Air pollution and transport
Policies at the city level
Content

- Background
- State of play of the transport sector
  - Emission levels
  - Ambient concentrations
- Policy interventions
  - Impacts of 5 selected measures
- Main conclusions
Background

- 2018 study by CE Delft for EPHA found that:
  - Currently, 67 to 80 bln € in road traffic related air pollution costs
  - Diesel vehicles
  - 90 to 95% of costs are health related
  - NOx has largest share in this (65%)
  - Social costs will decrease to 20 to 26 bln in 2030 due to policies already in place

- Exposure to traffic emissions high in urban areas → question from EPHA to CE Delft:
  - What transport policies can local/city governments adopt to reduce emissions and social costs?
State of play - emission levels

- Quick glance at:
  - Current total emission levels and trends (NOx and PM)
  - Share of transport in all emissions
  - Expected trend for 2030
  - Emissions vs ambient concentrations
All sectors (1990-2018)
Share of transport (PM10)
Share of transport (NOx)
Shares of different modes (PM10)

PM10 road transport 1990 - 2018

PM10 emissions in gG (1000 tonnes)

- Passenger cars
- HDVs and buses
- LDVs
- Moped and motorcycles
- Other road transport
Shares of different modes (NOx)
Projection 2016 - 2030 (PM2.5)
Projection 2016 - 2030 (NOx)
Costs of air pollution in 2030

Overview costs of air pollution from road transport in EU27 + UK in 2016 and 2030

Costs in million €

- Total costs
- Health costs

2016
- Method 1
- Method 2

2030
- Method 1
- Method 2
Ambient concentrations
Build up of ambient concentrations

- Urban area
- Rural area
- Streets
- (High) road

- National background
- International and natural background
Resume state of play

• Total NOx and PM emission have decreased in the last 20 years...
  - ... and are expected to decrease further
• Same is true for NOx and PM emissions from transport
  - Passenger cars and Heavy duty dominant modes in NOx (diesel)
  - Tyre and brake wear dominant in PM emissions
• Social costs will drop but still amount to 15 to 20 bln € in 2030
• Air quality (concentrations) poorest in densely populated areas
• Emission from transport in cities only partly contribute to ambient concentrations of NO\textsubscript{2} and PM
  - Local measures should be complemented by general measures
Policy interventions at city level

- Long list of measures (non exhaustive)

<table>
<thead>
<tr>
<th>#</th>
<th>Measure</th>
<th>AIS</th>
<th>Type</th>
<th>Effectiveness *</th>
<th>Up-front investment costs</th>
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<tbody>
<tr>
<td>1</td>
<td>Congestion charge</td>
<td>Avoid/Reduce</td>
<td>Spatial planning/TOD</td>
<td>Very effective (+++)</td>
<td>High (++ )</td>
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<td>Norms</td>
<td>Very effective (+++)</td>
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<td>3</td>
<td>Environmental / (ultra) LEZ zone</td>
<td>Avoid/Reduce</td>
<td>Pricing/fiscal incentive</td>
<td>Very effective (+++)</td>
<td>High (++ )</td>
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<tr>
<td>4</td>
<td>Parking policies (pricing)</td>
<td>Avoid/Reduce</td>
<td>Spatial planning/TOD</td>
<td>Effective (+++)</td>
<td>Low (-)</td>
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<td>Medium (+/-)</td>
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<td>8</td>
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<td>9</td>
<td>ZE city logistics - clean vehicles</td>
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<td>Increase public transport capacity</td>
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<td>High (+)</td>
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<td>12</td>
<td>Promote cycling/cycling infrastructure</td>
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<td>Moderately effective (+)</td>
<td>High (+)</td>
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<td>High (+)</td>
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<td>14</td>
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<td>Norms</td>
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<td>Medium (+/-)</td>
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<td>Medium (+/-)</td>
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<tr>
<td>17</td>
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<td>Norms</td>
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<td>Low (-)</td>
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<td>19</td>
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<td>Medium (+/-)</td>
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<td>Low (-)</td>
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<td>Car sharing schemes</td>
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<td>Medium (+/-)</td>
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<td>22</td>
<td>Green Public Procurement (GPP)</td>
<td>Improve</td>
<td>Subsidy</td>
<td>Slightly effective (+)</td>
<td>Medium (+/-)</td>
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<td>Subsidized (or free) public transport</td>
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<td>Pricing/fiscal incentive</td>
<td>Slightly effective (+)</td>
<td>High (+)</td>
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<td>Increase charging infrastructure</td>
<td>Improve</td>
<td>Spatial planning/TOD</td>
<td>Neutral (0)</td>
<td>High (+)</td>
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<tr>
<td>25</td>
<td>15 minute city</td>
<td>Shift</td>
<td>Spatial planning/TOD</td>
<td>Unknown (?)</td>
<td>High (+)</td>
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<tr>
<td>26</td>
<td>Mobility as a Service (MaaaS)</td>
<td>Shift</td>
<td>Spatial planning/TOD</td>
<td>Unknown (?)</td>
<td>Unknown (?)</td>
</tr>
<tr>
<td>27</td>
<td>ZE city logistics - spatial planning such as hubs</td>
<td>Improve</td>
<td>GPP</td>
<td>Unknown (?)</td>
<td>High (+)</td>
</tr>
<tr>
<td>28</td>
<td>ZE construction sites - (Non Road Mobile Machinery)</td>
<td>Improve</td>
<td>Norms</td>
<td>Unknown (?)</td>
<td>High (+)</td>
</tr>
</tbody>
</table>
5 selected measures

• More in depth analysis/review of 5 measures:
  - congestion charge,
  - environmental (low emission) zone,
  - car sharing,
  - parking policies, and
  - cycling/walking policies

• Selection based on:
  - Effectiveness
  - Experience
  - Different modes (diversity)
Congestion charge

- Adopted in London, Stockholm, Singapore, Gothenburg, Milan
- Pricing policy (tax/toll) aiming to influence demand of traffic in a certain time period and/or area
- ‘Simple’ charge-zone toll can also create significant effects
- Invest revenues in public transport and slow modes (walking, cycling)
- Effectiveness:
  - NOx, 8 to 10% reduction
  - PM, 7 to 17% reduction
  - Estimated reduction social costs in 2020
    - 31 - 96 mln Euro for cities > 1 mln
    - 1 - 3 mln Euro for cities < 200k
Low emission/environmental zone

- Adopted in Germany, The Netherlands, Milan, London, Malmö, Stockholm, Brussels (region)
- A LEZ is a designated area in a city where access is restricted for vehicles with a certain emission standard set by the (local) authority
- Success factors: a clear well drawn territory, legal enforcement, strict exemptions rules, clear communication to the public
- Effectiveness:
  - NOx, 2 to 36% reduction
  - PM, 2 to 23% reduction
  - Estimated reduction social costs in 2020
    - 9 to 131 mln Euro for cities > 1 mln
    - 0 to 4 mln Euro for cities < 200k
Car sharing schemes

- Adopted in many cities including Paris, Amsterdam, Cologne, other major cities in Europe/US
- Either platform between users (C2C) or (large-scale) business to consumer (B2C)
- Mostly (semi-)commercial initiatives, profitability issues
- Requires densely populated area
- Some competition with public transport and slow/active modes
- Effectiveness:
  - NOx, and PM -5 to 5% reduction
  - Estimated reduction social costs in 2020
    - 22 to 28 mln Euro for cities > 1 mln
    - ~ 1 mln Euro for cities < 200k

- Estimated social costs in 2020:
  - 22 to 28 mln Euro for cities > 1 mln
  - ~ 1 mln Euro for cities < 200k
Parking policies

- Widely used world wide
- Deals with pricing and supply
- Relatively easy to implement, generates steady income
- Restriction in supply best combined with Park and Ride

Effectiveness:
- NOx, and PM 5 to 10% reduction
- Estimated reduction social costs in 2020
  - 22 to 56 mln Euro for cities > 1 mln
  - 1 to 2 mln Euro for cities < 200k
Cycling and walking (active modes)

- Mix of different measures (infrastructure, bike sharing, low/zero car zones),
- Separate bike lanes preferable (safety), more challenging
- Often initiated from climate goals, not air quality
- City layout less of problem with electric bikes
- Effectiveness:
  - NOx, and PM 0 to 5% reduction
  - Estimated reduction social costs in 2020
    - 0 to 28 mln Euro for cities > 1 mln
    - 0 to 1 mln Euro for cities < 200k
Impacts of measures (emissions)
Impact of measures (social costs)

- Congestion charging and LEZ in metropoles 30 and 95 mln Euro per city, equivalent to 1 to 3% of the total social costs of these cities
- For small cities 1 to 3 mln Euro
- Other measures between 0 and 60 mln Euro in metropoles, 0 tot 2 mln Euro in small cities

Table 4 - Estimate of the change in social costs of congestion charging in 2020

<table>
<thead>
<tr>
<th>Metropolitan cities</th>
<th>Social return</th>
<th>% change</th>
<th>Big cities</th>
<th>Social return</th>
<th>% change</th>
<th>Small cities</th>
<th>Social return</th>
<th>% change</th>
</tr>
</thead>
<tbody>
<tr>
<td>North</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>3.7 - 8.7 €mln</td>
<td>1.2 - 2.7 %</td>
<td>-</td>
<td>1 - 2.3 €mln</td>
<td>1.2 - 2.8 %</td>
</tr>
<tr>
<td>West</td>
<td>30.8 - 71.7 €mln</td>
<td>1.1 - 2.6 %</td>
<td>4.4 - 10.2 €mln</td>
<td>1.1 - 2.6 %</td>
<td>-</td>
<td>1 - 2.4 €mln</td>
<td>1.1 - 2.7 %</td>
<td>-</td>
</tr>
<tr>
<td>South</td>
<td>39 - 90.9 €mln</td>
<td>1.1 - 2.6 %</td>
<td>3.1 - 7.1 €mln</td>
<td>1.1 - 2.7 %</td>
<td>1.3 - 2.9 €mln</td>
<td>1.2 - 2.7 %</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>East</td>
<td>40.8 - 95.7 €mln</td>
<td>1.2 - 2.8 %</td>
<td>5 - 11.8 €mln</td>
<td>1.2 - 2.8 %</td>
<td>1.4 - 3.2 €mln</td>
<td>1.2 - 2.8 %</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>
Main conclusions

• Local/urban measures are able to substantially reduce NOx and PM emissions, however...
  - ...depends highly on local situation and design
• Impacts on emissions and social cost reduction highest for Congestion charging and LEZ/environmental zones
• Uncertainties are large (tailor-made approach necessary)
• General governance issues:
  - Public awareness (campaign)
  - Clear long-term strategy, ‘vocal’ policy maker/governor
  - ‘Car minded’ professionals
• Potential ‘savings’ of in social costs may encourage local/city governments to implement these measures
CE Delft

- Independent research and consultancy since 1978
- Transport, energy and resources
- Know-how on economics, technology and policy issues
- 70 employees, based in Delft, the Netherlands
- Not-for-profit

Clients

- Industries (Small and medium size enterprises, transport, energy and trade associations)
- Governments (European Commission, European Parliament, regional and local governments)
- NGOs