

Cost-effective ship NOx control

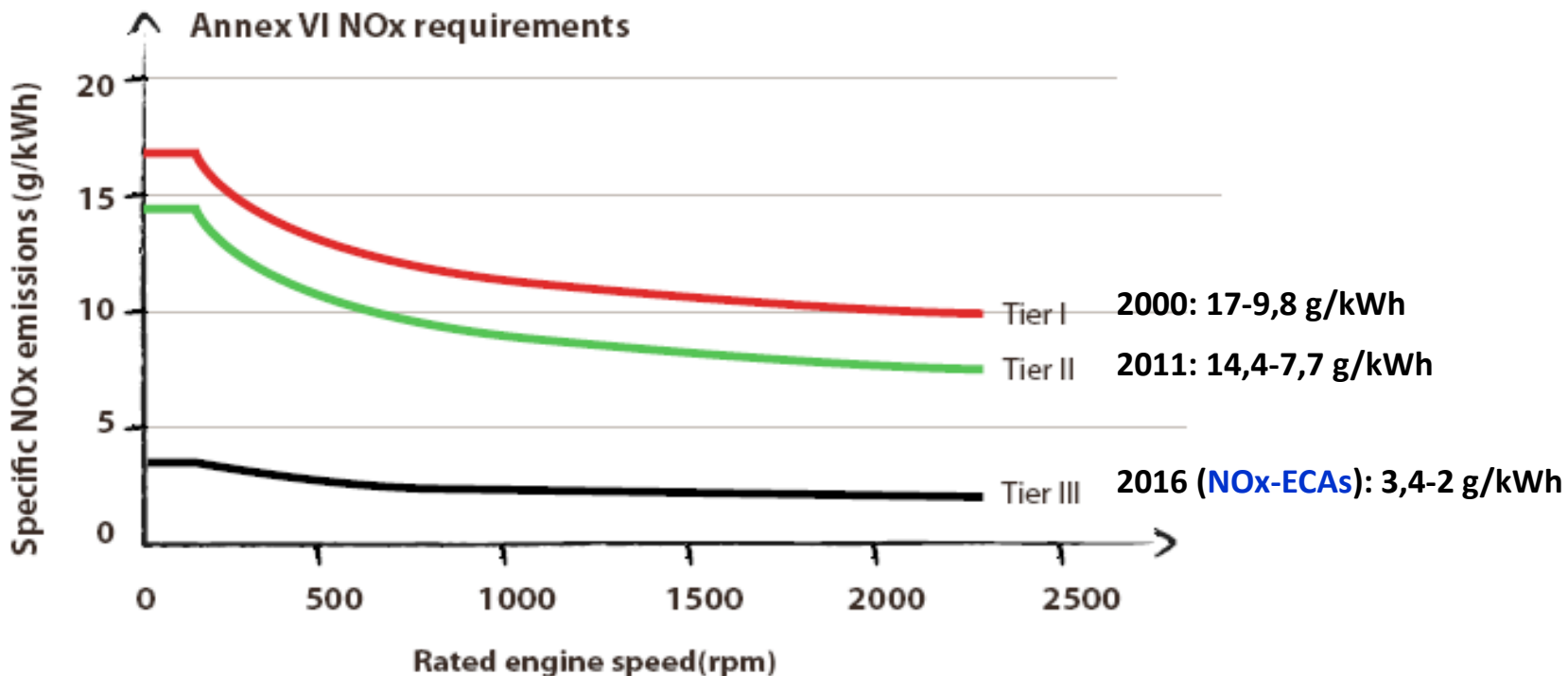
Christer Ågren
AirClim

CO₂ SO₂ NO_x
PM

SOS



IMO NOx-standards for new ship engines

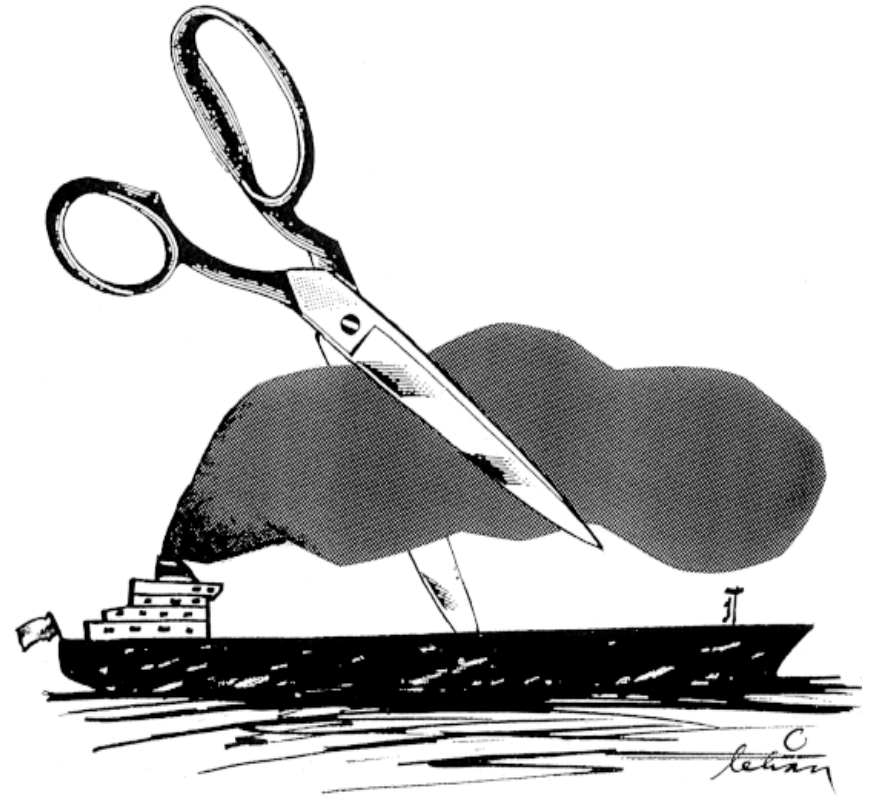


Compare to EU-standards (Euro VI) for new heavy duty diesel engines in trucks and buses set at **0.4 g/kWh** as from 2013 - down from 8 g/kWh from 1992 (Euro I).

NOx-abatement measures

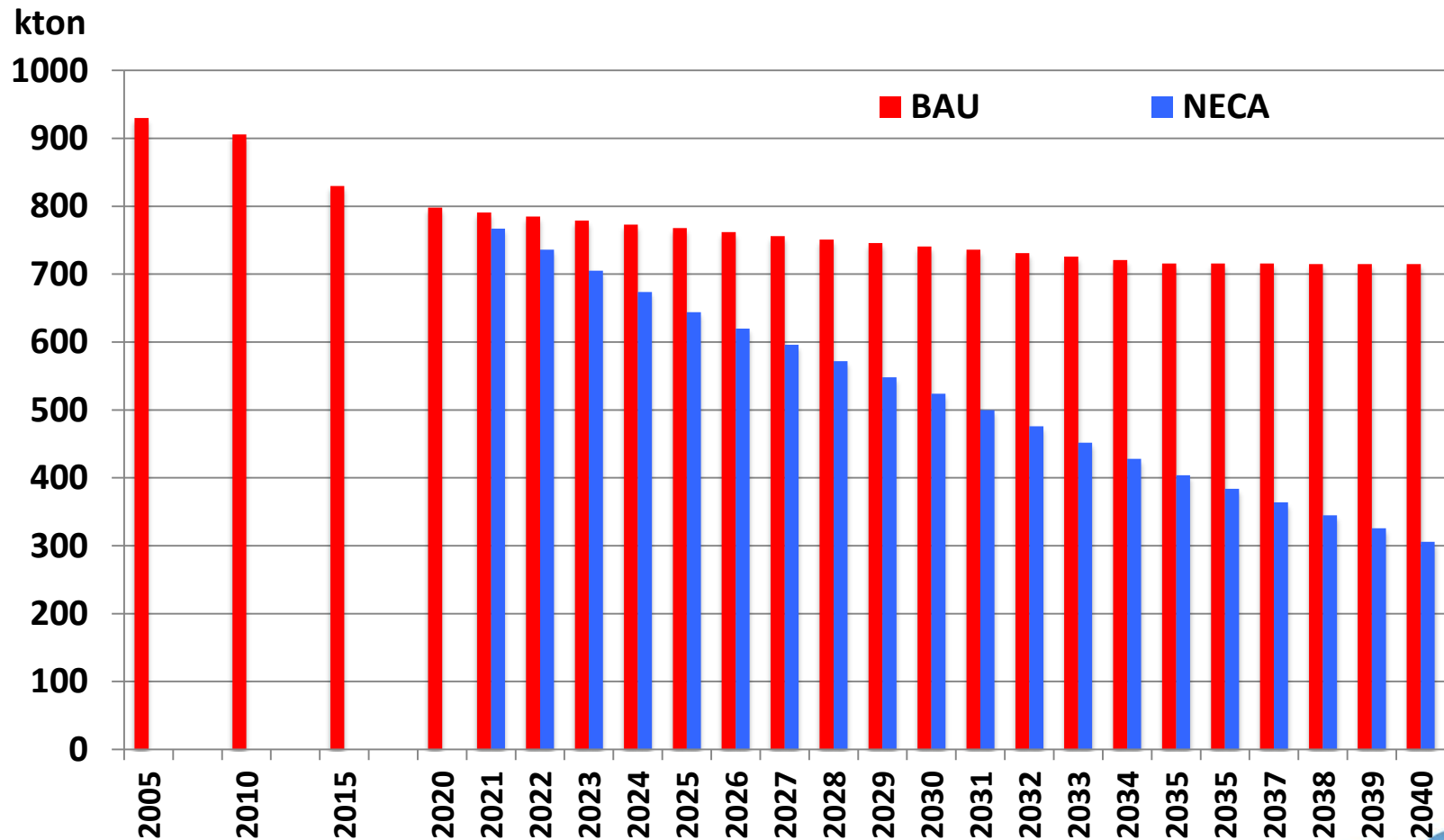
Some of the main NOx-abatement options for ships:

- **Exhaust gas after-treatment** (e.g. SCR)
- **Combustion modifications** (e.g. EGR)
- **Fuel switch** (e.g. to LNG or methanol)
- **Reduced fuel consumption** (e.g. lower speed)



Reducing NOx by NECA – new studies

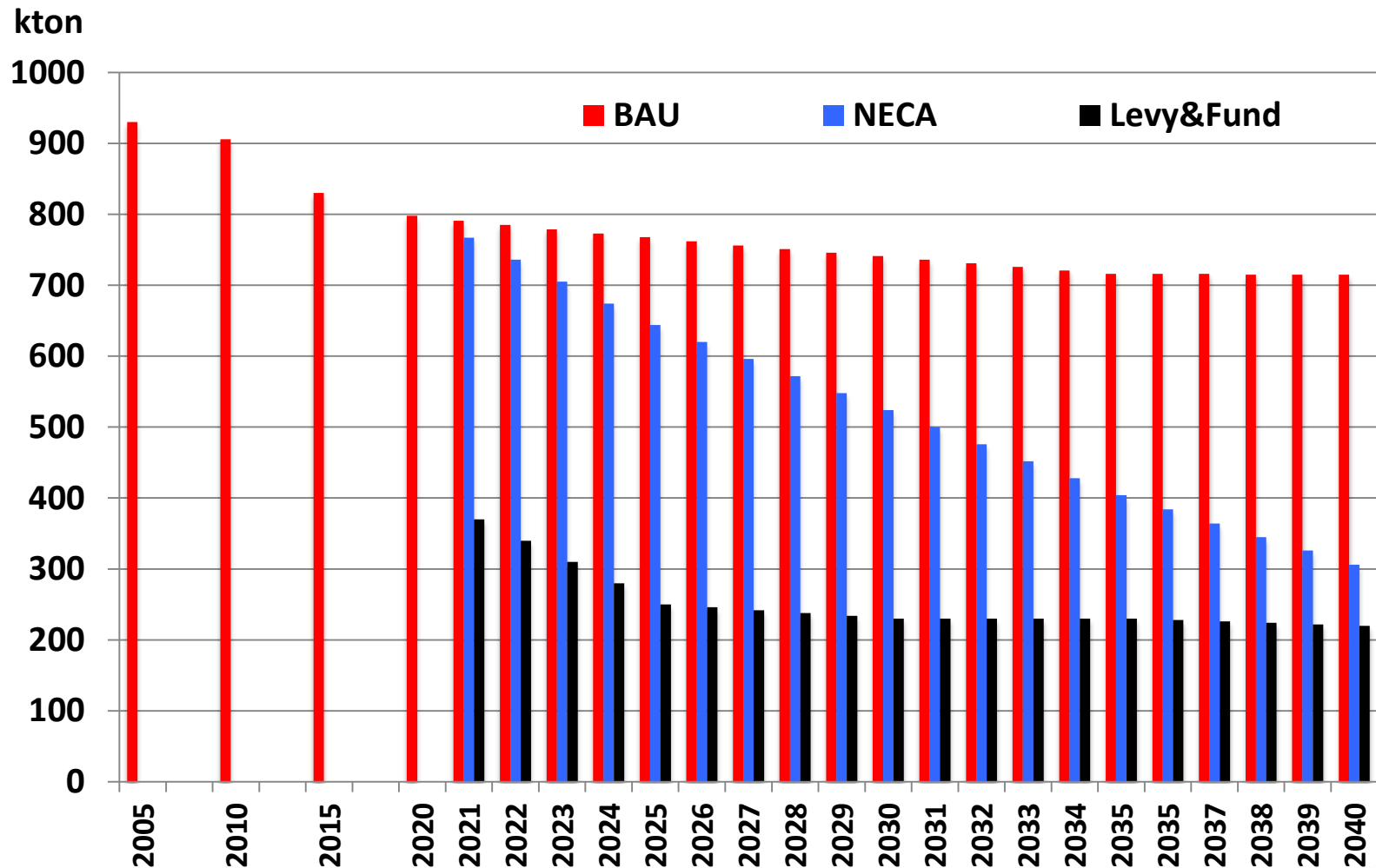
NOx emissions in the Baltic Sea and North Sea with/without NECA from 2021



Sources: IVL/CE Delft (2016); IVL (2017)



Reducing NOx by NECA + Levy & Fund



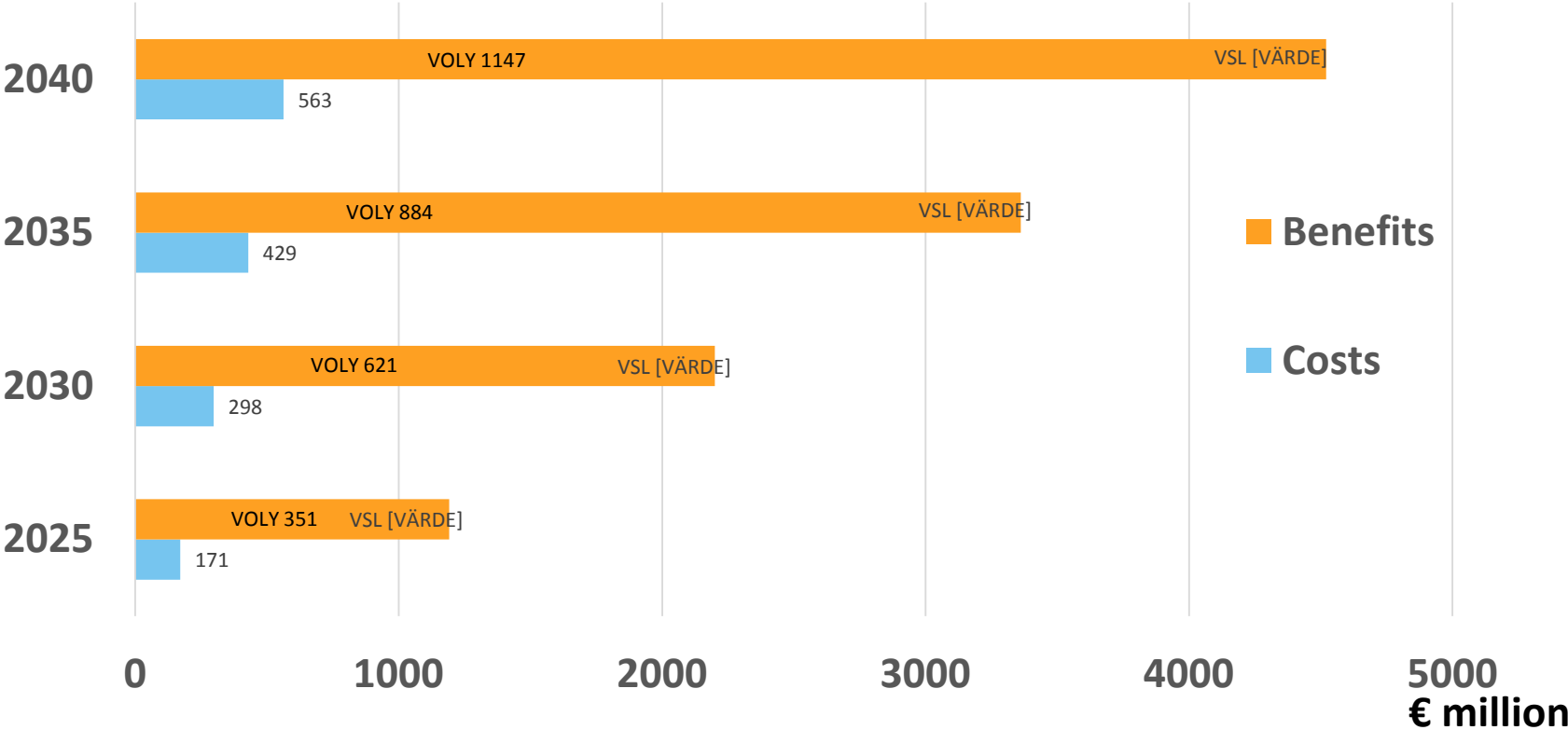
Sources: IVL/CE Delft (2016); IVL (2017)

Some conclusions from the studies

- Baseline (BAU) projection up to 2040 indicates a slight NO_x reduction (**-14% 2015-2040**) (due “optimistic” assumptions on improved efficiency?)
- A NECA would significantly cut NO_x in the longer term (**-63% 2015-2040**), but not so much in the near term (**-37% 2015-2030**)
- Significant short-term reductions are possible through the use of economic instruments, e.g. Levy & Fund (**-72% 2015-2030**)
- A Levy & Fund can cut NO_x by around **500,000 tonnes/year** throughout the 2020s. This equals current total annual land-based emissions from SE, DK, FI and NO combined.

CBA for NECA in Baltic Sea & North Sea

NECA: Benefits as VSL vs. costs (central valuation)

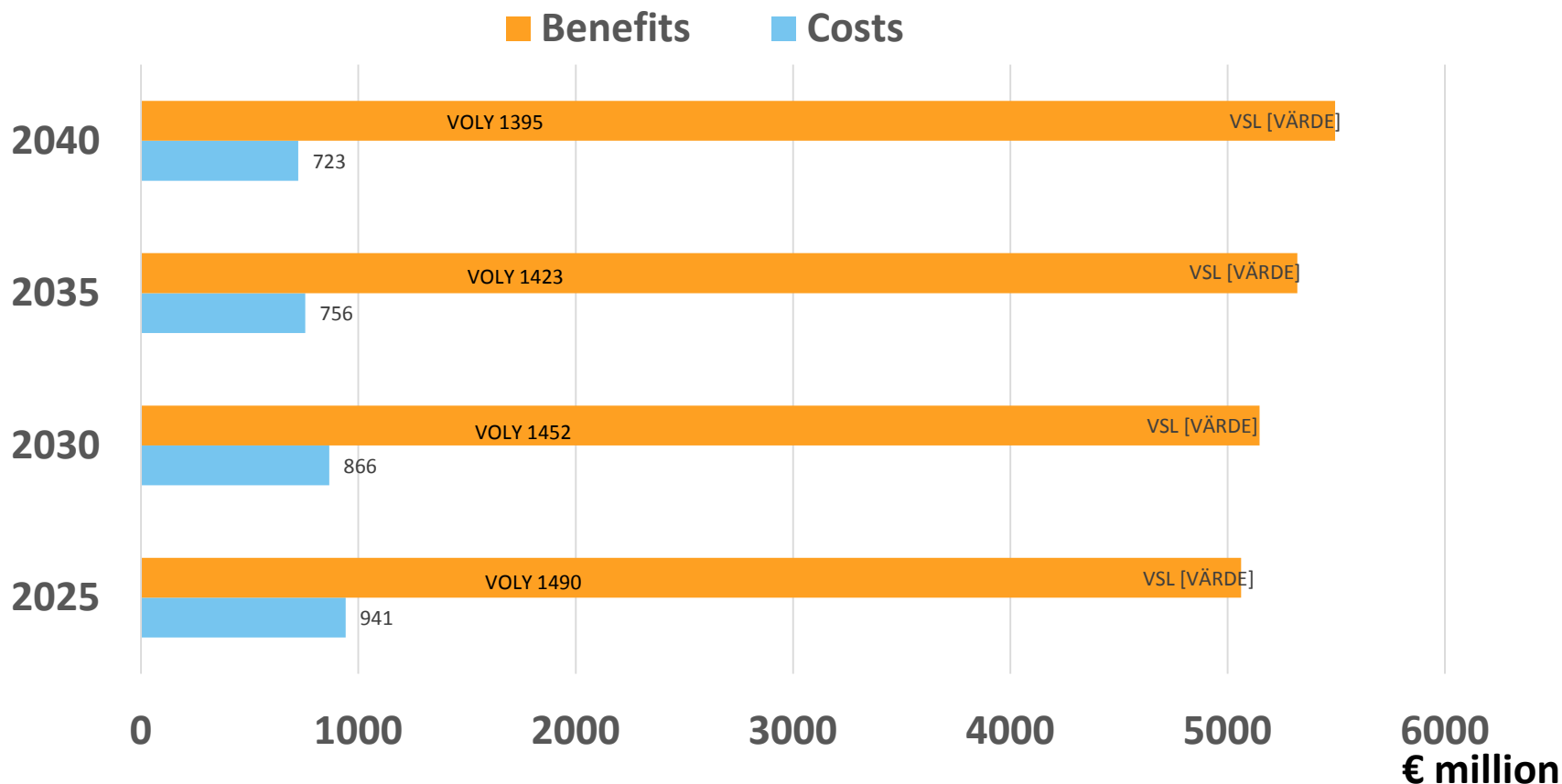


Source: IVL (2017)



CBA for NECA + Levy&Fund

NECA + Levy & Fund: Benefits as VSL vs. costs (central valuation)



Source: IVL (2017)



Measures to cut ship emissions



- Designate all European seas as full Emission Control Areas
- Emission charges to cut NOx (and PM?) from existing ships
- Enforce ECA limits + global 0.5% sulphur limit from 2020

- Improved emissions monitoring and compliance control
- Lowered speeds
- Emission standards for PM
- Develop and adopt an EU marine fuels quality directive



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