SUSTAINABLE WATERWAY TRANSPORT, CLEAN AIR

Looking back and forward

CLINSH conference 25 November

SUSTAINABLE WATERWAY TRANSPORT, CLEAN AIR

Agenda workshop CLINSH participants ea

- *Looking back and forward: Frank*
- *Tool for shipowners: Matthijs*
- *Results monitoring: Armin*

CLINSH

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Partners

- *The Netherlands*
- *Belgium*
- *Germany*
- *United Kingdom*

Budget: € 8,5 mio

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CLINSH programme summarized

Main objective: Improve air quality in urban areas by accelerating emission reduction in Inland Waterway Transport (IWT)

- *Testing the use of innovative technologies in real life conditions, alternative fuels and shore power in order to contribute to reducing emissions of Nox, PM and CO2.*
- *Carrying out monitoring activities on a fleet of vessels in real time, in orde to get a picture of the environmental gains from greening technologies and clean fuels.*
- *Carrying out on shore measurements of ship emissions*
- *Develop (fleet)scenario's with their social costs showing the expected impact on emissions of the inland shipping fleet and on air quality in urban areas.*
- *Monitoring of the effect of OPS cabinets in Ghent and Nijmegen and OPS-scenario development*
- *Policy tools and recommendations for shipowners and policymakers based on the developed scenario's*

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Activities A1 and B1

A1

- *Tender to recruit ships for CLINSH*
- *Tender for monitor equipment and on board measurements*

B1

- *Installation monitoring equipment and greening techniques*
- *Monitoring and measuring on the ships*
- *Collecting and validating data*

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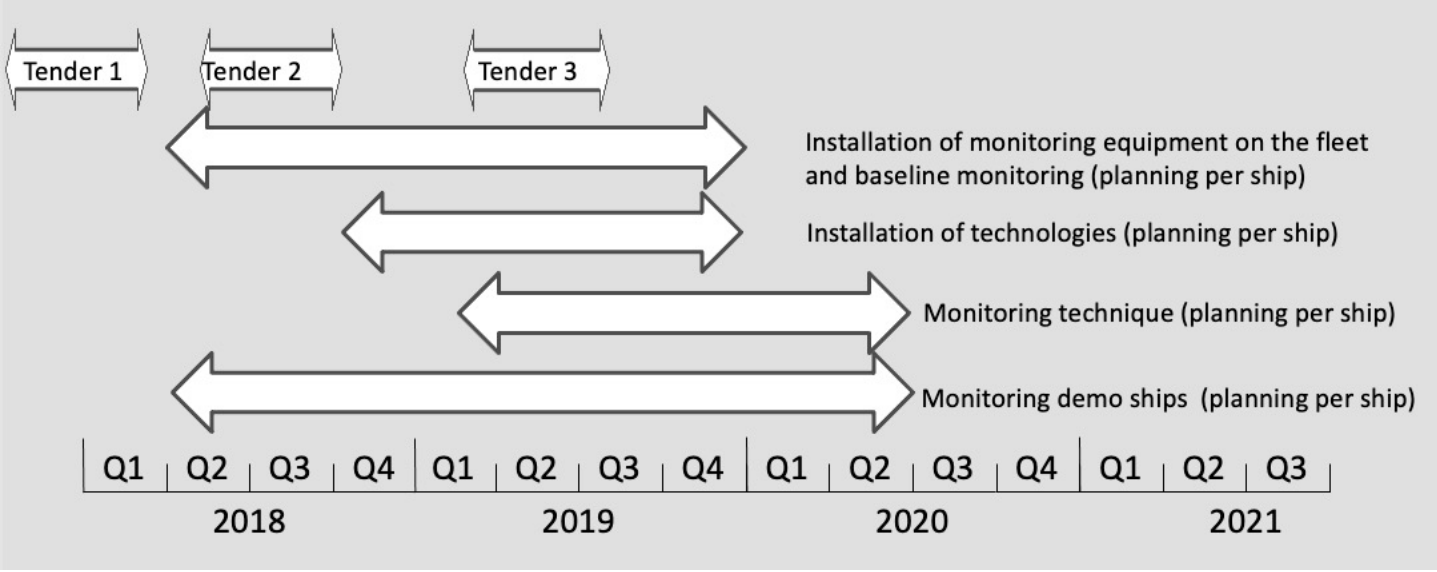
Timeline fleet demo



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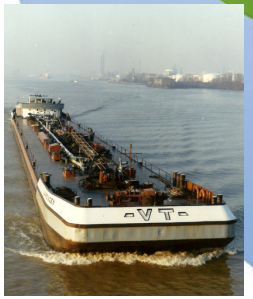
Oil Tankers

RyGo (SCR-DPF)

Seba (SCR-DPF)

MTS Rozalinde (GTL)



MTS Vlaardingen (SCR)

Container carriers

Sulomaro (SCR-DPF)

Mejana (SCR-DPF)

Gouwenaar II (SCR-DPF)

MS Semper Fi (Hybrid)

Factotum (SCR)

Salute (SCR)

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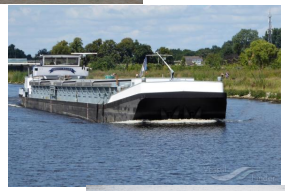
General cargo (Bulk carrier)

Invontes (FWE)

Vantage (GTL)

Tharsis (Diesel electric)

MS Essex (Hybrid)



Ora et Labora (GTL)

Vera Pax (SCR-DPF)

Mon Desir

Osar (GTL)

MS Liane (SCR-DPF)

MS Philipskercke (SCR-DPF)

Comienzo (SCR)

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Overview CLINSH fleet

Monitoring on ships – The CLINSH fleet

Green technology	Name/Description
SCR	Selective Catalytic Reduction
DPF	Diesel Particulate Filter
FWE	Fuel-Water Emulsification (fuel mixed with water)
GTL	Gas converted To Liquid (= synthetic diesel)
Hybrid/Diesel-electric	Combination of electric and diesel propulsion
Other fuel	LNG and Biodiesel

Green technology	Number of vessels
SCR-DPF	15
GTL	7
FWE	3
Hybrid/Electric	8
Other: LNG, HVO	10

Total number of ships: 43

Ship type

- 10 Oil tankers
- 7 Container carriers
- 29 General cargos

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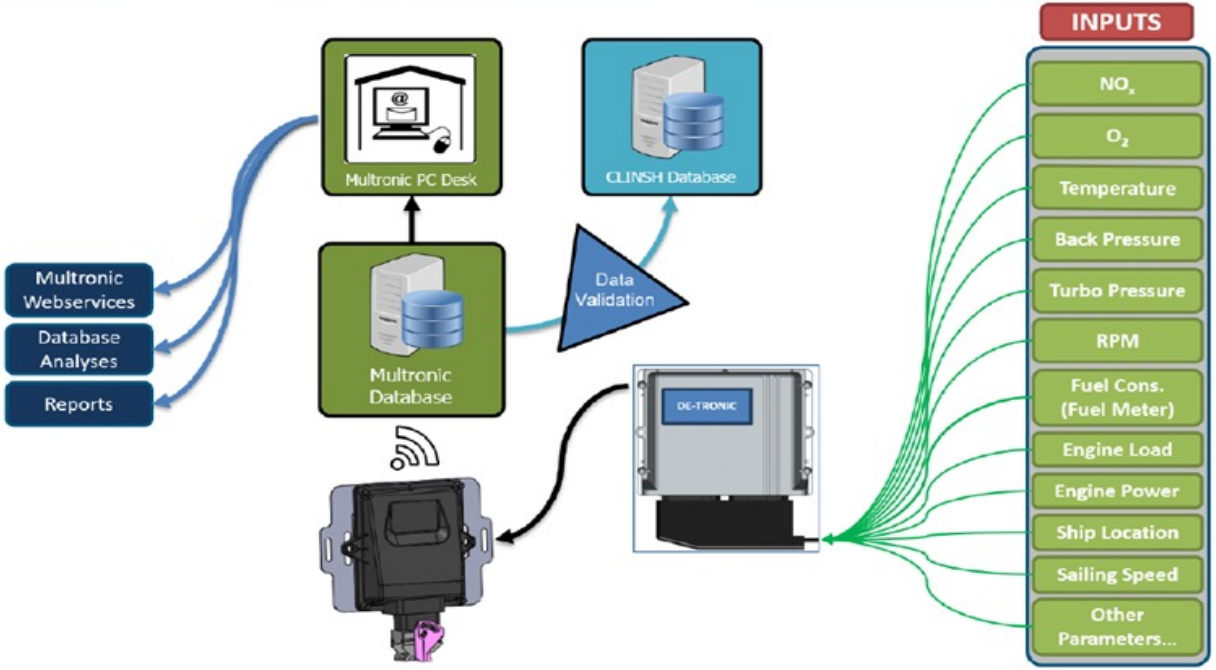
Layout of the OBM System



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Mobile reference measurements NOx and PM

testo 350 MARITIME

- Analyzer box testo 350-MARITIME fitted with: O_2, CO, CO_2-(IR), NO, NO_2 and SO_2,incl. gas preparation , differential pressure sensor, 2 temperature probe inputs, connection Testo data-bus, fresh air valve for long-term measurement, integrated battery, integrated combustion air probe (NTC), trigger input, measurement data store, USB interface
- Control-Unit testo 350-MARITIME V2
- Robust protection case with trolley function (without protective cap in the bottom)
- Exhaust gas probe for industrial engines with probe pre-filter, 335 mm immersion depth incl. cone and heat shield, Tmax 1000 °C, special hose for NO_2-/SO_2 measurements, length 5.2 m, incl. thermocouple for exhaust gas temperature measurement (NiCr-Ni, length 400 mm, Tmax. +1000 °C) with 5.4 m connection line and additional temperature protection
- Connection cable between Control Unit and analyzer box, length 5 m
- testo fast printer with wireless infrared interface, 1 roll of thermal paper and 4 mignon batteries for printing readings out on site
- Humidity/temperature instrument testo 610
- Silicon connection hose (Ø 4mm, length 5 m) incl. hose connector to exhaust gas probe to measure back pressure in the measurement
- Germanischer Lloyd (GL)-certificate no. 37 811 - 12 HH

Order No. 0563 3503

How many reference measurements

How many times measured	Number of ships
0	3
1	11
2	12
3	17
4	2
Total 94	Total 43

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Experiences contracting, installation and monitoring

- *Personal approach neededmanner: a European tender is a complicated and bureaucratic procedure. Three tender rounds were needed.*
- *The challenge was to organise a reliable, practical and affordable approach for the monitoring and measuring. Those features are difficult to combine.*
- *Sailing schedules change a lot and appointmemnts are last minute made and canceled, so flexibility is needed*
- *Each ship needed a seperate planning for the planned activities*
- *Shipconfigurations are different and need customized technical solutions, like for the measurementholes in the exhaustsystem and the installation of suitable fuelmeters*
- *Technicians had to return to the ships in a lot of cases to get all monitoring equipment in good working order*

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Experiences contracting, installation and monitoring

- *The installation processes of greening techniques had some complications due to COVID limitations and missing parts and also the optimalisation of the installations took sometimes a lot of effort, for instance with SCR and FWE*
- *Due to COVID-19 not all reference measurements were possible to organize*
- *The participating shipowners are very interested in the measurement results, but to present this information in a understandable format is a challenge*
- *The interpretation of the monitoring and measurementresults led to a lot of debate.*
  - *The Nox measurements seem reliable, but not always consistent due to changing circumstances on the ships*
  - *The PM measurements turned out lower than expected; there was discussion about the methods: the hot method (used by Tauw) or the dilution method (used by TUV). The latter is more expensive*

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Onshore Power Supply to vessels at berth

- Demonstration of OPS on public and private quays in Ghent and Nijmegen

Objectives of actions:

- Assess environmental and economic benefits of onshore power supply (OPS) for use of inland vessels
- Develop guidance for the provision of OPS
- Demonstrate how OPS can improve air quality and aid compliance with emission limits

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Onshore Power Supply Ghent

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OPS Nijmegen

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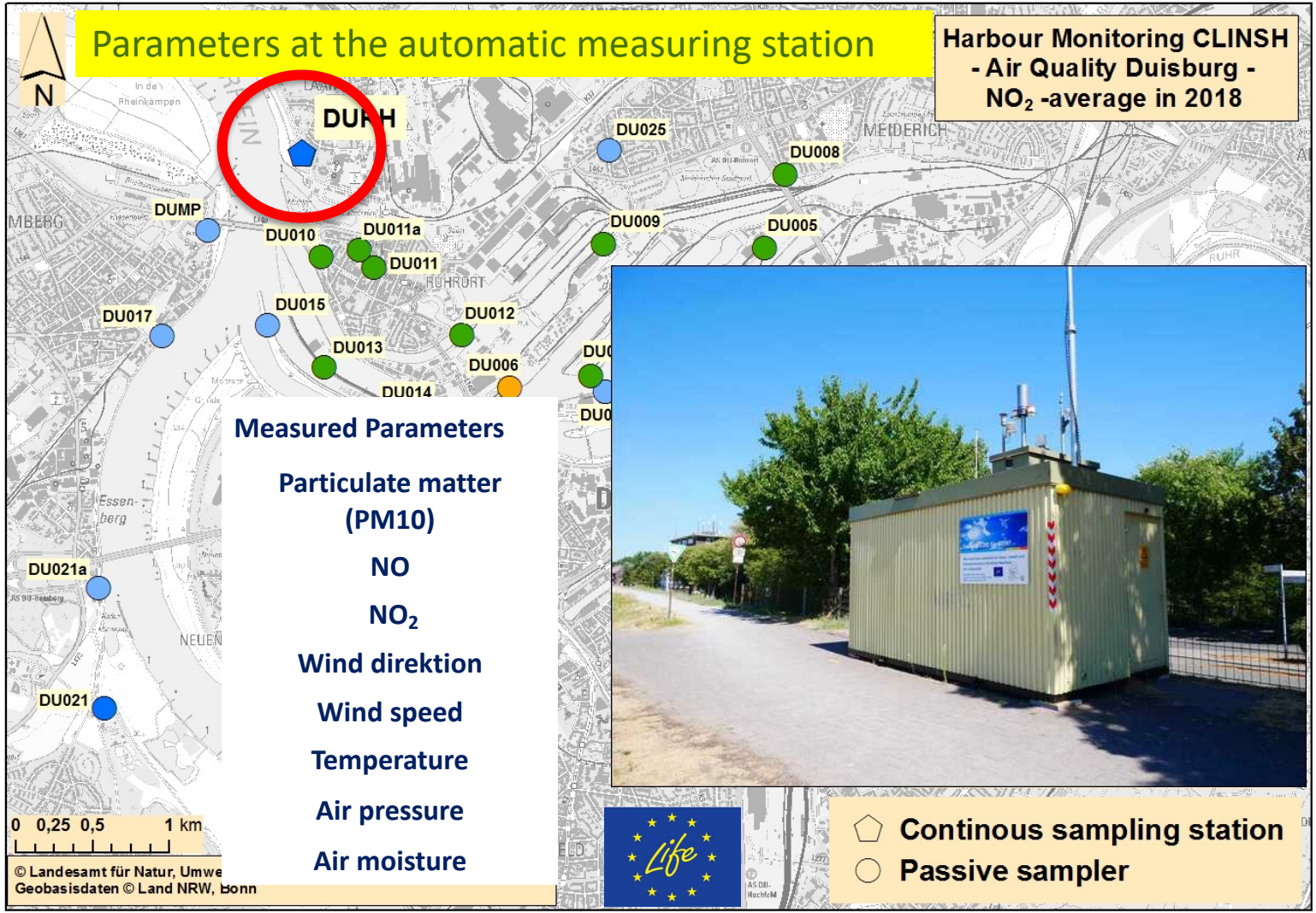
Measurement campaign near river Rhine Nov 2019

- *Trailer of TNO and University of Bremen are measuring in Lobith (the Netherlands).*

- *NOx, O3, CO2, Particulate Matter, Black Carbon and ultra fine particles are measured*

Parameters at the automatic measuring station

Harbour Monitoring CLINSH
- Air Quality Duisburg -
NO_2 -average in 2018



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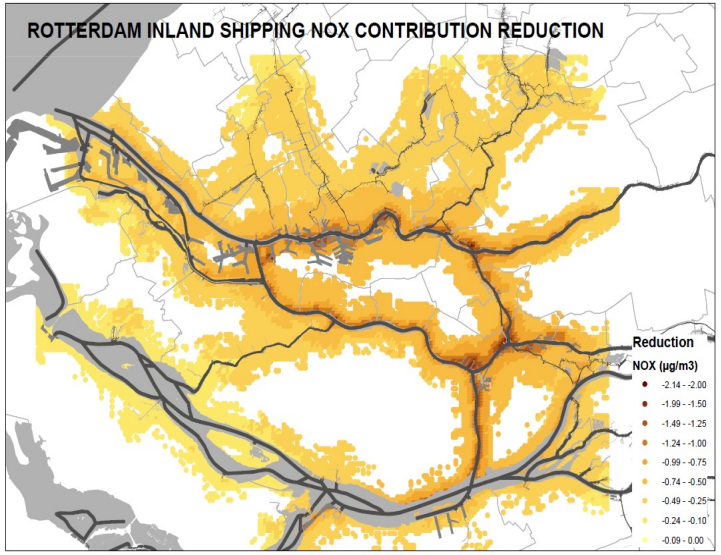
Air quality impact in CLINSH scenario



CLINSH developed a method to identify the inland shipping contribution to urban air quality for different emission scenarios in the cities of Antwerp, Rotterdam, Nijmegen and the greater Duisburg area.

Scenario	Max. contribution µg/m³	Average contribution µg/m³	Reduction vs. average Baseline 2020
Baseline 2020	3.0	1.2	-
Baseline 2035	2.6	1.0	16%
CLINSH 2035	1.3	0.4	66%

NOx reduction potential of the CLINSH scenario in Rotterdam region.

Realizing the CLINSH scenario would significantly improve air quality.

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Activities after CLINSH

- *The project website will be updated and kept online for at least five years (to ensure the models, scenarios and data remain available to all relevant stakeholders)*
- *(What additional applications could be derived from the data that is being generated the coming years?)*
- *The results (database, scenario's, air quality maps) will be open data and be communicated by the CLINSH consortium*
- *The dissemination of the projects results will be continued in the years after the end of the project, including to stimulate sources of funding, both public and private*
- *Continuation of a permanent structural platform / knowledge center with involvement of CLINSH partners and spread out to all national and European inland shipping organisations*
- *The monitoring on the ships will continue for five years. Challenges:*
  - Multronic will stay responsible, but only for their equipment
  - How to keep the data accessible for shipowners and interested parties
  - How to come to a good use of these data?

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Policy recommendations

- CLINSH calls for **investment in readily available emission reduction measures**, until zero-emission technologies are mature, like Stage V engines and effective after-treatment like SCR-DPF, that improve air quality (mainly NOx and PM emissions).
  - The social benefits are considerably larger than the added Total Cost of Ownership.

- Effective policy intervention on EU and national levels is needed through **investment support to ship owners.**
  - Create a **Greening Fund and/or differentiated tax schemes** that support low and zero emission technologies to enable ship owners to opt for better solutions.
  - The widespread adoption of Stage V (equivalent, including marinized Euro VI) engines and optimised after-treatment systems could be stimulated by applying the **Stage V (equivalent) emission standard to the existing fleet in 2035.** → *Only if combined with initial investment support*.
  - Budget for the fund or grant schemes could be raised by **allocating revenue from the taxation of IWT fuels** that is proposed in the Energy Tax Directive.

Policy recommendations (cont.)

- Aligned with financial support for engine renewal and emission reduction techniques until 2035 could be the implementation of **low emission zones in ports**.
  - Investigate the **feasibility and impact** of such zoning.
  - Use **emissions labelling** as the basis for local regulation of IWT vessels, e.g. new Dutch scheme.

- **Invest in OPS** where air quality and/or noise concerns are most pressing and where the cost effectiveness of euros spent to reduce emissions is the highest.
  - Develop **funding mechanisms and tax exemptions** to realize OPS in core locations can lead the way for a zero-emission power infrastructure by 2050.