

# Environmental performance of inland shipping in comparison with other modes

CCNR CO<sub>2</sub> conference, 12 April 2011, Strasbourg

Eelco den Boer

## ▶ CE Delft

- Independent, not-for profit consultancy, founded in 1978
- Based in Delft, the Netherlands
- Transport, Energy, Economy
- 15+ years of experience with environmental policies for aviation and shipping
- Clients include European Commission, national governments, ports, branch organisation, NGOs, IMO



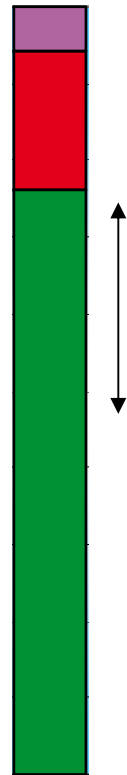
## ▶ Outline

- Introduction
- Objectives
- Methodological framework
- Factors defining the specific emissions
- Comparison of transport modes on specific links
- Conclusions



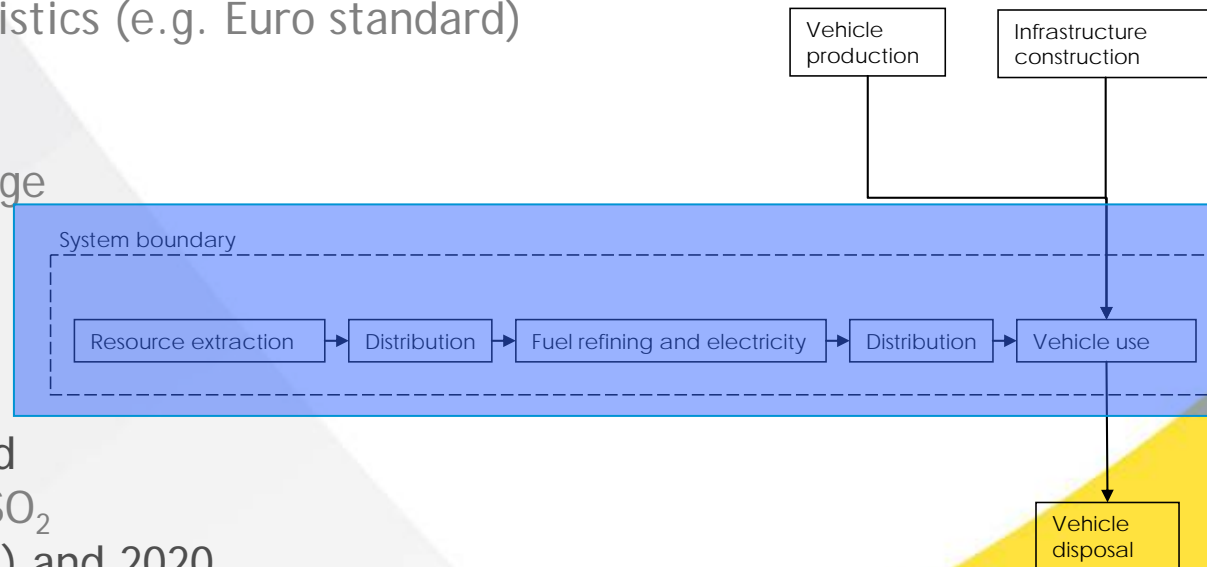
## ▶ Objectives

- Why comparing emissions of transport modes ?
  - 60% emission reduction in transport
- EU Transport White Paper put modal shift on the agenda
  - Climate point of view now
  - Air quality remains important
  - 30-50% over 300 km distance by waterborne and rail in 2030-2050
- Ports face accessibility and sustainability difficulties
  - Rotterdam applies modal shift criteria at MVII:
    - Inland shipping: 45% (currently approx. 30%).
    - Rail: 20% (currently approx. 10%).
    - Road: 35% (currently approx. 60%).
- Sustainability programs of shippers



## ▶ Methodology

- STREAM = Study into TRansport Emissions of All Modes
- Different factors define the emissions per output (tkm):
  - Emission characteristics (e.g. Euro standard)
  - Scale
  - Detouring
  - Pre- and end haulage
  - Type of goods
- Well-to-wheel analysis
- Main pollutants covered
  - CO<sub>2</sub>, NO<sub>x</sub>, PM and SO<sub>2</sub>
- Current situation (2009) and 2020
- Representing the EU situation (electricity/refining)
- Focussing on longer distance



## ▶ Methodology

- Calculation of emission factors grammes per tkm for all modes

$$EM_{overall} = \frac{vkm_{mode} EM_{mode} + (vkm_{truck} + EM_{truck})_{post-transport} + EM_{transfer}}{vkm_{truck} \cdot load_{mode}}$$

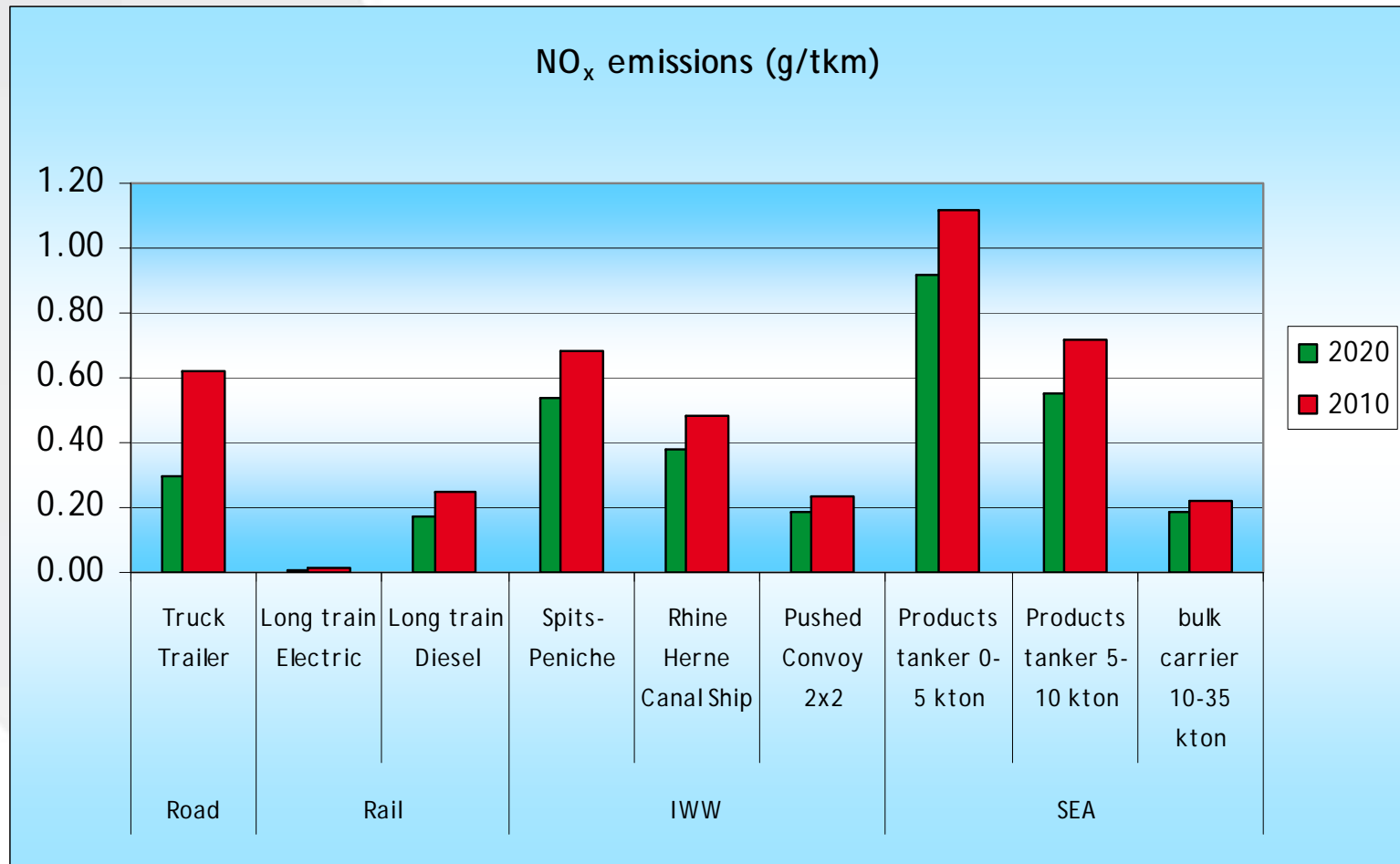
- $EM_{mode}$ : emissions per vehicle including the fuel cycle
- Load: maximum capacity \* utilization factor
- Detour factor:  $vkm_{mode} / vkm_{truck}$
- Emission data
  - Road: Dutch emissions inventory (TNO)/TREMOVE
  - Rail: Ecotransit
  - Inland barge: Dutch emissions inventory (TNO)
  - Seagoing ship: 2nd IMO GHG study
- Logistics data: market consultation

## ► Impact of detouring/pre-end haulage

- Case: Large scale container transport Rotterdam-Duisburg-Essen
  - Road: Rotterdam-Essen; 230km
  - IWT: Rotterdam-Duisburg; 214 km + road 26 km

depart	arrival	rail/road	iww/road	SSS/road
Port of Rotterdam	Milan	1.06	--	
Port of Rotterdam	Koln	0.91	1.13	
Hamburg	Duisburg	1.00	--	
Port of Rotterdam	Thionville	1.02	1.72	
Port of Rotterdam	Vienna	1.07	1.43	
Port of Rotterdam	Duisburg	1.04	1.06	
Port of Rotterdam	<i>Essen via Duisburg</i>	<i>1.04</i>	<i>1.06</i>	
Port of Rotterdam	<i>Dortmund via Duisburg</i>	<i>1.09</i>	<i>1.10</i>	
Groningen Port	Vienna	1.24	1.50	
Antwerp Port	Barcelona	1.03	--	2.52
Bilbao Port	Port of Rotterdam	1.04	--	1.04
Amsterdam Port	Regensburg	1.05	1.41	

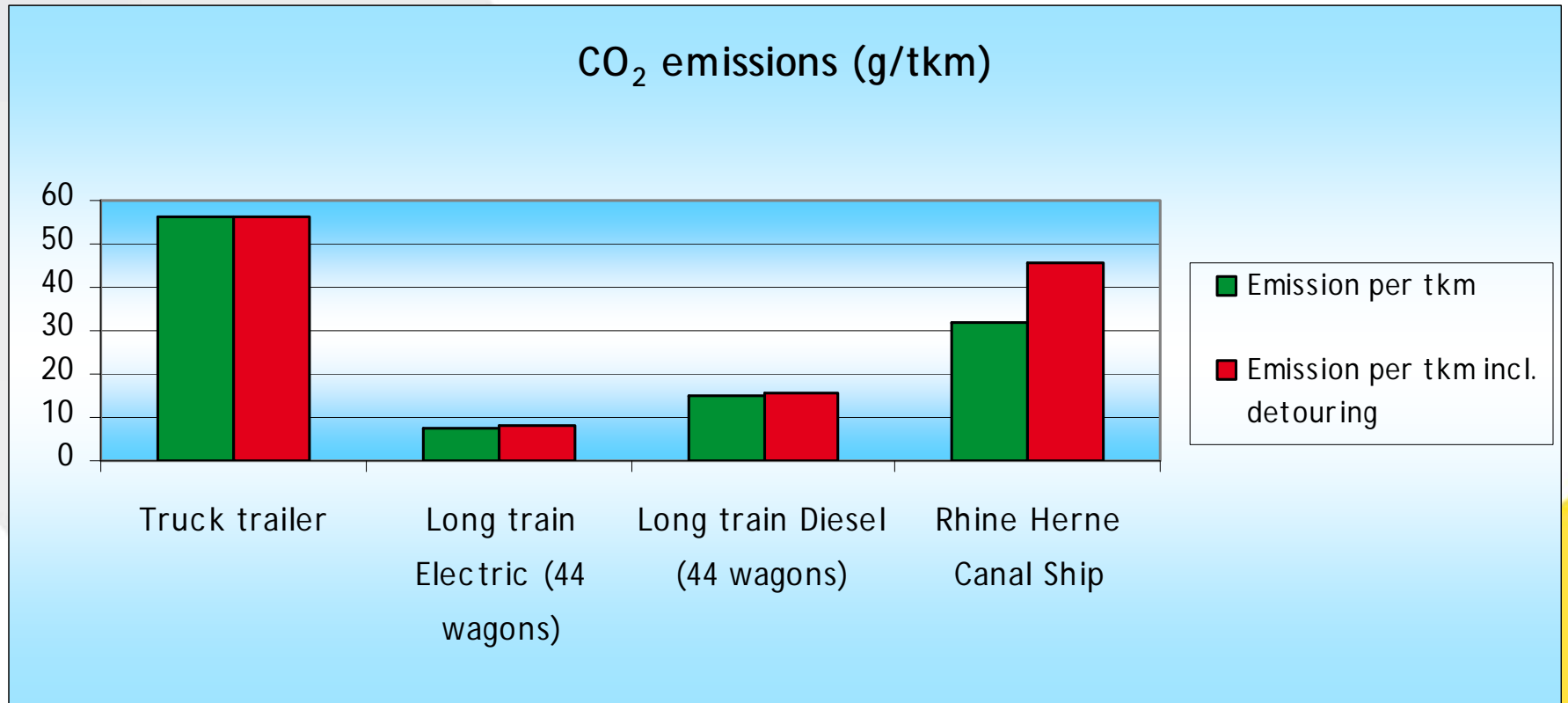
# Impact of scale of transport/future outlook



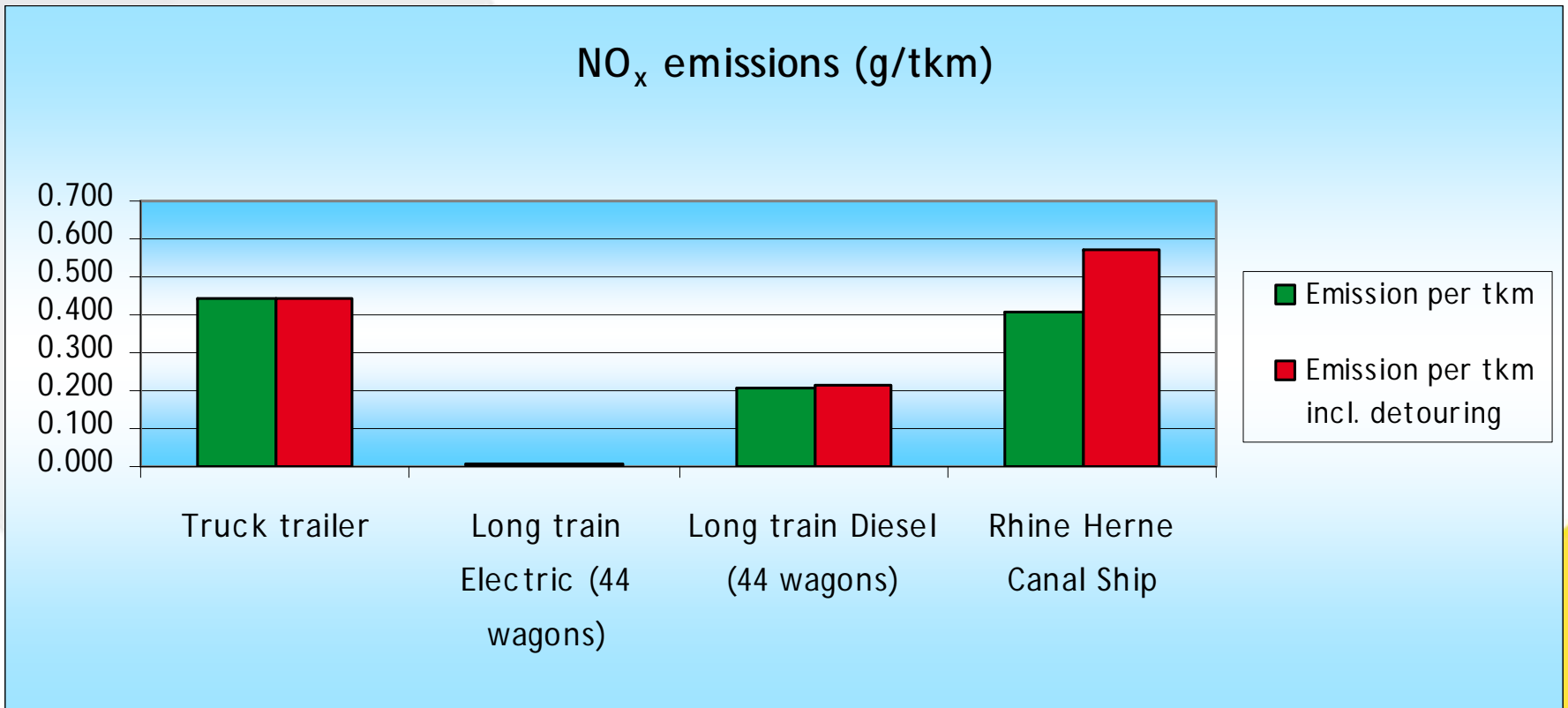
## ▶ Comparison of specific modes on specific links

- Average emission technology (2010)
- Representative logistical data
  - Real world distances/detouring/end haulage
- Emissions of transshipment included
- Definition of goods types
  
- Amsterdam - Regensburg
- Rotterdam - Duisburg, incl. end haulage

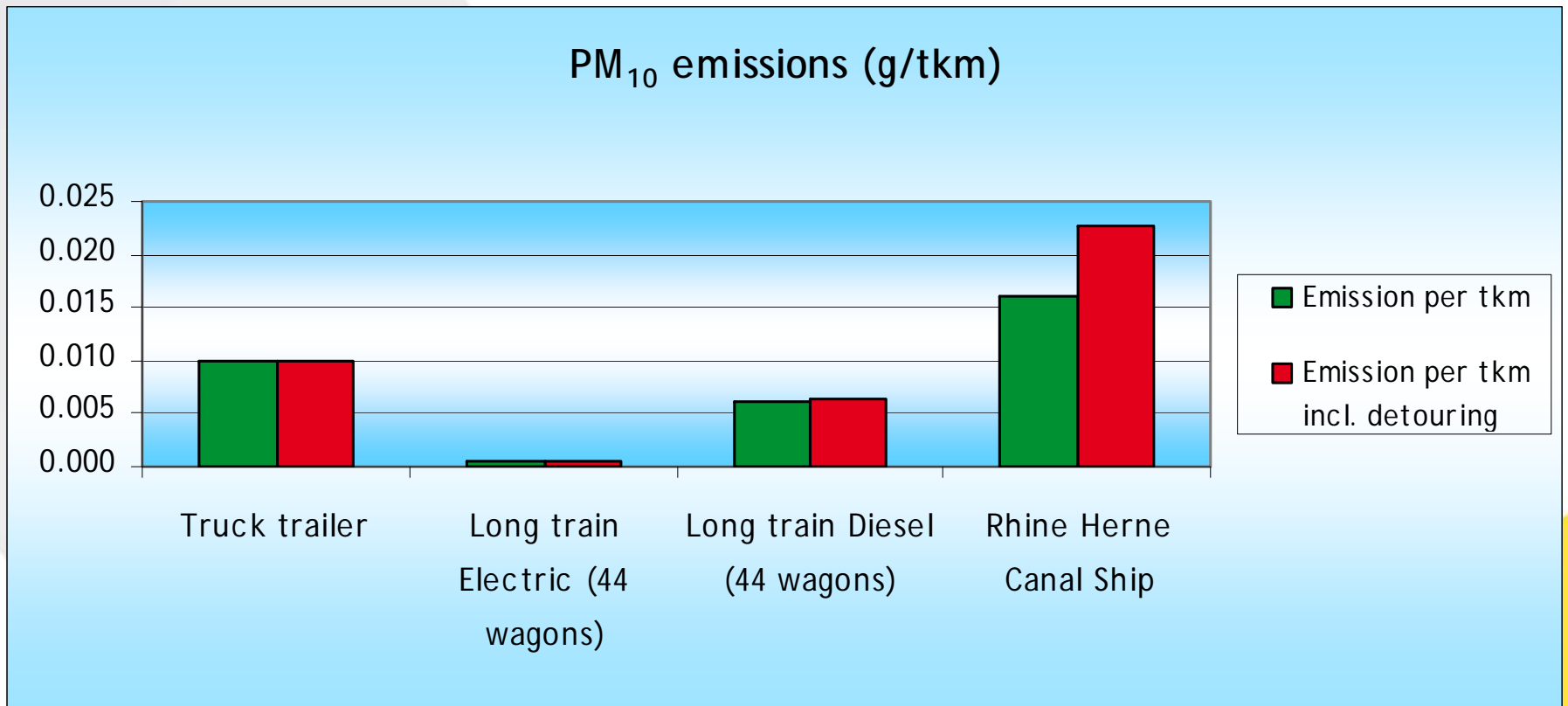
## ▶ Steel Amsterdam-Regensburg



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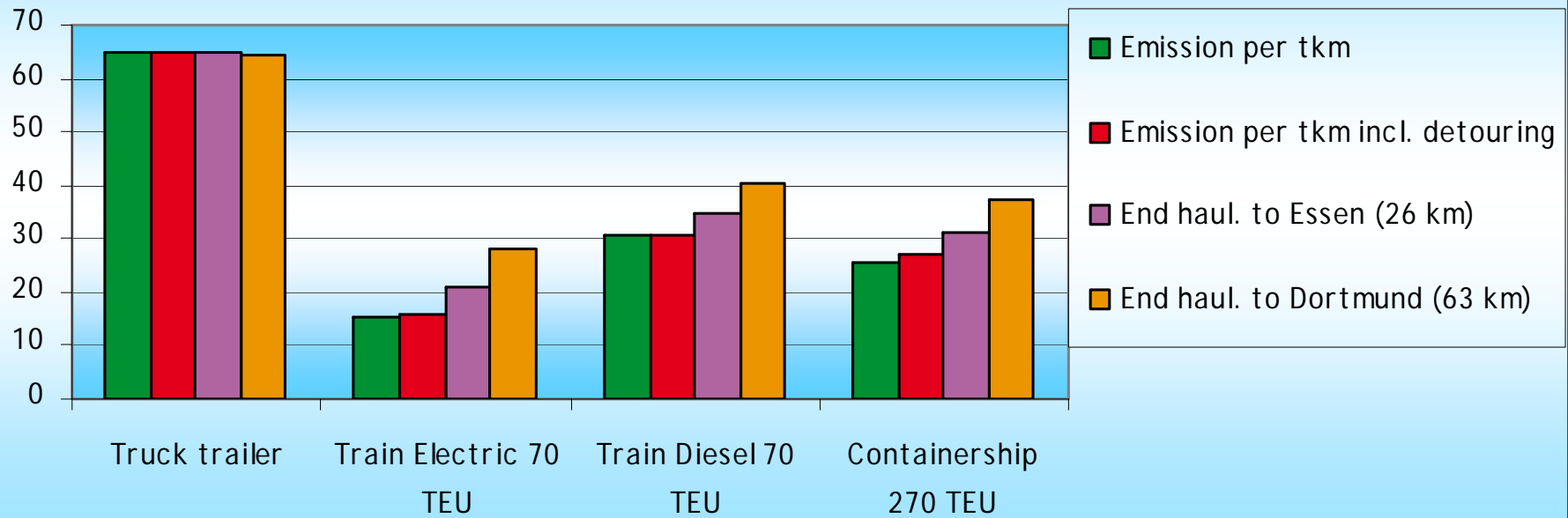


## ▶ Steel Amsterdam-Regensburg

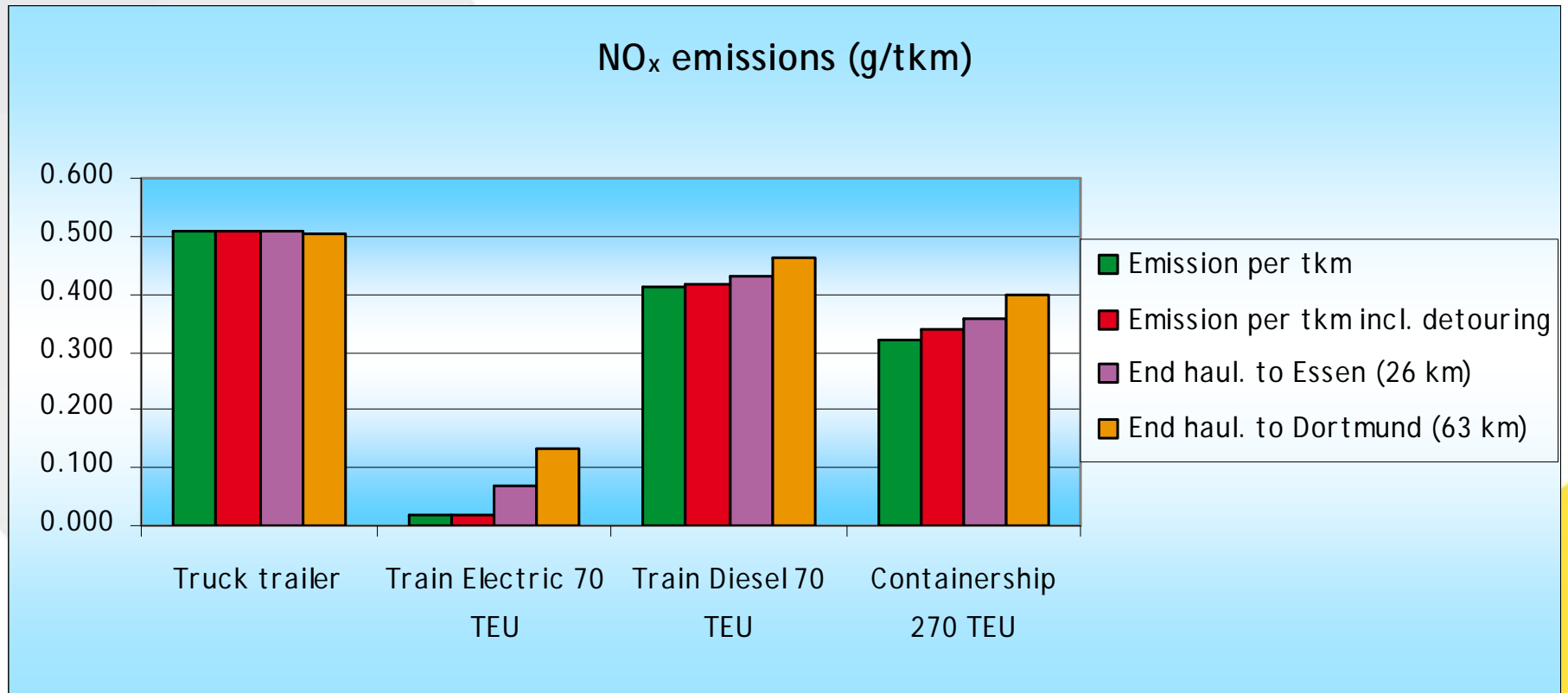


## Containers Rotterdam-Duisburg

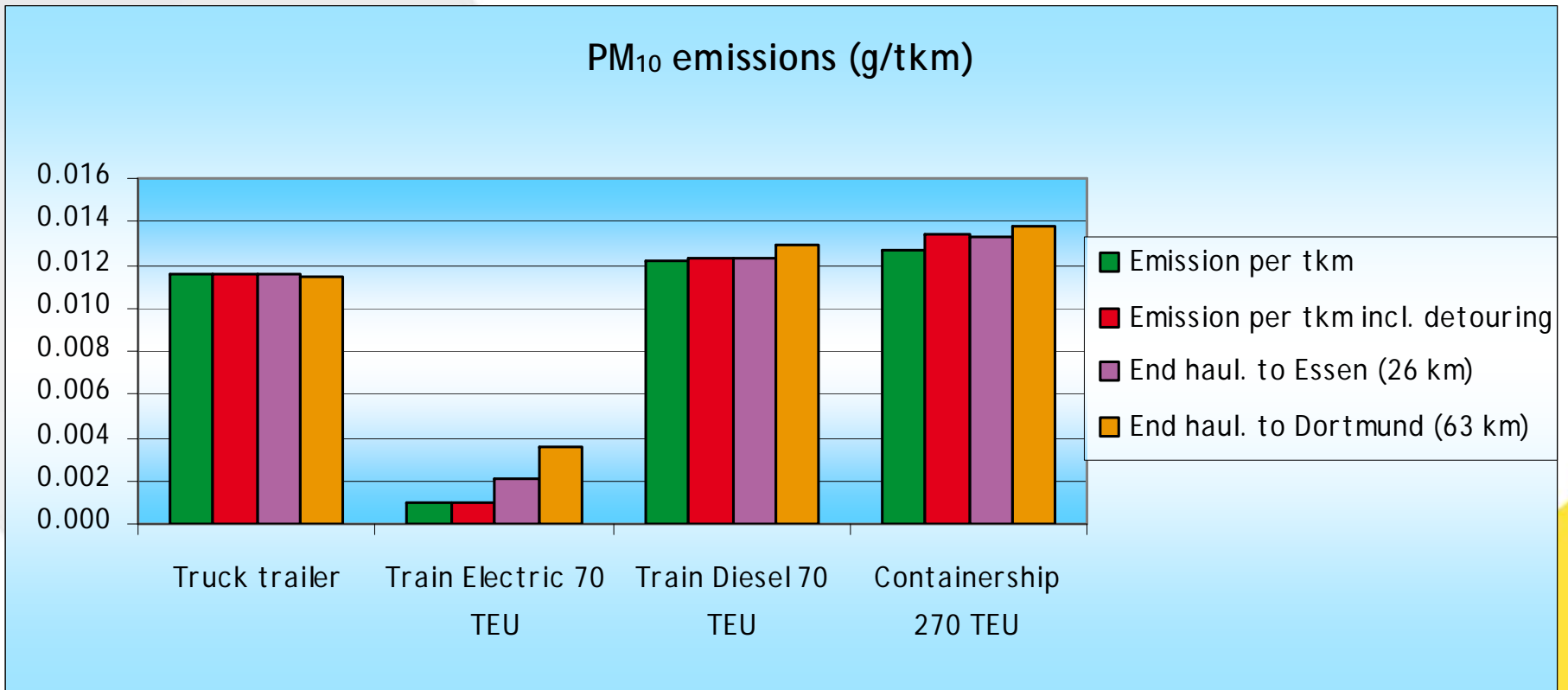
CO<sub>2</sub> emissions (g/tkm)



## ▶ Containers Rotterdam-Duisburg



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## ▶ Conclusions

- Many factors influence emissions
  - Logistical characteristics
  - Emission standard
  - Type of good
- Modal comparisons depend heavily on vehicle capacity and utilisation
  - CO<sub>2</sub> emissions:
    - Clear advantage for large ships
    - Small ships: load factors decisive
  - Pollutant emissions: road transport comparable or cleaner
    - Strongly dependent on case
    - 2020 difference greater than 2010
  - Significant GHG reduction potential IWT
  - Fuel efficiency and carbon-intensity road likely to improve

▶ Thank you for your attention!

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