Joint UNECE-UNCTAD Workshop:

Climate Change Impacts on International Transport Networks

08 September 2010, Geneva

Climate Change and Inland Waterway Transport

Presentation by

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The Deltacommission

In 2008, the dutch cabinet took over the recommendations of the "Deltacommission". This commission concluded that "the fresh watersupply" in the Netherlands is not climate proof on the long term.

A consequence of climate change...

Our country will face the consequences of sea level rise, higher river discharges during wintertimes and more dry periods in summer.

The Delta program

To anticipate to the consequences of climate change, the cabinet initiated the "Delta program". It contains several research programs to provide the dutch policymakers with the essential knowledge to realize a new "National Waterplan".
And what about inland navigation?

Inland navigation is one of the users of the “national fresh watersystem”

Climate change could be a threat for inland navigation

Knowledge on climate change is important to make proper policy and infrastructure planning

The Ministry for Transport, Public Works and Watermanagement decided to participate in the research program “Knowledge for Climate” (KvK)

KvK Research project: Effects of climate change on inland navigation and competitiveness of the port of Rotterdam

- TU Delft: Framework, system analysis and -reliability
- VU: Literature review & Interviews
- Deltares: Effects on river discharges and water depths
- Effects on river morphology
- Rijkswaterstaat: Impacts on inland navigation (costs)
- TNO: Impacts on modal split & Dutch ports

Effects on inland waterway transport costs

<table>
<thead>
<tr>
<th>Study</th>
<th>Increase costs</th>
<th>Time horizon</th>
<th>Region</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base 2004</td>
<td>5% - 7%</td>
<td>2004 - 2050</td>
<td>Full year</td>
<td>€/ton km</td>
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<tr>
<td>Rijkswaterstaat</td>
<td>-4% - +35%</td>
<td>2002 - 2100</td>
<td>Middle Mississippi, USA</td>
<td>Low + High</td>
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<tr>
<td>Olsen, 2005</td>
<td>-44% - +35%</td>
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<td>Middle Mississippi, USA</td>
<td>Low + High</td>
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<tr>
<td>Nomden, van Deursen, 1999</td>
<td>10%</td>
<td>1990 - 2050</td>
<td>Rhine</td>
<td>Low + High</td>
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<tr>
<td>Jonkeren e.a., 2007</td>
<td>15%</td>
<td>2004 - 2050</td>
<td>Rhine (Kaub)</td>
<td>Low</td>
</tr>
<tr>
<td>Rijkswaterstaat, 2005</td>
<td>54%</td>
<td>2004 - 2050</td>
<td>Dutch waterways</td>
<td>Low</td>
</tr>
<tr>
<td>Rijkswaterstaat, 2009</td>
<td>4%</td>
<td>2004 - 2050</td>
<td>All freight transport from/to/in NL</td>
<td>Low + High</td>
</tr>
<tr>
<td>idem</td>
<td>10%</td>
<td>2004 - 2050</td>
<td>All freight transport from/to/in NL</td>
<td>Low</td>
</tr>
</tbody>
</table>

Effects on water depths

- Low/High water
- Millerd, 2005: 3% - 14% 2001 - 2030 Great lakes, USA/Canada Low
- idem: 6% - 22% 2001 - 2050 Great lakes, USA/Canada Low
- Olsen, 2005: -44% - +35% 2002 - 2100 Middle Mississippi, USA Low + High
- Nomden, van Deursen, 1999: 10% 1990 - 2050 Rhine Low + High
- Jonkeren e.a., 2007: 15% 2004 - 2050 Rhine (Kaub) Low
- Rijkswaterstaat, 2005: 54% 2004 - 2050 Dutch waterways Low
- Rijkswaterstaat, 2009: 4% 2004 - 2050 All freight transport from/to/in NL Low + High
- idem: 10% 2004 - 2050 All freight transport from/to/in NL Low

How will shippers react on higher costs....

- Modal shift from navigation to road and rail transport
- Invent new logistical chains
- Postponement of transportation
- Transportation with smaller (less deeper) ships
- Investments in storage capacity
- Increase navigation speed

Effects on modal share

<table>
<thead>
<tr>
<th>Commodity groups</th>
<th>Volume (*1000 tonnes)</th>
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</table>

Need for adaptation?

- Resumé
  -> more wet-periods during wintertimes and dry-periods in summer
  if climate change persists
  -> hinder for navigation because of higher and lower waterdepths in the rivers
  -> higher transportcosts and delay in arrival of goods
  -> modal shift from navigation to road- and rail transport

- What is the problem for the government?

Work in progress

- Who owns the problem?
  Government, shippers, ports etc?
- Search for solutions.
  Together with all stakeholders.
- Extend and share our knowledge.
  Impacts of Climate Change on all Freshwater users (agriculture, energy/industry, navigation, leisure) within the Delta program and Knowledge on Climate
- Providing the proper information to the policymakers as input for our New National Waterplan to anticipate on climate change.