



SUSTAINABLE WATERWAY TRANSPORT, CLEAN AIR

CLINSH mid term conference Brussels



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Welcome and introduction

Mr Filip Boelaert

*Secretary-General of the department Mobility and
Public Works, Government of Flanders*

Flemish Policy on Air Quality // Action: Greening IWT



- NRMM-regulation: emission standards (NOX, PM & VOCs) new engines, 85% lower (2019-2020)
- Use new engines and old remediation (greening consultant)



CLINSH support: building OPS in North Sea Port, Ghent



- Encourage use of alternative fuels: tax exemption for electricity, subsidies, port taxes
- CLINSH's input (info real-world performance, cost-benefit analysis, fuel transition)
- Reduce emissions at quays by using OPS (CLINSH's results about OPS technologies for IWT)

Mr Rik Janssen

*Regional Minister of the province of Zuid-Holland
and chairman of the CLINSH Consortium*

Mr François Wakenhut

*Head of the Clean Air Unit, DG Environment,
European Commission*



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TALKING ABOUT CLINSH

The human factor of sustainable inland shipping





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SUSTAINABLE WATERWAY TRANSPORT, CLEAN AIR

Welcome and introduction

Dr Alan Murphy

*Associate Professor in Maritime Engineering at
Newcastle University*



CLEAN INLAND SHIPPING

Contribute to improved air quality in urban areas situated close to ports and inland waterways

By measuring to what extent emission reduction technologies and alternative fuels can reduce air pollutant emissions on ships and by OPS

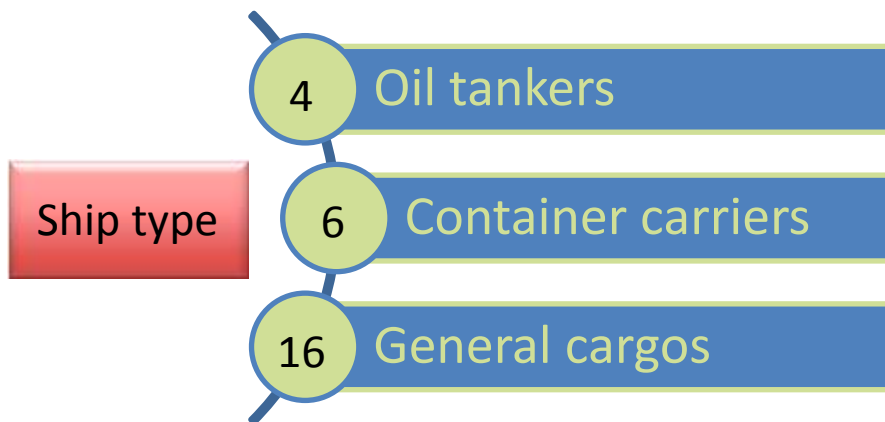
Understanding Inland Shipping Emissions

- *Airborne emissions from inland shipping:*
 - Continuous and discontinuous monitoring on ships
 - The Fleet
 - Monitoring Systems and Methods
 - Initial Results
 - Emissions burden in the environment
 - Indexing and attribution of emissions
 - Onshore measurements of ships sailing by
 - The role of Onshore Power Supplies (OPS)

Monitoring on ships – The CLINSH fleet

Green technology	Number contracted
SCR-DPF	15 Vessels
GTL	7 Vessel
FWE	2 Vessels
Hybrid	2 Vessel

Total number of ships: **35**
 -26 monitored to date
 -Boasting a variety of Green Technologies



Green technology	Name/Description
SCR	Selective Catalytic Reduction
DPF	Diesel particulate filter
FWE	Fuel-water emulsification (fuel mixed with water)
GTL	Gas converted to a liquid to ease of use
Hybrid (SNCR-SCR)	Combination of selective non-catalytic reduction (SNCR) and selective catalytic reduction (SCR) technology

Oil Tankers



RyGo (SCR-DPF)



Seba (SCR-DPF)



MTS Rozalinde (GTL)



MTS Vlaardingen (SCR)

Sulomaro (SCR-DPF)



Gouwenaar II (SCR-DPF)



MS Semper Fi (Hybrid)



Factotum (SCR)



Container carriers



Mejana (SCR-DPF)



Salute (SCR)

Invontes
(FWE)



Vantage
(GTL)



Tharsis
(Diesel
electric)



MS
Essex
(Hybrid)



General cargo (Bulk carrier)

Ora et
Labora
(GTL)



Vera Pax
(SCR-DPF)



Mon Desir



Osar
(GTL)



MS Liane
(SCR-DPF)



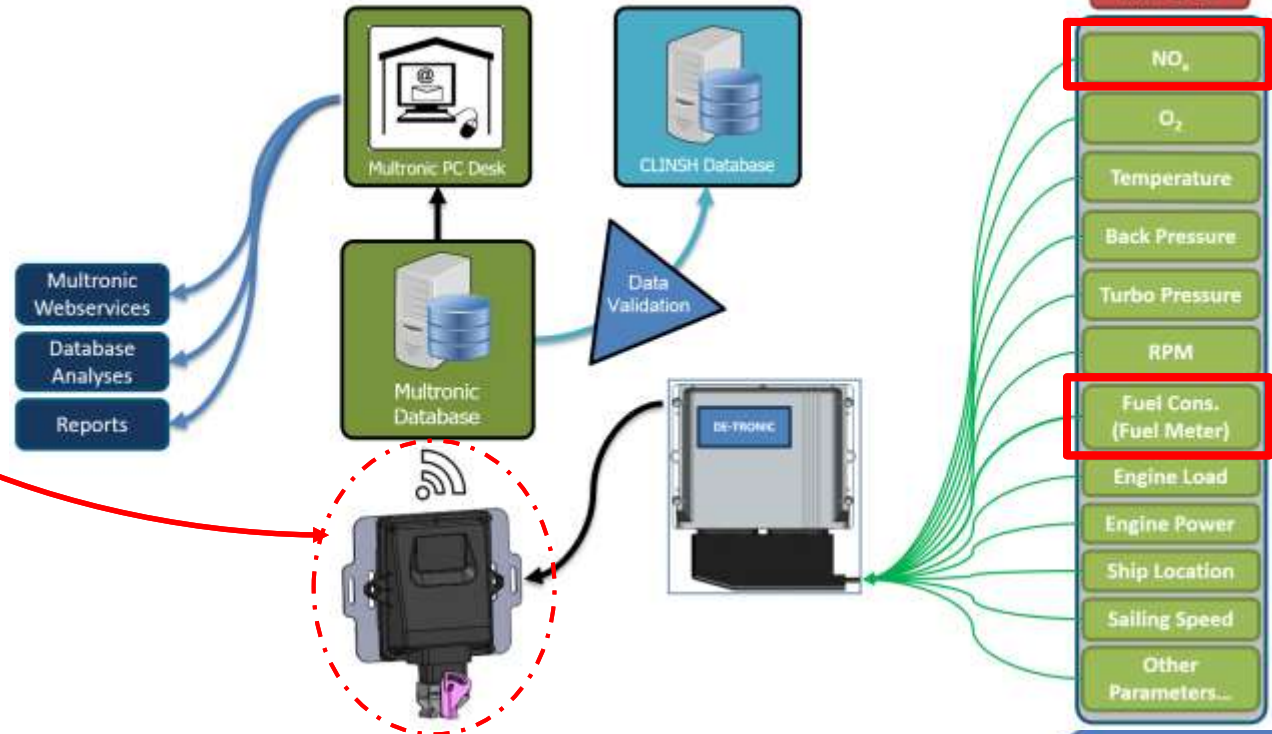
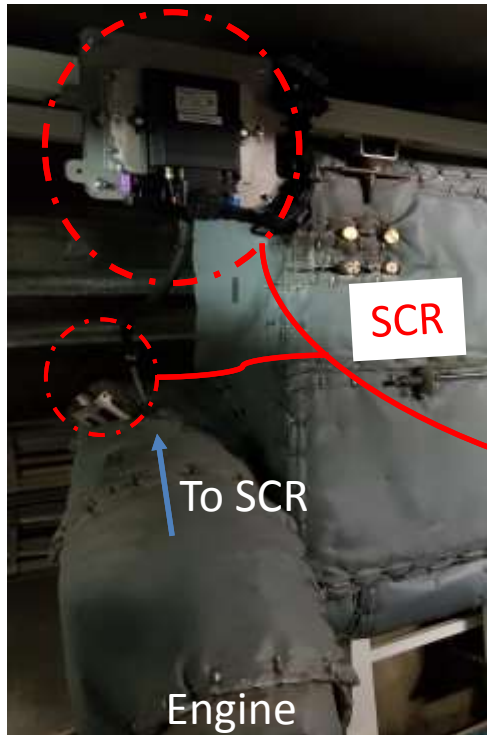
MS Philipskercke
(SCR-DPF)



Comienzo
(SCR)



Monitoring on ships-Continuous monitoring



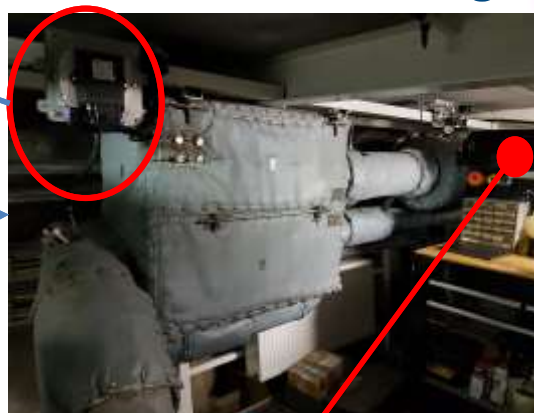
Monitoring on ships-Continuous and discontinuous monitoring



Max Pruss
(SCR-DPF)

Continuous
monitoring

Multronic



Discontinuous
monitoring



TESTO350



Onboard measurements

Experimental preparation:

- Time synchronization for all sensors
- Calibration of TESTO with fresh air
- Reciprocal run
- And other quality assurance checks



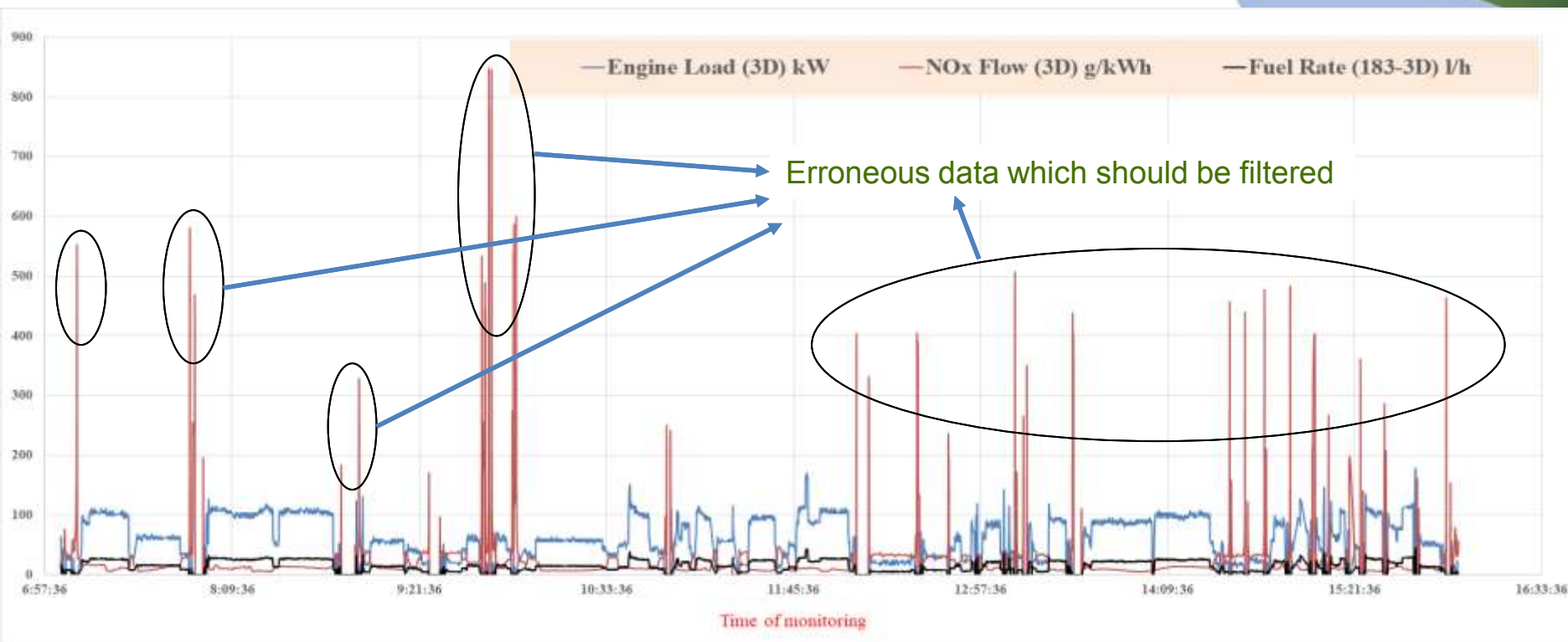
Case	Low MCR	Medium low MCR	Medium high MCR	High MCR
Engine speed (rpm)	1000	1200	1400	1600
Vessel speed through water (km/h)	7	10.4	12	13.5

Increasing Engine Load

MCR = Maximum Continuous Rating

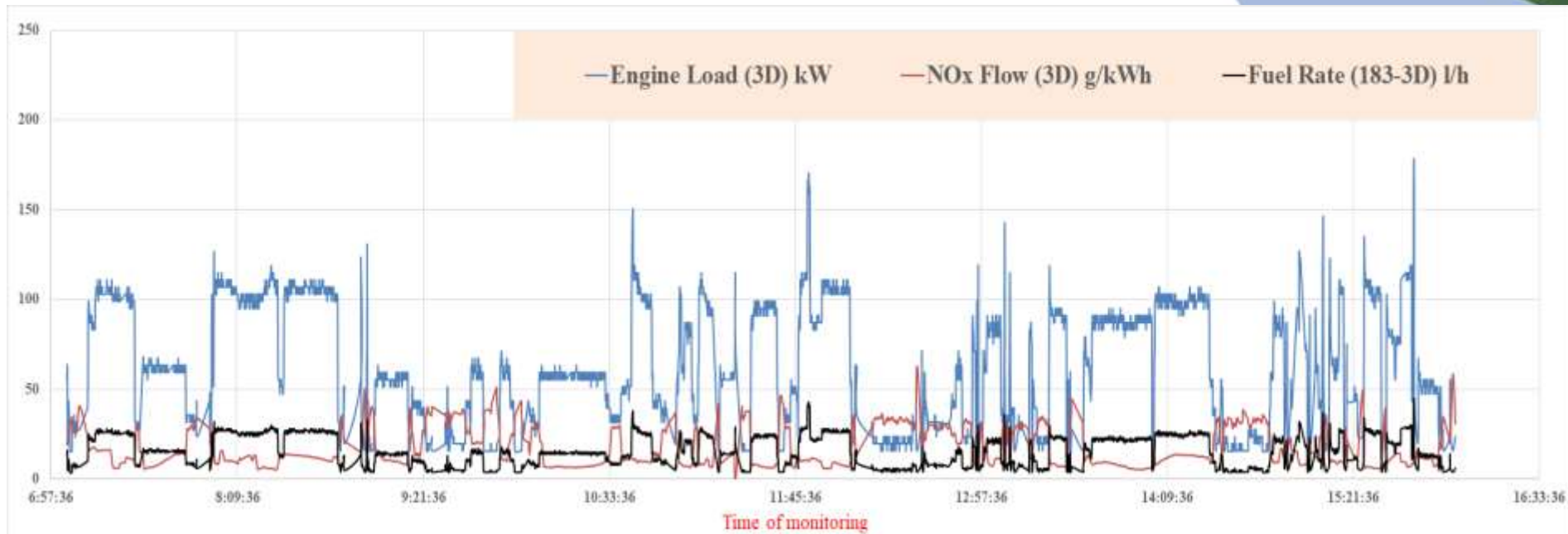
- Tests have been conducted in two conditions when SCR is off and is on.
- Frequency of Data collection: 1 Hz.

Continuous monitoring on ships- Raw data example



Typical raw data of a ship in a complete journey (Data before being filtered)

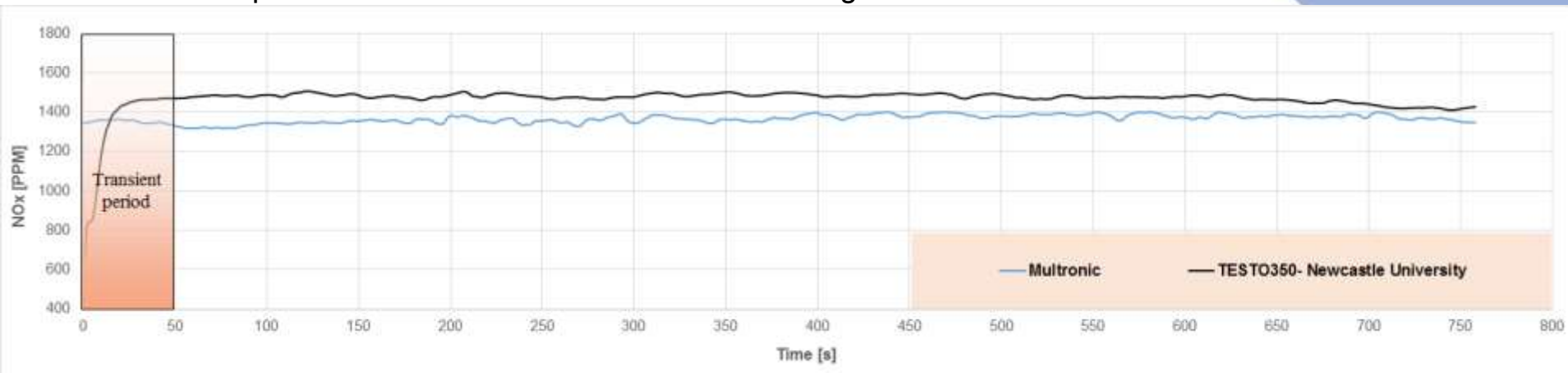
Continuous monitoring on ships- Raw data example



The data after filtering

Quality Assurance in Monitoring : A comparison between monitoring methods

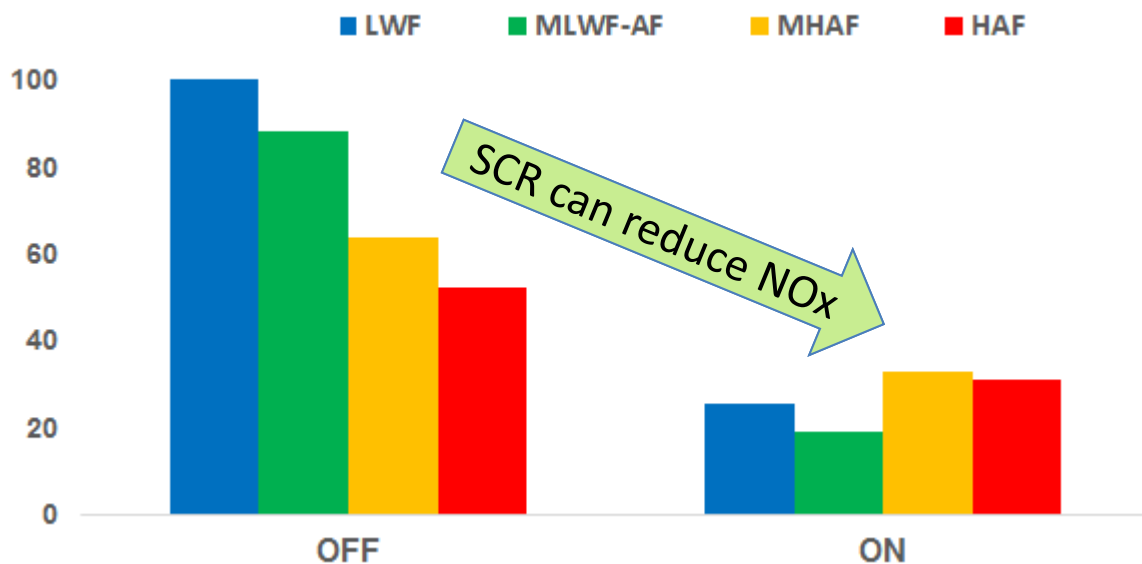
Comparison between measurement of NO_x using TESTO and Multronic sensors



	Mean	StDV
TESTO	1464	75.4
Multronic	1366	20.2
Difference %	6.7	

* Difference was calculated based on TESTO's result

First analysis of data - SCR (catalytic reduction of NOx)

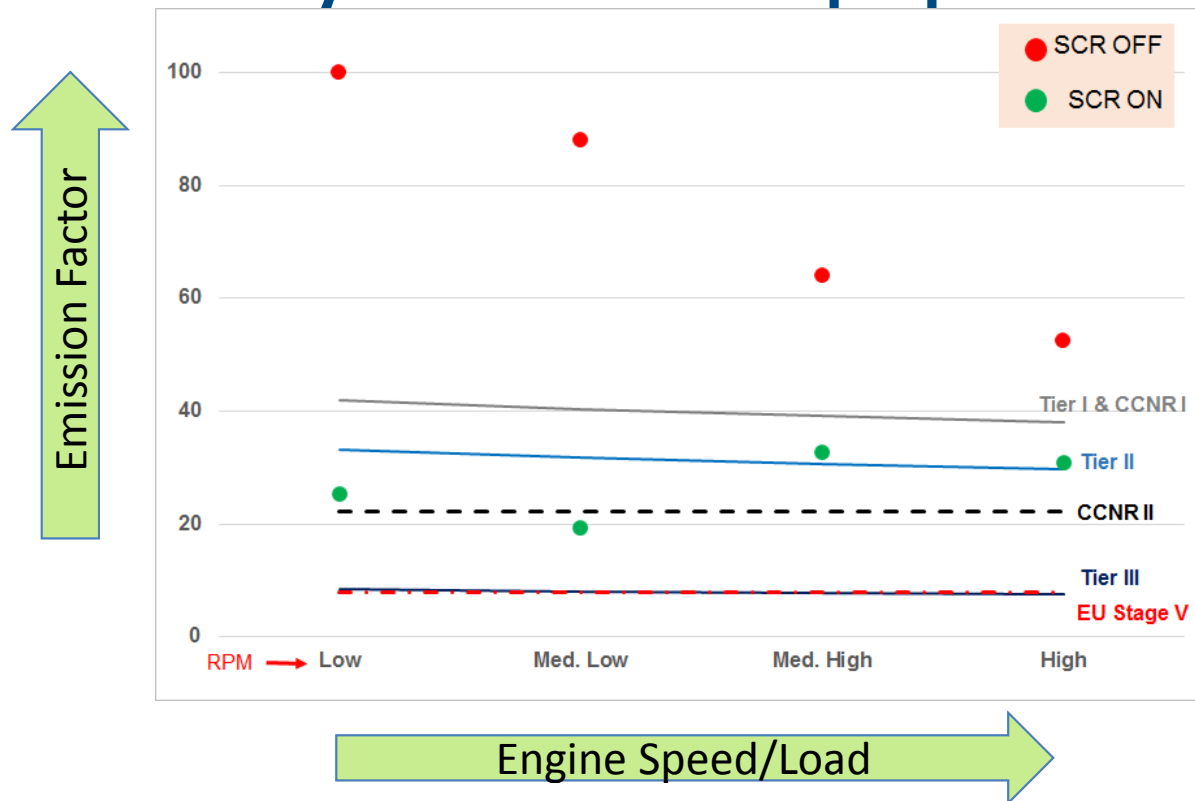


Case	effect of SCR %
LWF	75
MLWF-AF	78
MHAF	49
HAF	41
Mean	61

	OFF	ON
Mean	76.1	27.1
StDev	21.8	6.1

Case	MCR	Heading
LWF	Low	With flow
MLWF-AF	Medium low	With flow (WF) Against flow (AF)
MHAF	Medium high	Against flow
HAF	High	Against flow

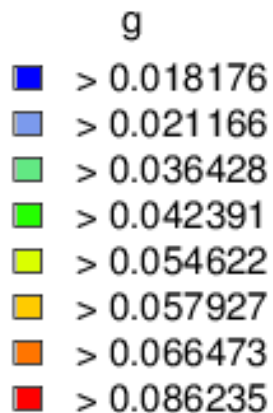
First analysis of data – Ship-Specific Emission Factors



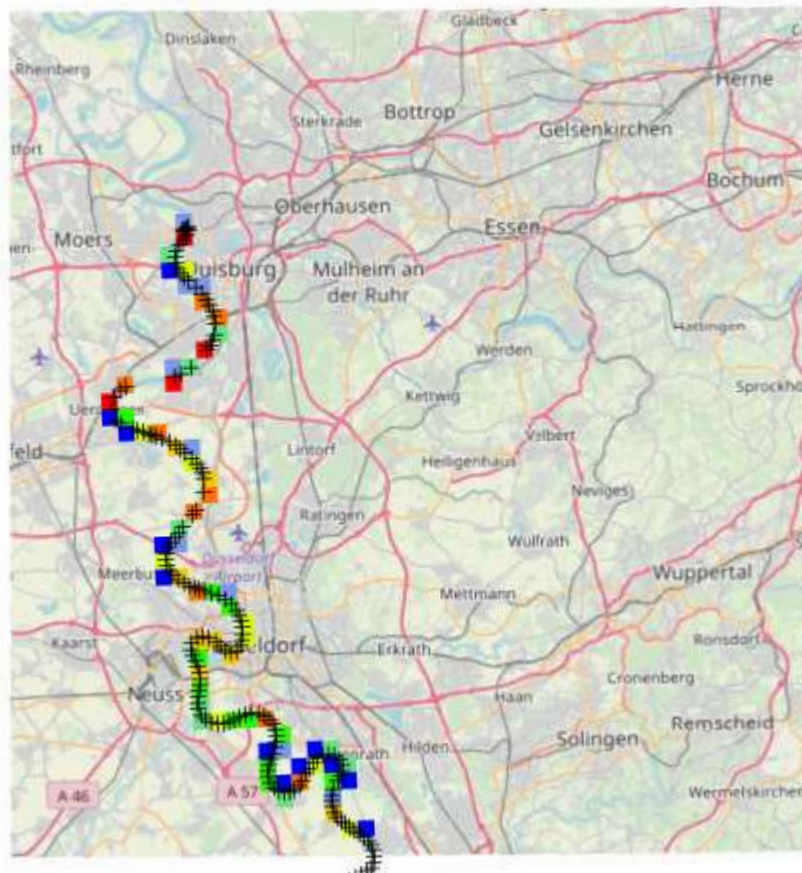
This graph shows a comparison between real NOx emission by a ship in CLINSH fleet with IMO and CCNR test cycle benchmarks

Emissions in the Environment

Example ship on August 15th 2018

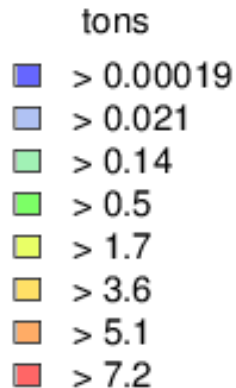


NO_x

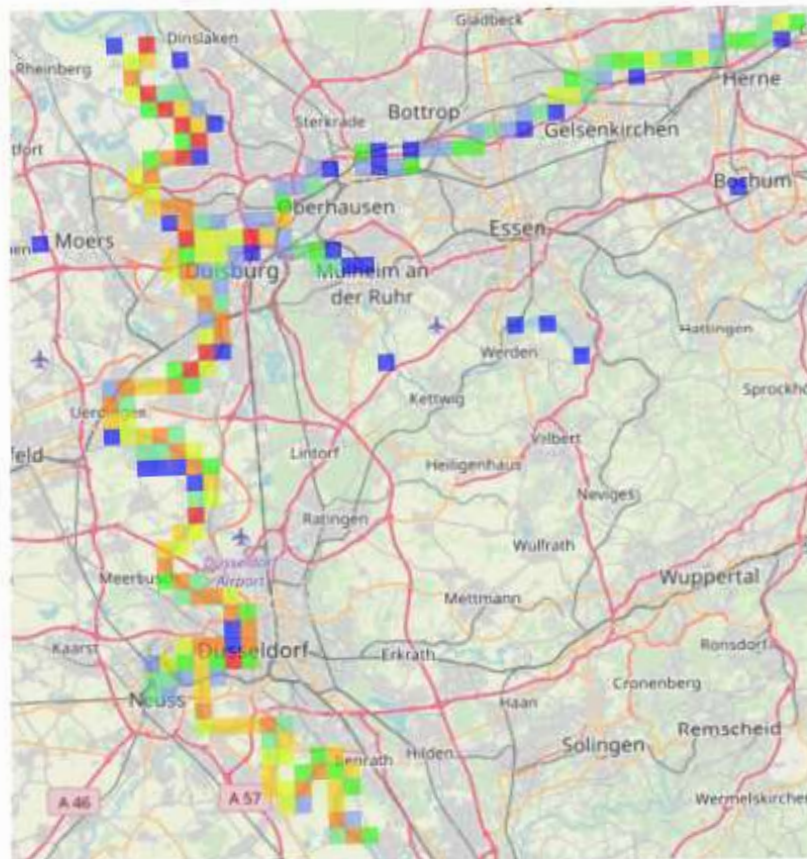


Emissions in the Environment

Test for NRW I domain



NOx emissions in Aug 2018

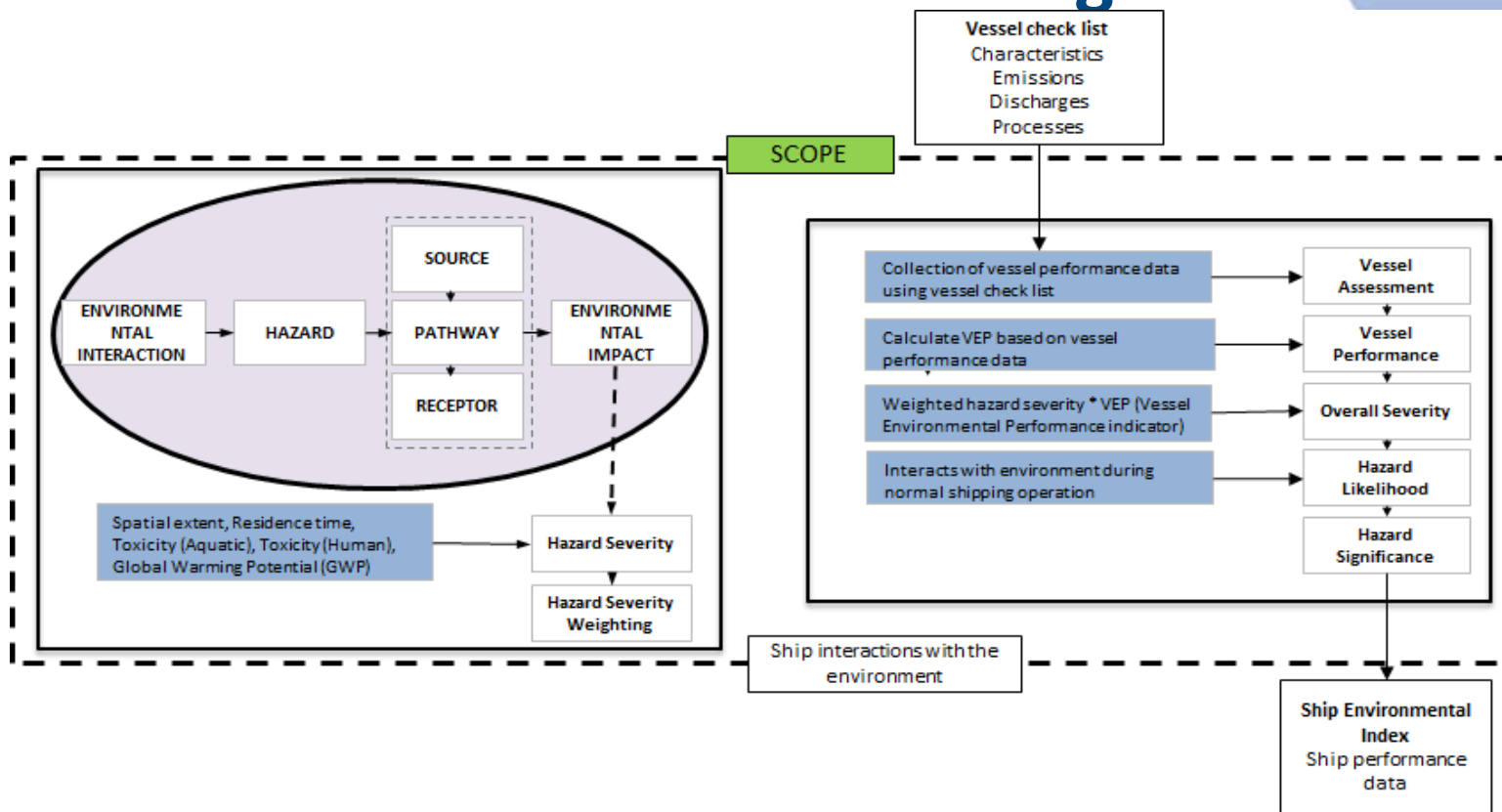


Environmental Indexing methodology

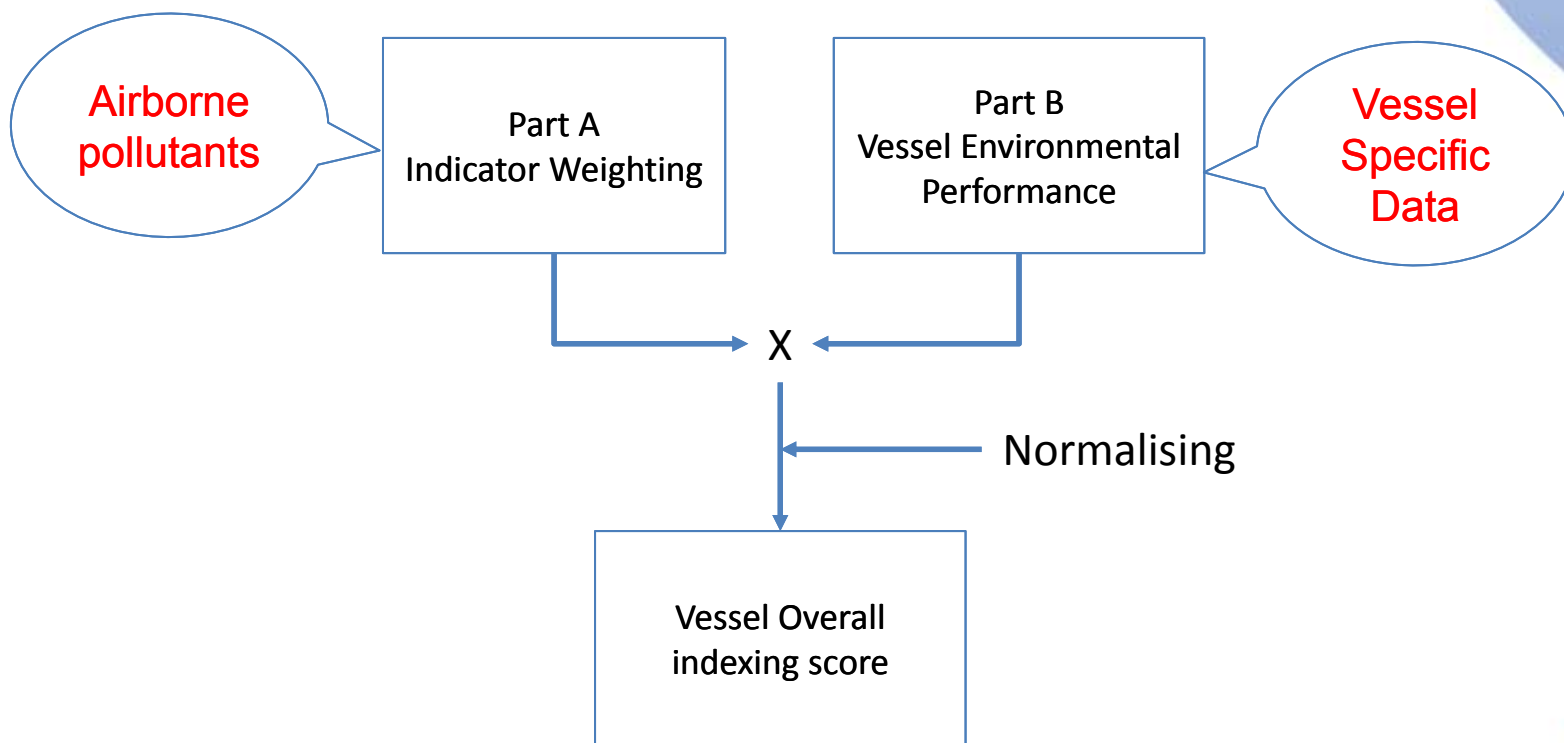
CLINSH Index

- *Based on emissions rather than installed power*
- *Uses calculated weighting factors to prioritise pollutants*
- *This flexible method can be adjusted to suit the needs of the project or policy objectives*

Overall Environmental Indexing Framework



CLINSH Index



CLINSH Index (Part B – Vessel Specific Data)

Validation

Continuous emission
monitoring

Engine data
(power, air
mass flow)

Actual
emissions

Normalising

OR

Vessel
Pollutants
score

Vessel Specific Data

Fuel Consumption
(kg/voyage or year)
Engine power

X

Estimated
emissions

Type of Fuel
Type of Engine

Emission
Factors

IMO, LR, IVL



Initial Conclusions

- *CLINSH Fleet – Established and Expanding*
- *Continuous and Discontinuous Monitoring – State-of-the-Art*
- *Data Analysis – Revealing Real-World Emissions Levels*

➤ *Future*

- More ships being monitored
- Establish emission factors of CLINSH fleet
- Revealing the genuine effect of green technologies
- Use of Indexing to Characterise and Monitor Ships
- Use of Indexing for Policy Interventions



Thank you for attending the mid term conference!





SUSTAINABLE WATERWAY TRANSPORT, CLEAN AIR

Case: the air quality research project in two German ports

Dr Dieter Busch
LANUV



Inland Shipping

Impact on Air Quality

Impact of inland vessels on air pollution with NO₂

1. Direct impact of ships on air quality

Where: Bimmen / Lobith (Rhine "out") and
Bad Honnef / Bad Godesberg (Rhine "in").

Who: LANUV NRW & University of Bremen

2. Air pollution (NO₂) in large inland ports

Where: Duisburg (Duisport) and Neuss (Rheincargo)

Who: LANUV NRW

Direct impact of ships to air quality

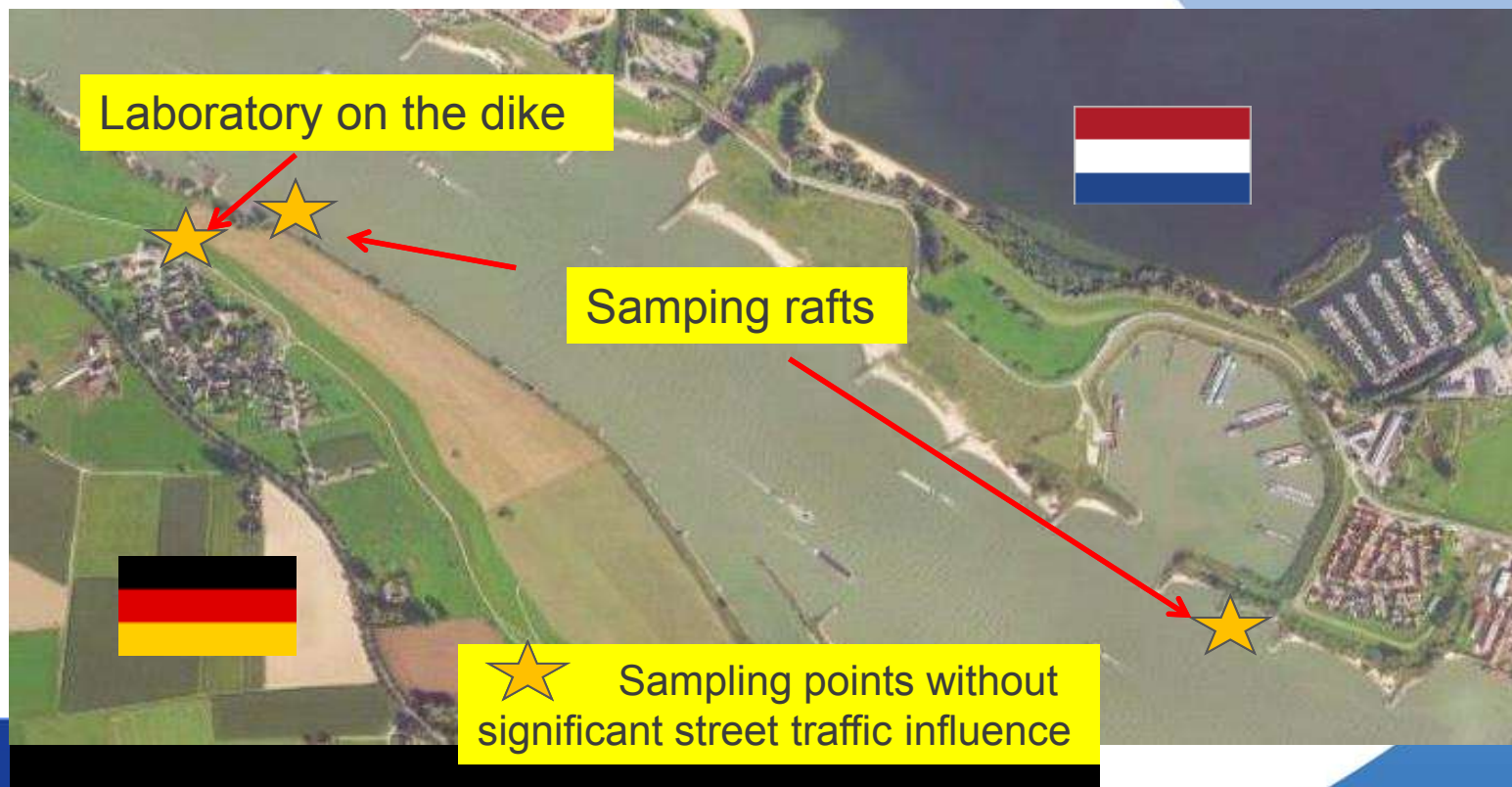
at the Dutch/German border

We use the water-sampling rafts of the

„International Monitoring Station Bimmen/Lobith (IMBL)“

which is operated by Rijkswaterstaat and LANUV NRW

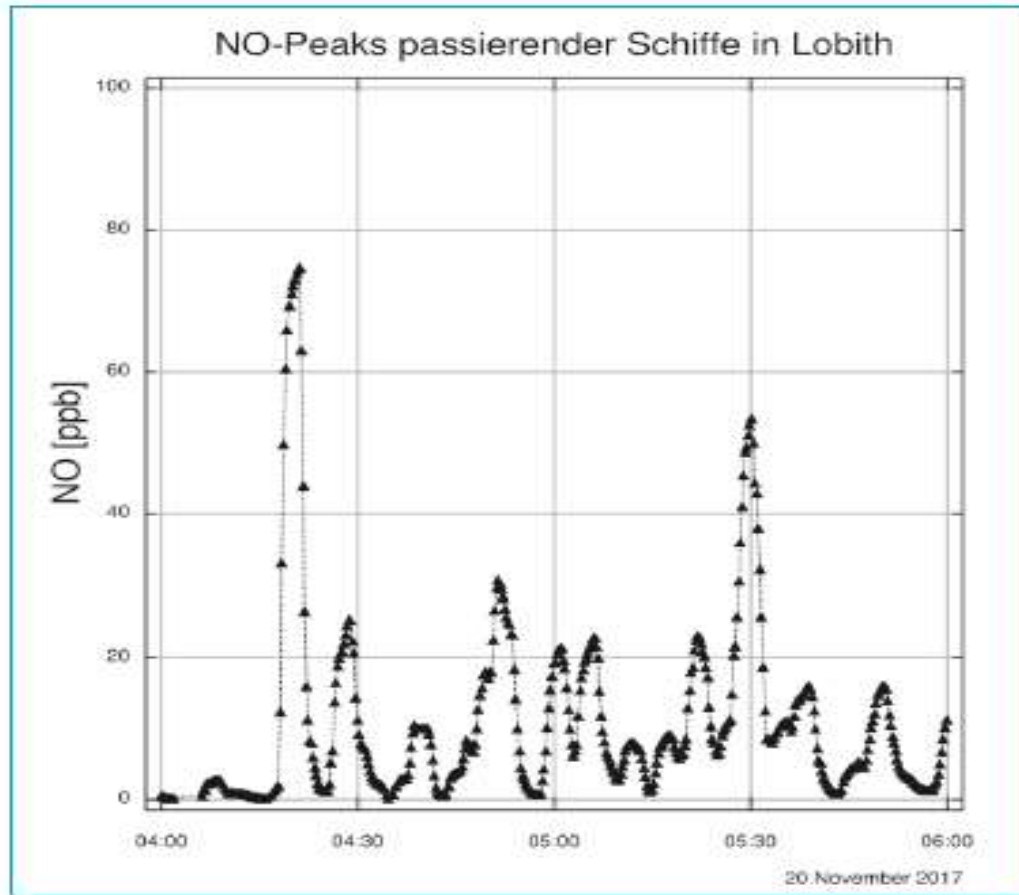
1. Direct impact of ships on air quality



Peaks of passing ships (NO)

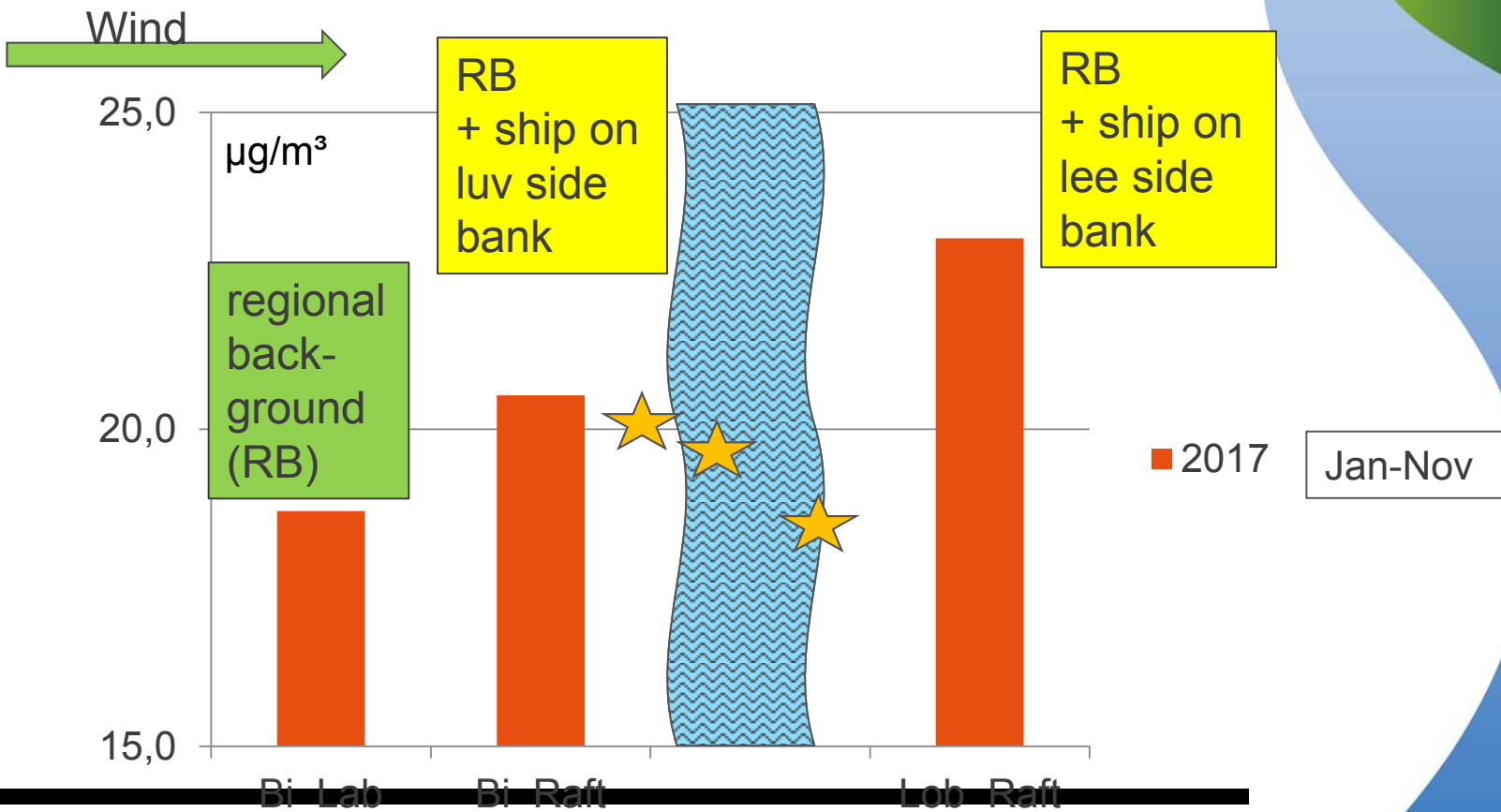
Result of the Airpointer of Bremen's University at Lobith

Samplingstation with passive collector and Airpointer at Lobith

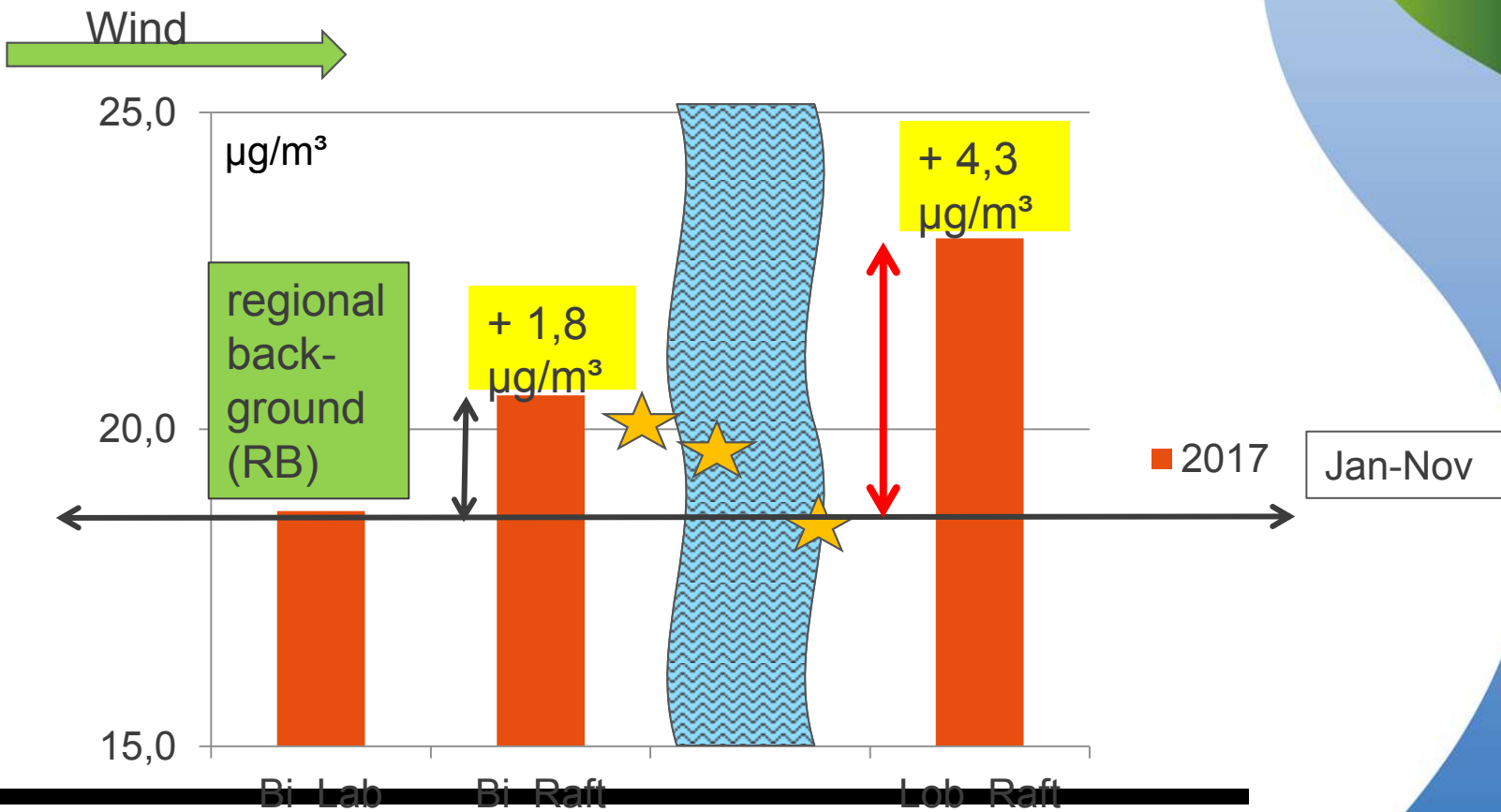


Each passing ship causes a clear peak

Bimmen/Lobith: Preliminary Results for NO₂



Bimmen/Lobith: Preliminary Results for NO₂



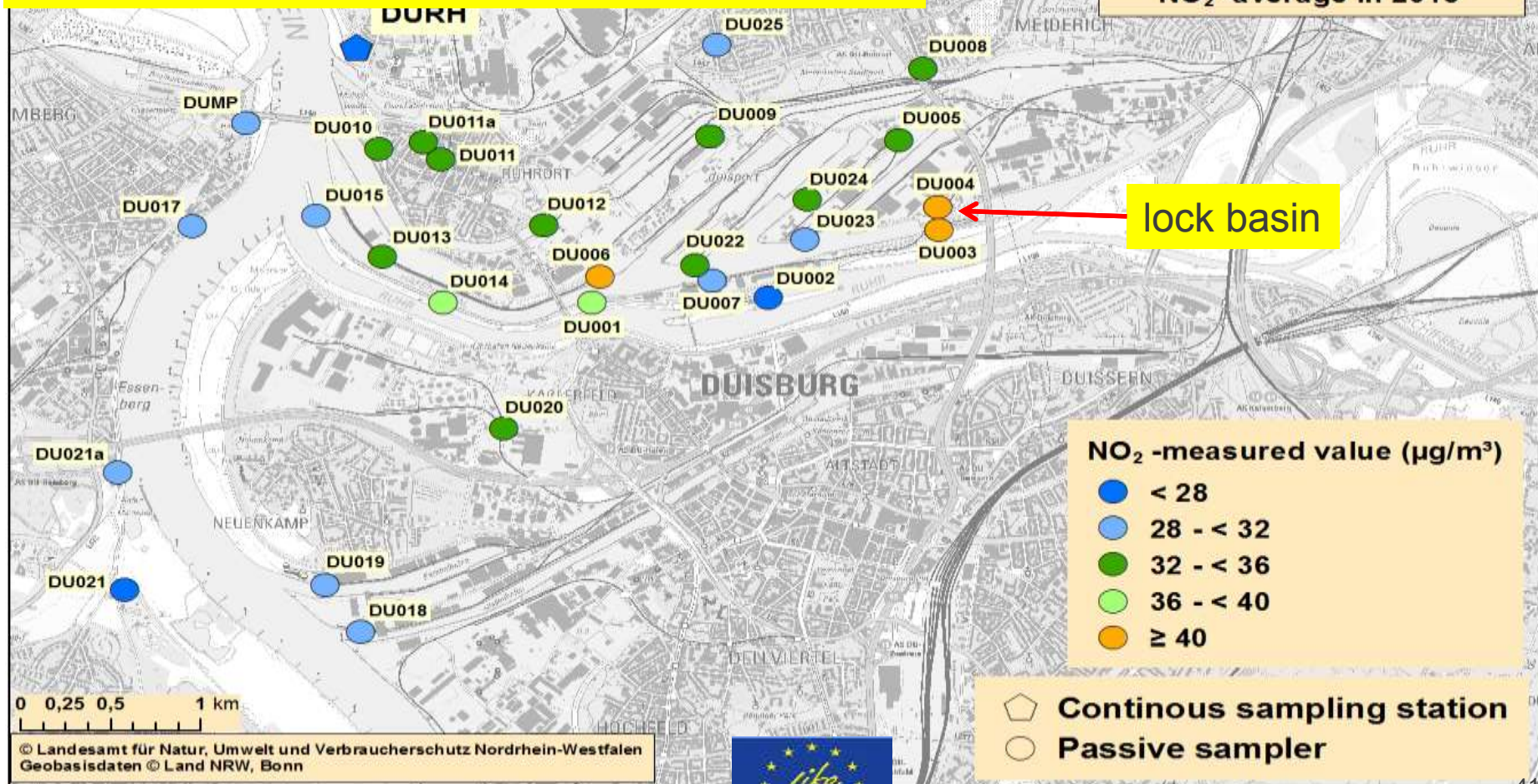
What about the air quality in and around the large inland ports?

- Intensive monitoring of NO₂ air pollution in the ports of Duisburg and Neuss/Düsseldorf.
- In both harbors, a large-scale NO₂ monitoring with about 20-25 passive collectors.
- In addition, a continuous measuring air monitoring in Duisburg and Neuss.



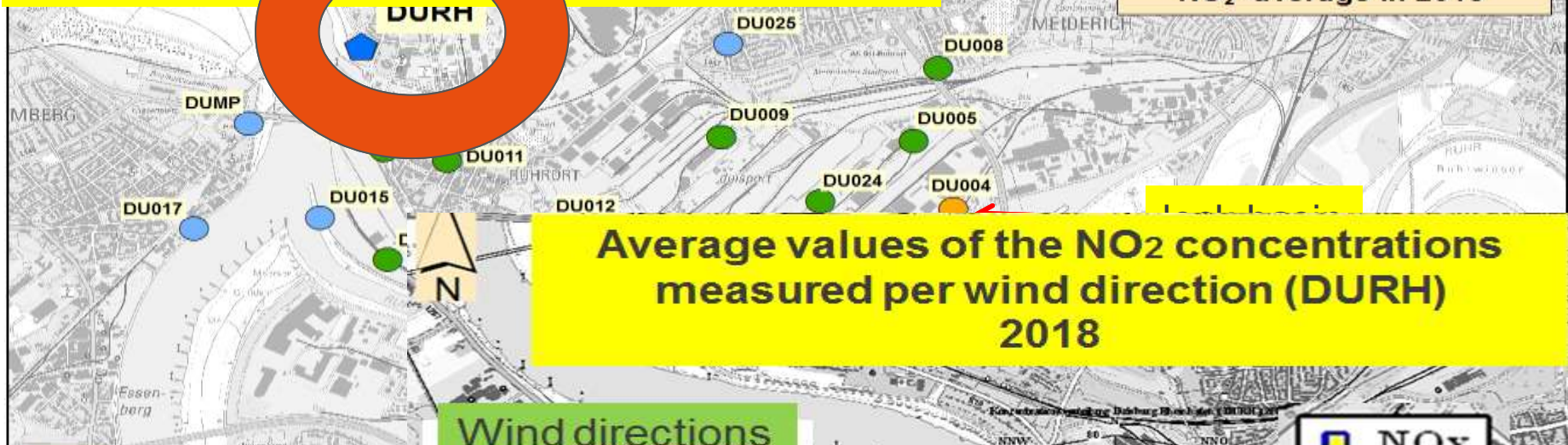
Average values of the NO₂ concentrations measured with passive samplers (2018)

Harbour Monitoring CLINSH
- Air Quality Duisburg -
NO₂ -average in 2018



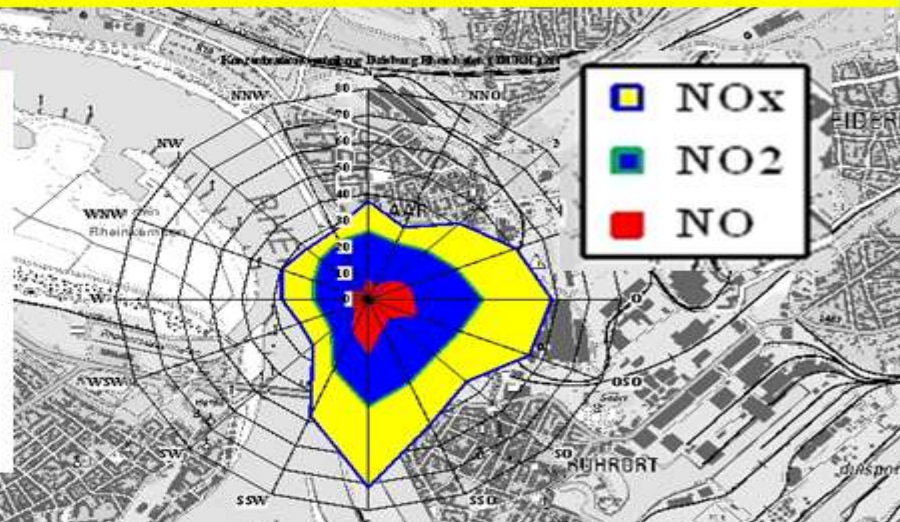
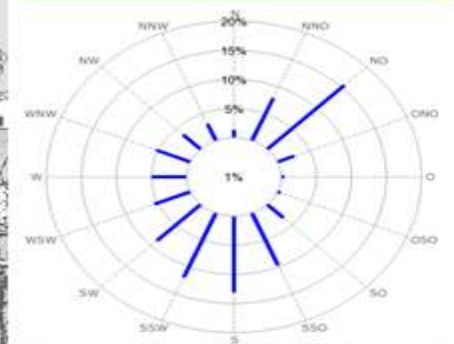
Average values of the NO2 concentrations measured in pass samplers (2018)

Harbour Monitoring CLINSH
- Air Quality Duisburg -
NO₂ -average in 2018



Average values of the NO2 concentrations measured per wind direction (DURH) 2018

Wind directions



0 0,25 0,5 1 km
© Landesamt für Natur, Umwelt und Verbraucherschutz
Geobasisdaten © Land NRW, Bonn



What can we learn from these results?

- Inland vessels have a clear impact on air quality
- There is a distinct potential for reducing the contribution to NO₂ -immissions by inland shipping
- By doing this, the status of inland shipping as a "green" transport alternative can be secured
- Ship emissions to the Rhine and big inland ports have a lower impact on ambient air quality than expected

**Nevertheless, much remains to be done
- let's get started**



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Onshore power supply and the path towards zero emission shipping – Experiences and perspective

Harriët Tiemens

Deputy mayor, City of Nijmegen

Bert de Groot

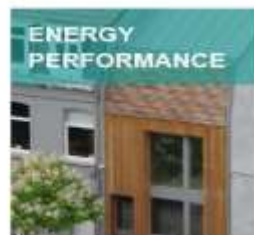
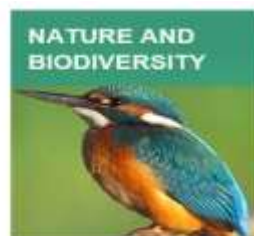
Deputy Director, BCTN

CLINSH midterm meeting 13 March 2019



SUSTAINABLE WATERWAY TRANSPORT, CLEAN AIR

Nijmegen European Green Capital 2018





SUSTAINABLE WATERWAY TRANSPORT, CLEAN AIR

Remarkable sustainable achievements





SUSTAINABLE WATERWAY TRANSPORT, CLEAN AIR

CALL FOR ACTION

THE EUROPEAN GREEN CAPITAL NETWORK AIMS TO INSPIRE
CITIES WORLDWIDE TO BECOME MORE SUSTAINABLE AND
CLIMATE-RESILIENT BY CREATING A GREEN MOVEMENT

Our challenge: sustainable urbanization



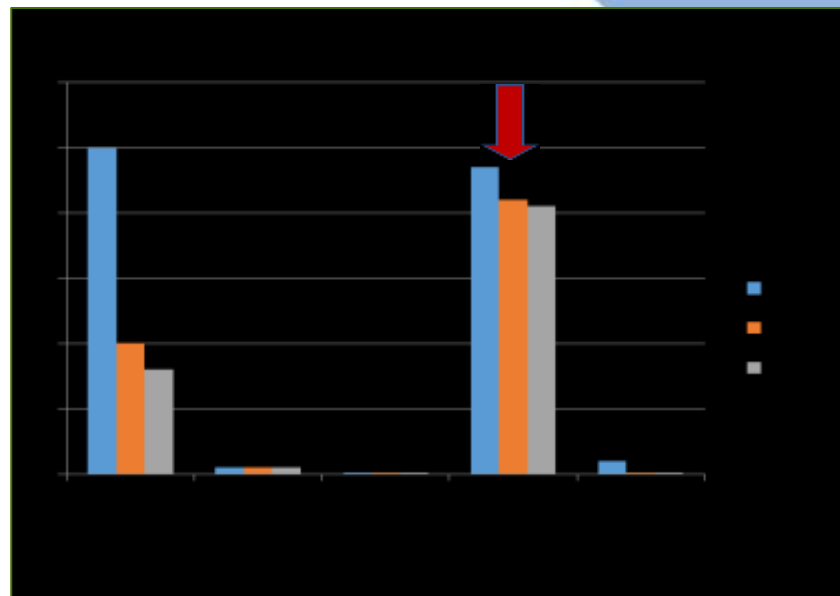
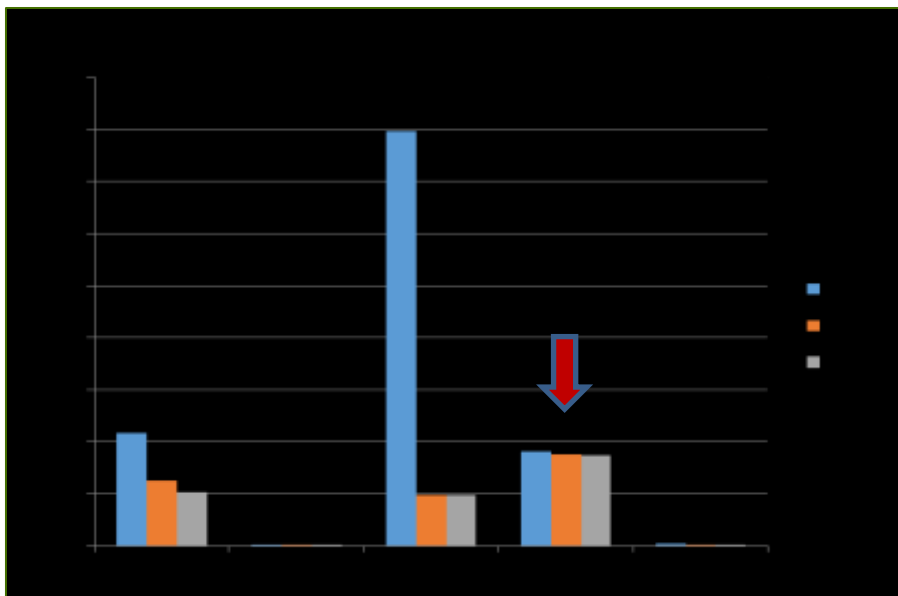
Source: City Region Arnhem Nijmegen

- Growing cities, shrinking villages
- Housing, industry and recreation along the river
- Economic importance but also environmental pressures of inland shipping (and transport in general)
- App 100,000 vessels sail by each year



Source: City of Nijmegen

Relevant sources of air pollution in Nijmegen



Households woodburning ca. 10% of PM10 and soot (EC)

Initiatives for cleaner shipping

To influence international Inland Waterway Transport is a huge task for a single city. However we do what we can:

- OPS for river cruise and cargo vessels (with ban on using on-board generators where OPS is available)
- Differentiation of harbor dues (linked to Green Award)
- Permitting of bunkering site for (bio-)Liquid Natural Gas
- Participation in CLINSH and Green Deal Shipping and Ports
- Hosted Ports & the City conference 2018
- Cooperation with local companies for zero-emission pilots



OPS locations on public quays in Nijmegen



- Waalkade OPS for river cruise and cargo ships
- Waalhaven and Lindenberghaven OPS for cargo ships overnight and weekends
- Waalkade OPS also used for big events

Onshore power supply and the path towards
zero-emission shipping

Next focus on OPS in industry port



Nijmegen, Oostkanaalhaven

Company	Status
APN	Realisation Q2 2019 in CLINSH
EKI	In study, ambition realisation Q3 2019 in CLINSH
Daanen Shipping (Westkanaaldijk)	OPS available for own use
Rhenania	OPS available for winterberthing cruise vessel "De Zonnebloem"
Gelria / VPG	OPS available for own use
BCTN	Noordkanaalhaven, not on map

Lessons learned from procurement

- Despite CLINSH grant, OPS has low priority of companies in industrial port
- "Providing OPS to visiting ships is a hassle and does not increase customer base"
- Noise complaints from neighbours help
- Tankships need adjustments to electric system to operate pumps on OPS (chicken-egg)

Declaration of Nijmegen

- 19 signatories (public & private) aim to jointly develop pilot projects for near zero and zero emission shipping
- A potential CLINSH follow-up initiative?





SUSTAINABLE WATERWAY TRANSPORT, CLEAN AIR

What we would like to work on with you

- *EU-wide financing mechanisms for clean ships*
(NL Green Deal ?; Juncker funding?; ESCO-financing?)
- *EU phase-out plan for polluting ship fuels*
(Pathways to zero-emission)
- *EU harmonised port dues approach*
- *Joint investment projects for OPS*
(e.g. CEF, Intereg)
- *Implementation in CLINSH 2.0 or in workpackage D2 (Policy tools & recommendations) ?*



SUSTAINABLE WATERWAY TRANSPORT, CLEAN AIR





BCTN in numbers

Market leader with 30 years experience

- ✓ ~200 employees
- ✓ ~600 customers

Operating daily:

- ✓ ~10-20 barges
- ✓ ~150-250 trucks
- ✓ 11 quay cranes
- ✓ 22 lift trucks

Expectation: 1 Million lifts in 2019

Onshore power supply and the path towards
zero-emission shipping



SUSTAINABLE WATERWAY TRANSPORT, CLEAN AIR



Kraft *Heinz*

TOYOTA

NESPRESSO®

TRADE MARK

NUTRICIA

Heineken

xerox



BCTN network of container terminals



Onshore power supply and the path towards zero-emission shipping

Current zero-emission plans

Vessels:

- Den Bosch – Rotterdam (on order)
- Nijmegen – Duisburg (under study in INTERREG IVa)
- Nijmegen – UK (under study)

Trucks:

- First e-truck delivered September (INTERREG)

BCTN NIJMEGEN: Green logistical hub of the future

BCTN



Onshore power supply at the terminal

- Our first experience with electricity for ships in 2015
- Cost 45 kEUR for 2 cabinets incl. digging, cables (40 & 320 m)
- Supported with grant by City Region Arnhem Nijmegen
- Electricity replaces on-board diesel generators, saves ca. 10 kEUR annually
- Mandatory connection when berthing >3 hours, no fee for skippers
- Positive experiences and desire to go full electric!
- Next : OPS for reefer containers



First two zero-emission ships on order



Onshore power supply and the path towards
zero-emission shipping

Thank You



*Harriët Tiemens
Deputy mayor
City of Nijmegen*



*Bert de Groot
Deputy Director
BCTN*



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COFFEE BREAK

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Twitter: #CLINSH





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Greening the inland shipping sector. Interactive discussions among key players and with the audience about the role of the ports

Philipp Westerwalbesloh

Traffic and Environmental Strategy, Port of Hamburg

Pieter Vandermeeren

Environmental Services, Port of Antwerp



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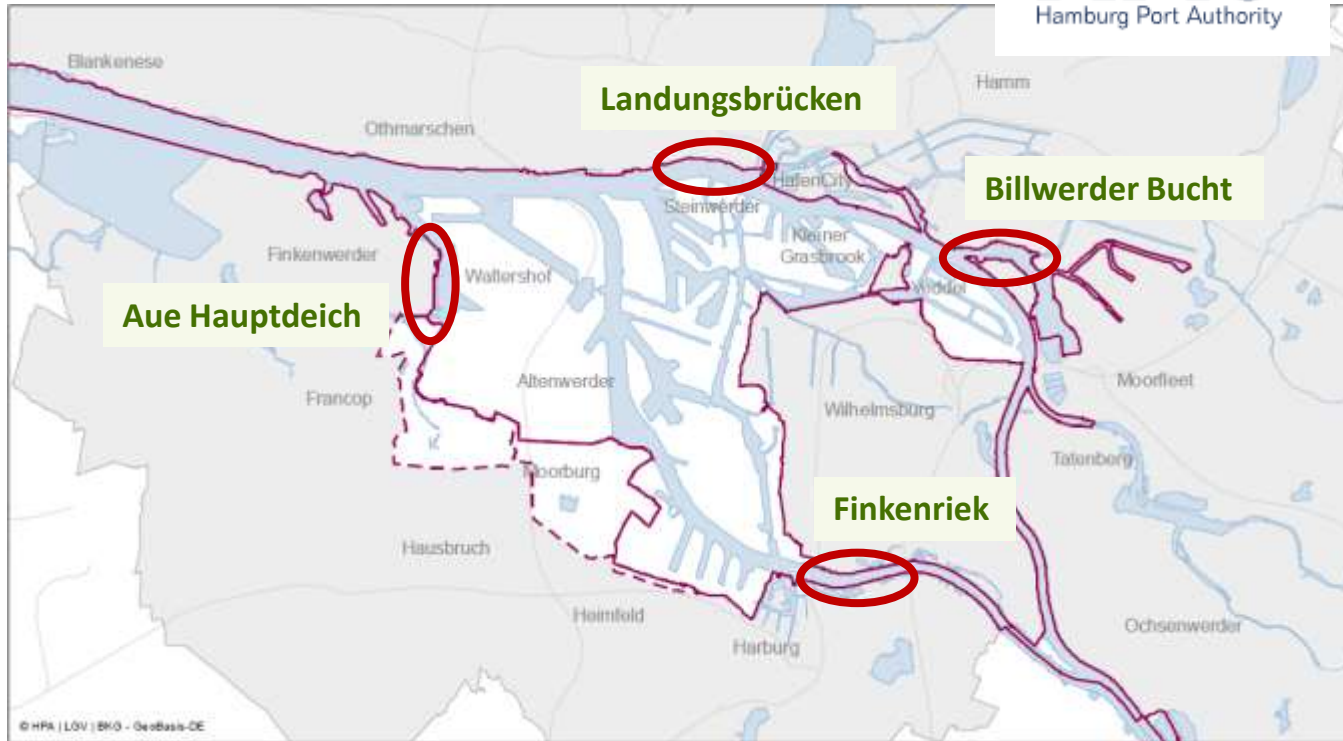
Greening the inland shipping sector

- Scope of action for the Port of Hamburg



1. *Shore Power*
2. *Environmental module of Port fees*
3. *Fleet of Hamburg*

Shore Power



Environmental module of Port fees

environmental module of the fees since 01st Jan. 2019

	Fullfilled norm regarding CCR/ NRMM	Classification in category	Percentage addition/ deduction
UK0	Worse than CCR I or no validation	0	+ 7,5%
UK1	CCR I	1	+ 5%
UK2	CCR II or NRMM stage IIIa	2	0%
UK3	*reducing NOx by more than 65%, Validation for permanent achievement of the category necessary NRMM stage V or exceeding CCR II*	3	- 15%



SUSTAINABLE WATERWAY TRANSPORT, CLEAN AIR

Fleet Hamburg



5 pillars of the
environmentally friendly
urban fleet

Low-emission fuels

Exhaust aftertreatment for new ships

Retrofit solutions

Innovative propulsion technologies

Energy efficient ship operation



SUSTAINABLE WATERWAY TRANSPORT, CLEAN AIR

Hamburg Port Authority AöR
Philipp Westerwalbesloh
Traffic and Environmental Strategy



THANK YOU FOR YOUR ATTENTION



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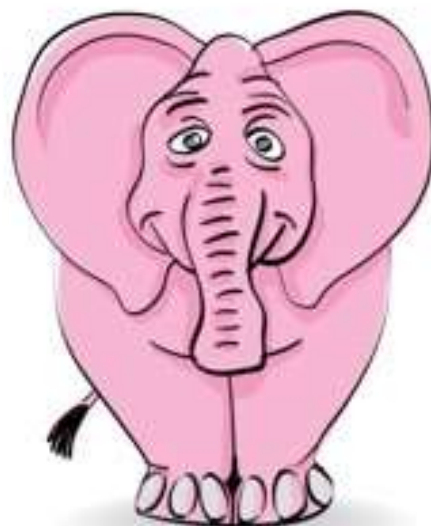
Greening the inland shipping sector. Interactive discussions among key players and with the audience about the role of the financial sector

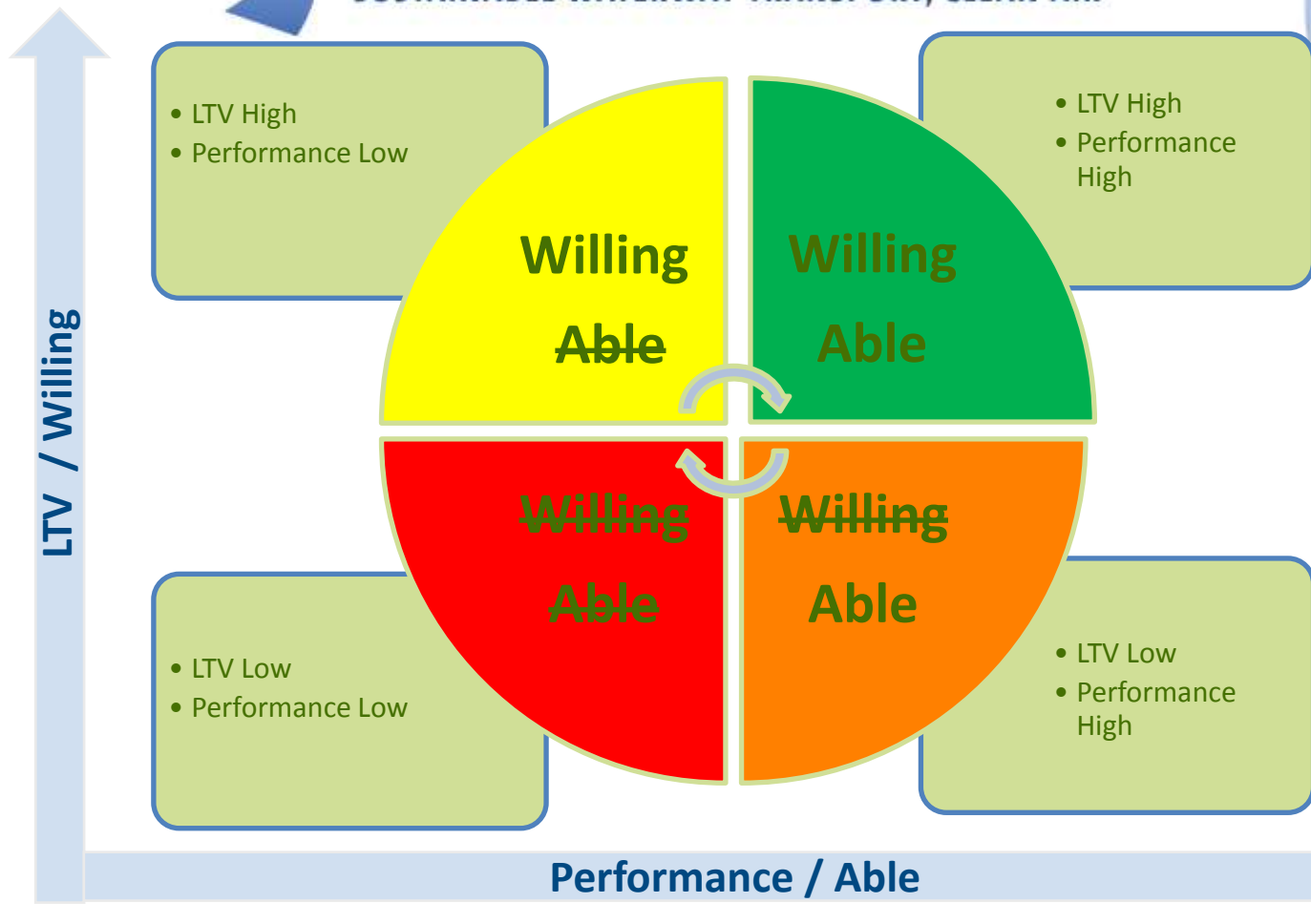
Marco van Beek

Sector Manager Inland Shipping, Rabobank



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SUSTAINABLE WATERWAY TRANSPORT, CLEAN AIR

Greening the inland shipping sector. Interactive discussions among key players and with the audience about the role of the shippers and clients



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