, GHG (CO\textsubscript{2}, CH\textsubscript{4}, N\textsubscript{2}O, CO\textsubscript{2-eq}); Years: 2013 and 2020

**Method:** Activity call (Port of Oslo $\approx$ 3000 calls), EF, time, load factor, and engine power


Emissions related with the activities in the Port of Oslo

**Shipping Emissions**

- Harbour Vessels
- Oceangoing Vessels (cruising, manoeuvring, berth)

**Land Emissions**

- Cargo Handling Equipment
- Vehicles
Results - Emission Inventory (e.g. NO$_x$)
Results - Mitigation Measures (e.g. NO$_x$)

**NO$_x$ emissions**

- **2013**
  - SHOREPOWER
  - SPEED REDUCTION ZONE
  - 15% NO$_x$; -29% CO$_2$

- **2020**

NO$_x$ emissions with Speed Reduction Zone (12 knots) in 2020

- **2013**
  - SHOREPOWER
  - SPEED REDUCTION ZONE
  - 15% NO$_x$; -29% CO$_2$

- **2020**

[Graph showing emissions and mitigation measures]
References


Acknowledgement

The Port of Oslo: Neilson H., Sørensen T.O., Svendsen T., Hatteland C.J.
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