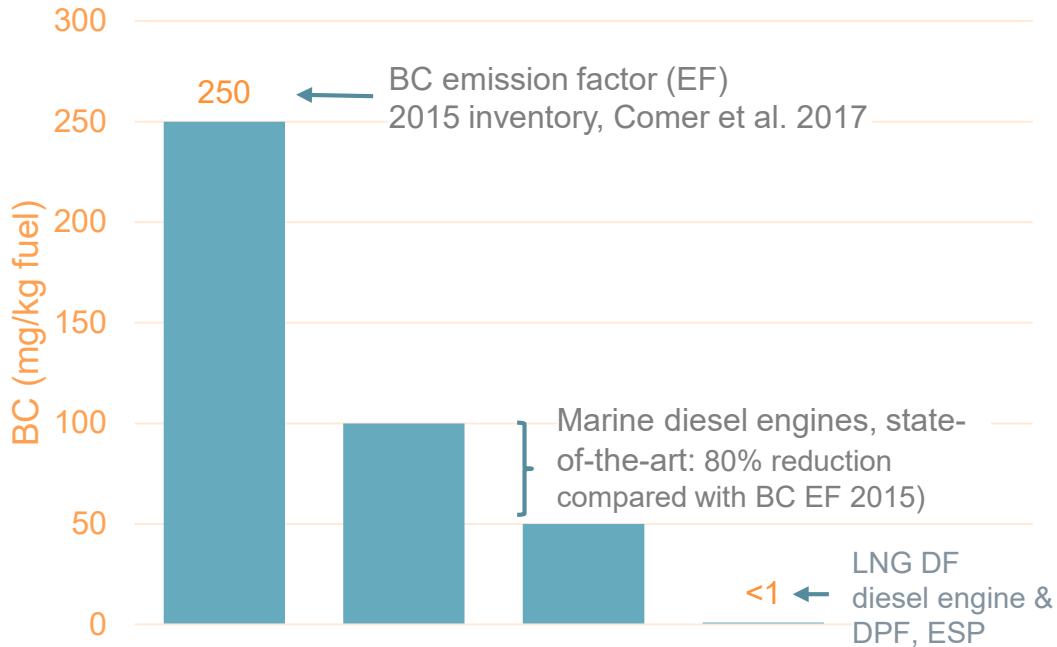


# Black Carbon emission control options for shipping

**Päivi Aakko-Saksa, VTT**

**“Switching fuel - How to Cut Black Carbon Emissions from Arctic Shipping”, 22.3.2021**

# BC emissions from marine engines vary substantially

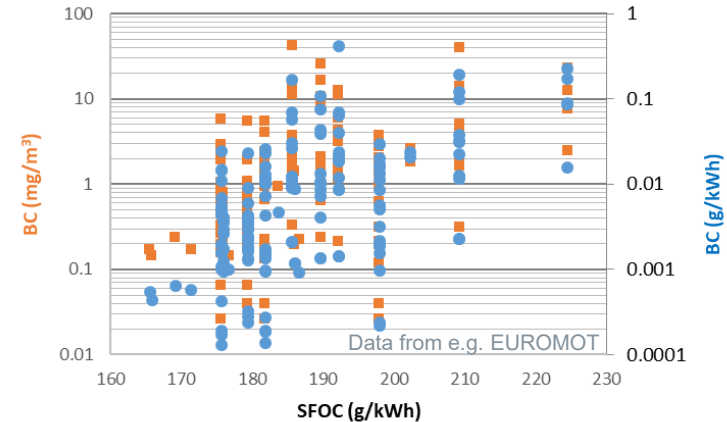


## BC emissions

- lower for modern than for old diesel engines.
- lowest at OEM recommended engine loads
- extremely low for e.g. LNG, DPF, ESP

→ Substantial potential to reduce BC emission burden from shipping.

## Concentrations vary by a factor of 10 000

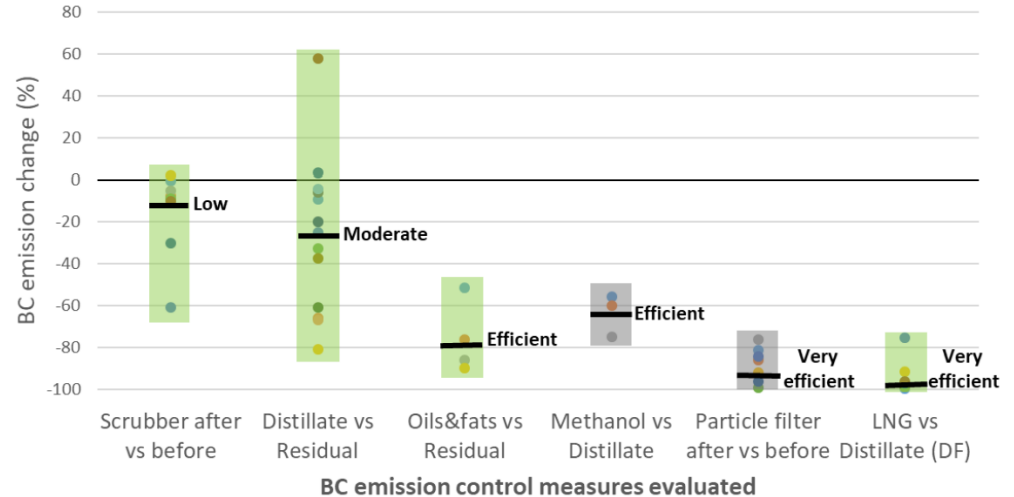


DPF = diesel particulate filter  
ESP = electrostatic precipitator

# BC emission control options

Recent progress:

- Global sulphur limit reduced from 3.5% to 0.5% in 2020.
- DPF demonstrations ongoing.
- ESP developments.
- LNG DF use continues.
- Emerging technologies R&D.



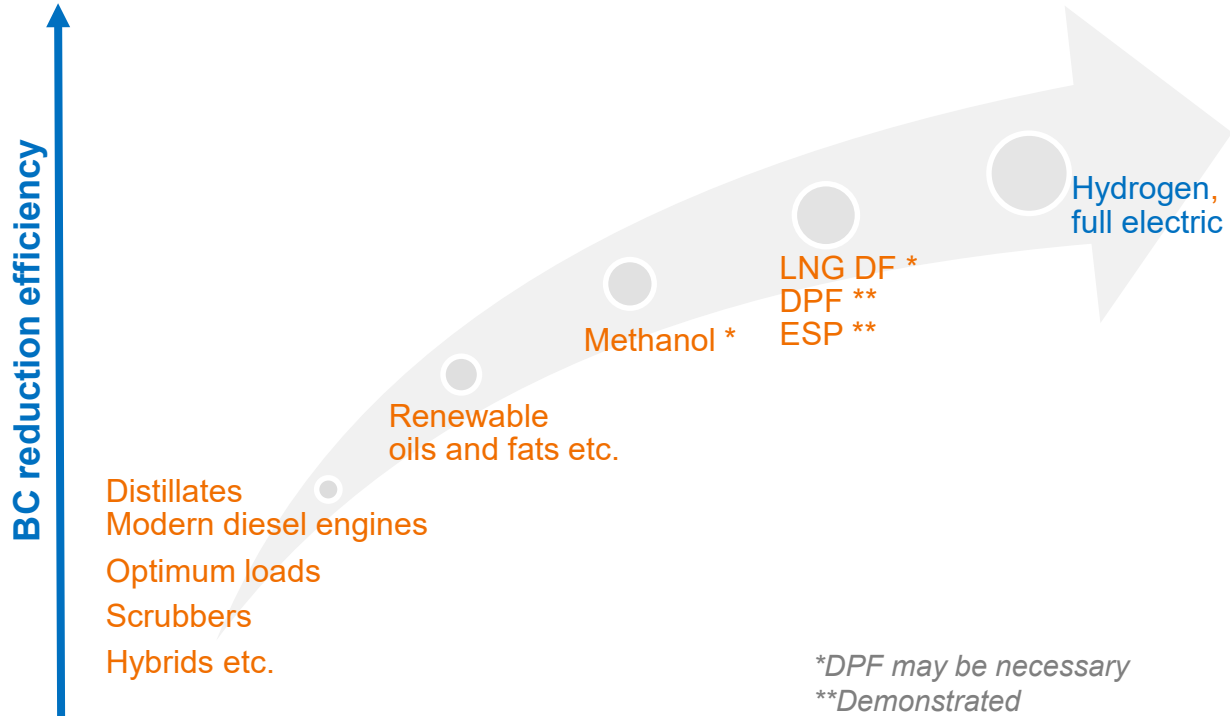
Ref. IMO PPR 6/7/2

# BC emissions from marine engines

Technology options e.g.:

- Cleaner fuels
- Exhaust aftertreatment (particulate filters, ESP etc.)
- Modern engines, optimal engine loads, hybridisation
- Hydrogen, batteries
- Shore power

Role of small vessels/boats, auxiliary engines and boilers?



# Conclusions

BC emissions from marine engines vary substantially.

BC emissions from marine engines can be reduced by **many technologies** to alleviate climate and environmental burden of shipping.



# Thank you!

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*Black carbon research project examples from Finland.*



TUBE-PROJECT.EU

*This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 814978 (TUBE).*

## Black Carbon Footprint

The aim of BC Footprint is to develop a BC Footprint concept that can be used as a uniform metrics for the BC, covering the whole chain from BC emissions to atmospheric BC concentrations and climatic effects.



<https://projects.tuni.fi/bcfootprint/>

## SEA-EFFECTS BC

**Project:** Shipping Emissions in the Arctic (Black Carbon), SEA-EFFECTS BC

The SEA-EFFECTS BC project aims at more reliable and unequivocal basis of black carbon (BC) emission evaluation to shipping environment, and towards new options for on-line monitoring techniques. Definitions of sampling and sample treatment are essential for reliable measurements in ship environment, particularly when using new fuels and emission control technologies. This approach will also support generation of the reliable ship emission factors. In-depth analysis of other emissions in parallel to BC measurements increase understanding of the results



<http://www.vtt.fi/sites/sea-effects>