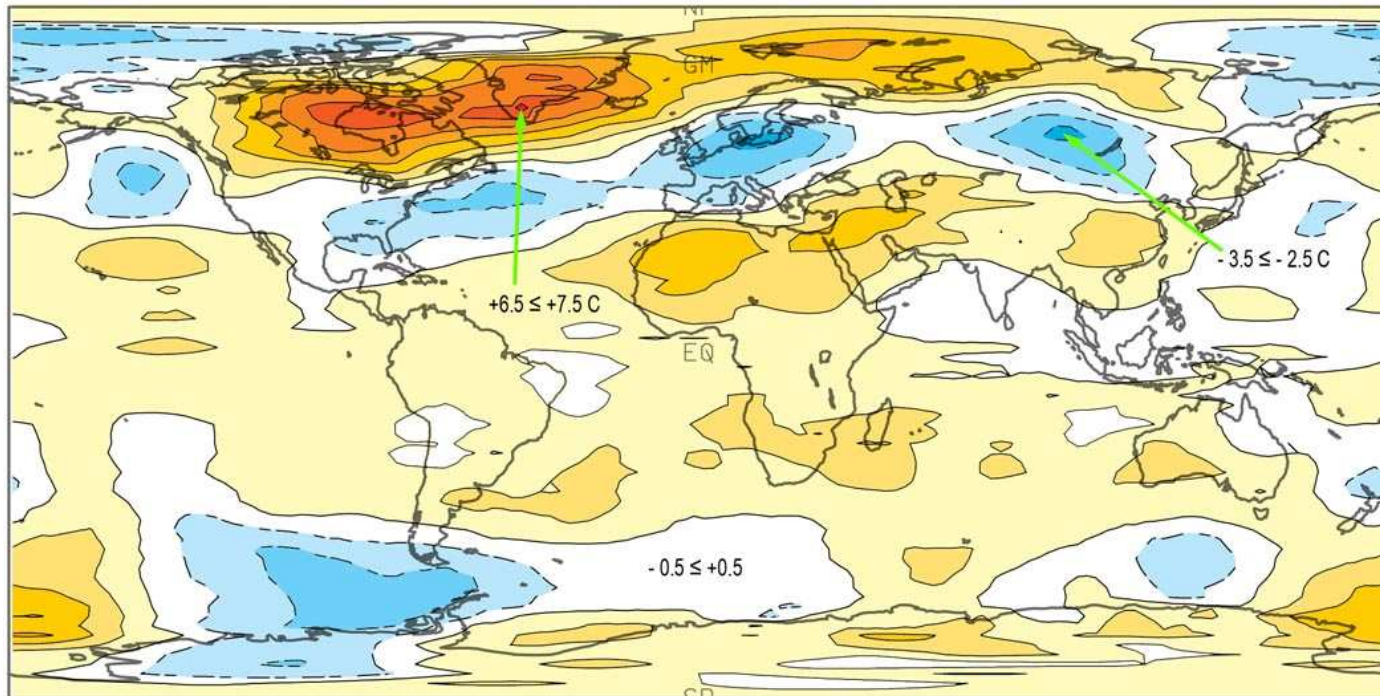






JAN 2010
LAYER = LT LOWER TROPOSPHERE



ZERO CONTOUR OFF
CONTOUR FROM -10.500 TO 10.500 CONTOUR INTERVAL OF 1.0000 PT(3,3)= 0.49000

Broken lines outline areas that were cooler than seasonal norms; solid lines outline areas that were warmer than seasonal norms. Each contour represents one degree Celsius, starting at -0.5 and +0.5 degrees C.



Ministerie van Verkeer en Waterstaat

Climate Change and Inland Waterway Transport

Bas Turpijn

Rijkswaterstaat - *Ministry of
Transport, Public Works and
Watermanagement*

3 september 2010



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*".

Samen werken met water

Een land dat leeft, bouwt aan zijn toekomst

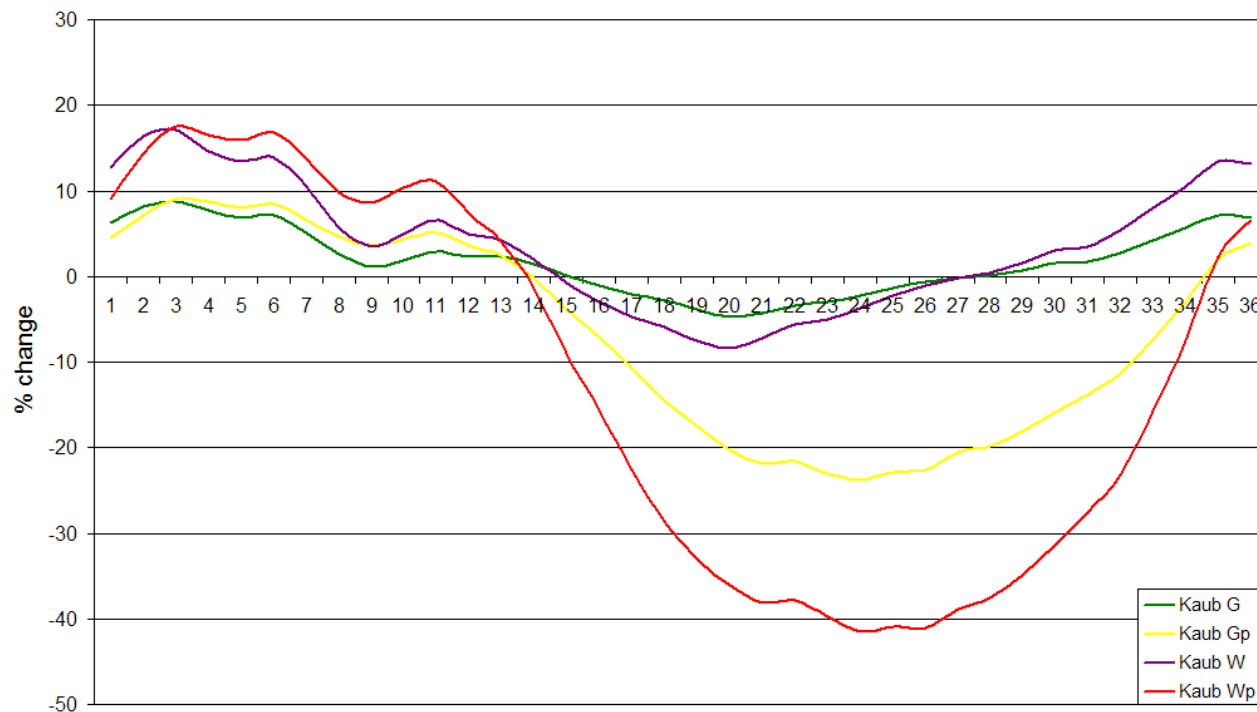
Bevindingen van de Deltacommissie 2008





A consequence of climate change...

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





The Deltaprogram

To anticipate to the consequences of climate change, the cabinet initiated the "Deltaprogram".

It contains several researchprograms to provide the dutch policymakers with the essential knowlegde to realize a new "National Waterplan".





Hoofdwatersystemen

Hoofdwatersysteem (in km ²)	65.250
Primaire waterkeringen (dijken, duinen, dammen, kunstwerken, vooroevers) (in km)	267
Stormvloedkeringen (aantal)	4

And what about inland navigation?

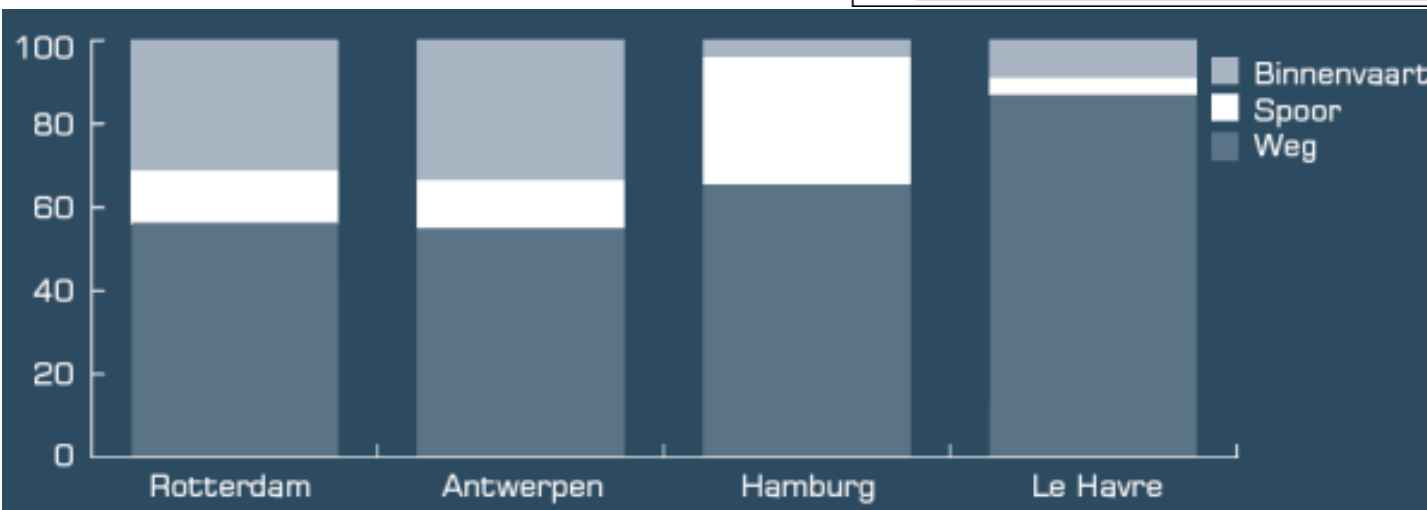
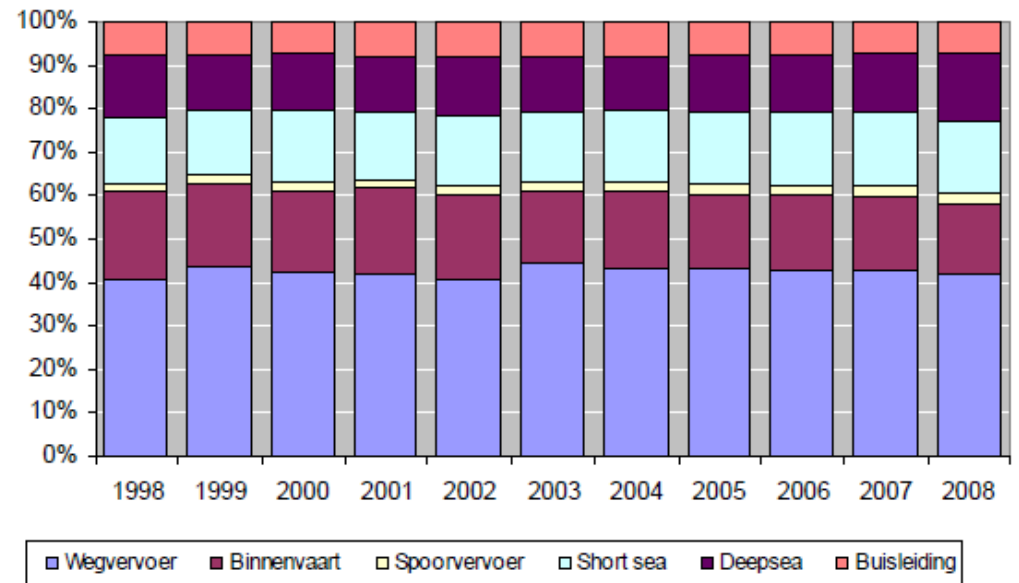
Inland navigation is one of the users of the “national fresh watersystem”





And what about inland navigation?

Inland navigation (*binnenvaart*) is also an important mode in (inter)national freight transportation





Knowlegde on Climate

- Climate change could be a threat for inland navigation
- Knowlegde on climate change is important to make proper policy and infrastructureplanning
- The Ministry for Transport, Public Works and Watermanagement decided to participate in the researchprogram "Knowlegde for Climate" (KvK)



Kennis voor Klimaat Knowledge for Climate



KvK Research project:



Effects of climate change on inland navigation and competitiveness of the port of Rotterdam

TU Delft

Framework, systemanalysis and -reliability

VU

Literature review &
Interviews

Deltares:

Effects on riverdischarges and
waterdepths

Effects on rivermorphology

Rijkswaterstaat

Impacts on inland navigation (costs)

TNO

Impacts on modal split & Dutch ports

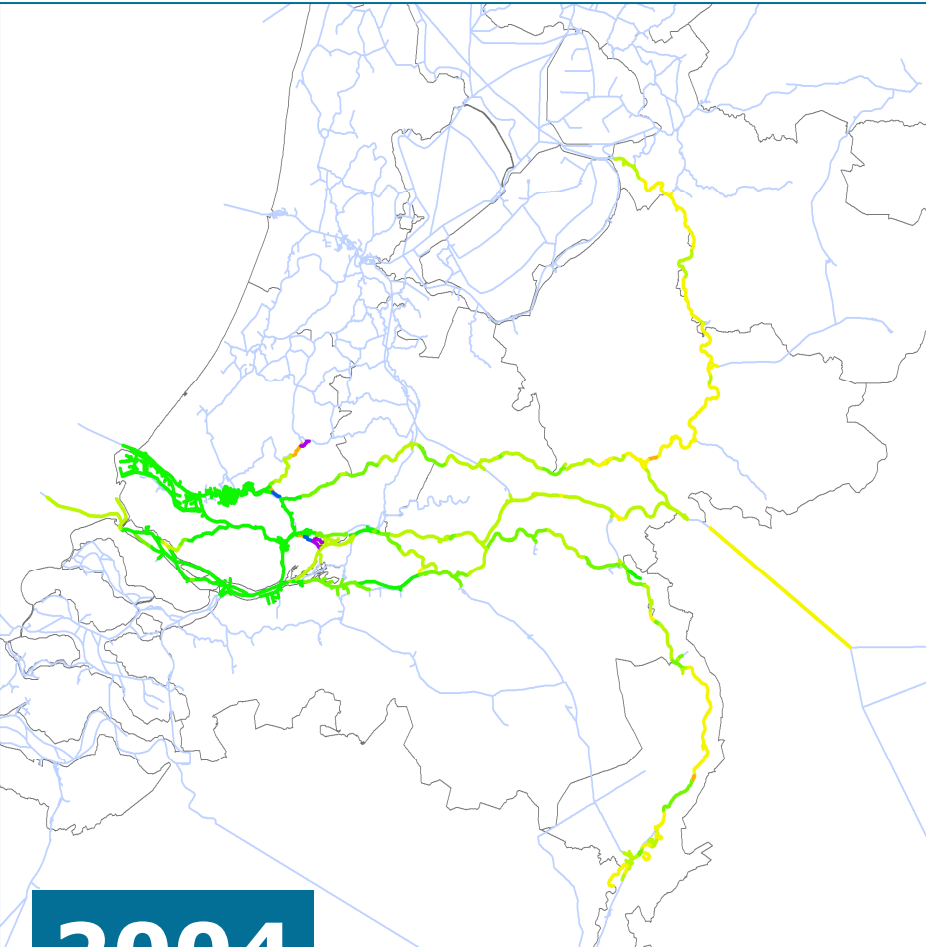


Legenda

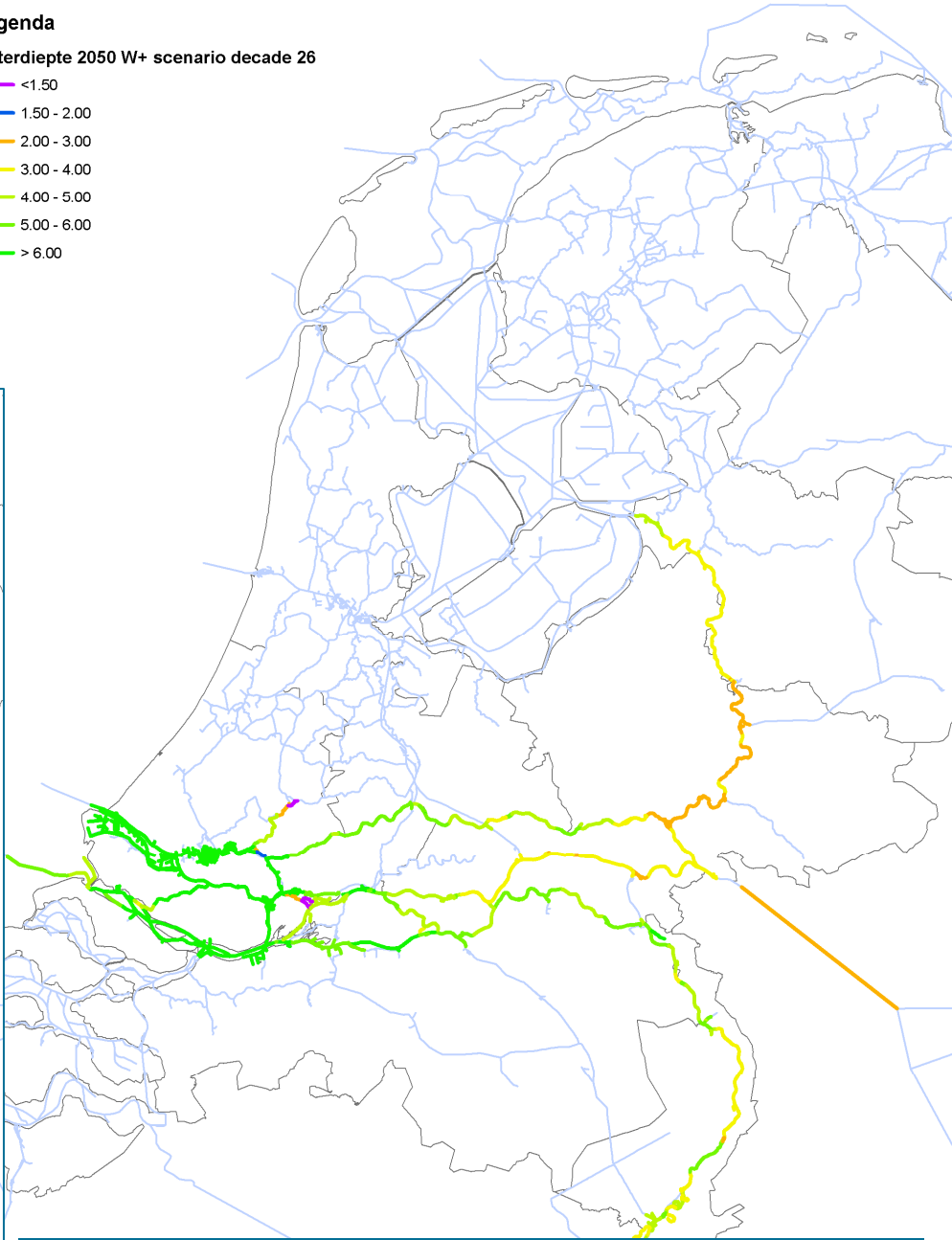
Waterdiepte 2050 W+ scenario decade 26

- <1.50
- 1.50 - 2.00
- 2.00 - 3.00
- 3.00 - 4.00
- 4.00 - 5.00
- 5.00 - 6.00
- > 6.00

Effects on waterdepths



2004



2050 W+ scenario



Effects on inland waterway transport costs

Study	Increase costs	Time horizon	Region	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%	Gem (1901 - 2000) - 2050	Dutch waterways	Low
Rijkswaterstaat, 2009	4%	2004-2050	All freight transport from/to/in NL	Low+High
idem	10% - 12%	2004-2050	All freight transport from/to/in NL	Low

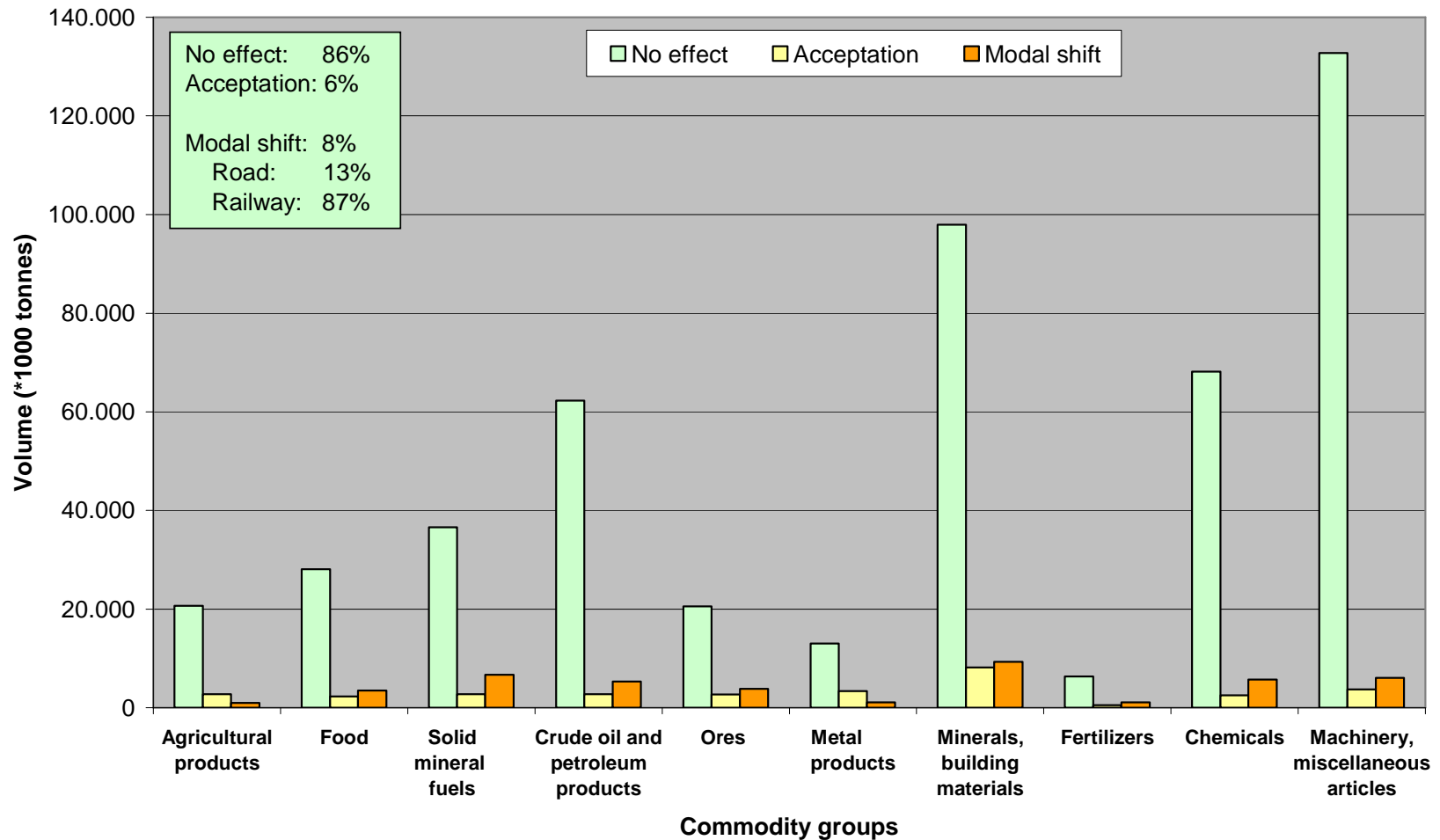


How will shippers react on higher costs....

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



Effects on modal share





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 railtransport
- What is the problem for the government?



Need for adaptation?

- Recall: navigation is not the only user of the fresh watersystem



agriculture ...



... and navigation

- Rijkswaterstaat (2005):
damage (in €) to agriculture because of draught is 2x damage to navigation



Work in progress

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