NOx control policy options for shipping in EU Seas

“BLUE SKY OVER THE SEA?” Conference
Berlin, 17-18 November 2016
CE Delft

• Independent research and consultancy since 1978
• Based in Delft, the Netherlands
• Not-for-profit organisation
• Know-how on economics, technology and policy issues
• Work Areas: Transport, Energy, Economics, Supply Chain Analysis
• 40 researchers/consultants

Clients: IMO, European Commission and Parliament, national and regional governments, industries and NGO’s

Our publications are available on www.cedelft.eu or @CEDelft
Background - underlying study

• “NOx controls for shipping in EU Seas”
  [link](http://www.ce.nl/publicatie/nox_controls_for_shipping_in_eu_seas/1833)

• Joint study of IVL Swedish Environmental Research Institute and CE Delft

• Commissioned by Transport & Environment and published in June 2016

• Main aims of study:
  1. Projection of shipping NOx emissions in Baltic and North Sea for the case that a NOx Emission Control Area (NECA) is established at a realistic point in time/is not established.
  2. Analysis of additional/alternative NOx reduction policy instruments.
Outline of presentation

1. Implemented NOx instruments for maritime shipping
2. Baltic and North Sea NECA negotiations
3. NOx emissions from ships in Baltic and North Sea in period 2010-2040
4. Selection and analysis of additional/alternative NOx policy instruments
Implemented NOx instruments for maritime shipping

Mandatory NOx policy instruments:

- **Global:** MARPOL Annex VI Regulation 13 Tier I and Tier II requirements;
- **Regional:** MARPOL Annex VI Regulation 13 Tier III requirements in North American NECA and in US Caribbean NECA

![Graph showing NOx limits for different tiers]
Implemented NOx instruments for maritime shipping

Mandatory NOx policy instruments (2):

• Other Regional:
  • Environmentally differentiated port dues (Sweden, Finland) and fairway dues (Sweden)
  • NOx tax with NOx fund as alternative compliance option (Norway)

Voluntary NOx reduction measures:

• Environmentally differentiated port dues (ESI, CSI etc.) and pilotage fees (Norway).
Baltic and North Sea NECA negotiations

Reality caught up with analysis:

• Baltic and North Sea riparian states submitted to MEPC 70 in parallel proposal to designate Baltic, North Sea and English Channel as NECA (MEPC 70/5/1, MEPC 70/5/Rev. 1)

• Designation approved by MEPC 70

• Formal adoption expected at MEPC 71

• Effective date: Marine diesel engines installed on ships built on or after 1 January 2021 would have to comply with Tier III requirements in Baltic and North Sea NECA
NOx emission projection for ships in Baltic and North Sea

NOx projection based on Kalli, Jalkanen, Johansson, Repka (2013), but NECA implementation date 2021 and not 2016
## Potential additional policy instruments - longlist

High-level assessment longlisted potential additional policy instruments

<table>
<thead>
<tr>
<th></th>
<th>ETS</th>
<th>MRV</th>
<th>Levy &amp; fund</th>
<th>Levy/tax</th>
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<tbody>
<tr>
<td>Environmental effectiveness</td>
<td>+</td>
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<td>++</td>
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<td>Certainty of emission reduction</td>
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<td>Costs for responsible entity</td>
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<tr>
<td>Initial cost incidence</td>
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<td>Sector pays; ETS revenues accrue</td>
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<td>Sector pays and receives</td>
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<td>Administrative costs</td>
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## Potential additional policy instruments - longlist

High-level assessment longlisted potential additional policy instruments (2)

<table>
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<th>Speed limit</th>
<th>Different. port dues</th>
<th>EU coastal NECA</th>
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<tr>
<td>Costs for responsible entity</td>
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<td>0</td>
<td>+/-0</td>
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<tr>
<td>Initial cost incidence</td>
<td>Sector/shipper pays or receives</td>
<td>Port/sector pays; sector receives</td>
<td>Sector pays</td>
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<td>Administrative costs</td>
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</table>
Analysis shortlisted potential additional instruments

Shortlisted measures analysed:

1. Regulated slow steaming with NOx levy as alternative compliance option, where revenues are used to fund uptake of NOx abatement measures.

2. Stand-alone NOx levy whose revenues are not earmarked.

3. NOx levy whose revenues are used to fund uptake of NOx abatement measures.

Alternative levy rates: €1/kg NOx, €2/kg NOx, €3/kg NOx.

Focus of analysis: NOx emission reduction and costs for shipping sector.
Analysis shortlisted potential additional instruments

Important modelling assumptions:

• Only non-Tier III ships have to comply with additional measure.

• Regulated slow steaming:
  • 15% speed reduction;
  • ferries and 10% other ships pay levy instead.

• Lower uptake due to non-financial market barriers is accounted for.

• Use of levy revenues:
  • Difference between levy rate and abatement costs is funded;
  • remaining revenue is refunded lump sum to the sector.
Analysis shortlisted potential additional instruments

NOx abatement measures considered:

1. Exhaust gas aftertreatment device: selective catalytic reduction (SCR)
2. Combustion modification:
   A) Exhaust gas recirculation (EGR)
   B) Direct water injection (DWI)
   C) Humid air motors (HAM)
3. Fuel switching:
   A) LNG
   B) Methanol
4. Energy efficiency improvement measure: slow steaming
Analysis shortlisted potential additional instruments

NOx abatement measures considered

<table>
<thead>
<tr>
<th>Tier</th>
<th>Measure</th>
<th>Reduction wrt Tier I</th>
<th>Reduction wrt Tier II</th>
<th>Cost estimate (central value, €/kg NOx)</th>
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<td>90%</td>
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<td>LNG</td>
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<td>80%</td>
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<td>Tier II</td>
<td>DWI</td>
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<tr>
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<td>WIF</td>
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<th>Stand-alone levy</th>
<th>2025</th>
<th>2030</th>
<th>2035</th>
<th>2040</th>
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<tr>
<td><strong>Levy rate: €1/kg NOx</strong></td>
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<tr>
<td>NOx change wrt NECA baseline</td>
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<tr>
<td>Total costs (million €)</td>
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<tr>
<td><strong>Levy rate: €2/kg NOx</strong></td>
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<tr>
<td>NOx change wrt NECA baseline</td>
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<tr>
<td>Total costs (million €)</td>
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<td>570</td>
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<tr>
<td><strong>Levy rate: €3/kg NOx</strong></td>
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<td>NOx change wrt NECA baseline</td>
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<td>-30%</td>
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<tr>
<td>Total costs (million €)</td>
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<td>690</td>
<td>420</td>
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<th>Levy and fund</th>
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<th>Slow steaming/ levy &amp; fund</th>
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Analysis shortlisted potential additional instruments

Conclusions:

Two from three instruments stand out as additional instruments in terms of NOx reduction and costs for sector:

1. NOx levy combined with a fund:
   Relatively high reductions with less costs for the sector than stand-alone levy.

2. Regulated slow steaming (-15%) combined with levy & fund:
   Approx. half of reduction of NOx levy combined with fund, but costs also approximately half.
Analysis shortlisted potential additional instruments

Implementation issues

**Monitoring options:** continuous monitoring; one onboard measurement; EIAPP certificate and NOx technical file of motor, standardized emission factors; proof that aftertreatment device is used and maintained properly.

**Enforcement:** coastal states can impose environmental requirements on foreign-flagged ships, with exception of foreign-flagged ships in transit or on innocent passage, but can only enforce requirements within territorial waters. As alternative, compliance with requirement could be set as a condition for entry into ports.

**Revenue collection options:** collected by coastal states, existing EU body, newly established international body.