



SUSTAINABLE WATERWAY TRANSPORT, CLEAN AIR

After LIFE report

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CLEAN INLAND SHIPPING

WWW.CLINSH.EU

1. About CLINSH

CLINSH – CLean INland SHipping - was a 5-year project from 2016 until 2021 in which emission reducing technologies and alternative fuels have been tested in practice for the Inland Waterway Transport (IWT) sector. In this project a total of 17 partners were involved, consisting of public bodies, ports, knowledge institutes and private organizations. This has provided valuable information about their effectiveness and operating costs. The main objective of CLINSH was to contribute to better air quality in urban areas. The focus of the project is on air quality, although calculated carbon emissions are also taken into account as the global conversation shifted towards climate mitigation.

The performance of various emission reduction techniques and alternative fuels (GTL, LNG, HVO) was tested on 43 ships.

- Emissions from the ships were monitored in real life conditions partly before and after the adjustments. Onshore measurement of airquality (NO_x, PM₁₀) has also taken place in some ports and along the river Rhine.
- Measurement results have been collected in a database and used as input for the modelling of emission scenarios and air quality results and an advisory tool for shipowners.
- Formulating best practices for the use of shore power and identifying possible energy saving measures to reduce emissions and improve air quality in ports and waterways. Shore power avoids the use of generators for heating, lighting and other demands for berthed ships.
- Within the framework of CLINSH, new methods were developed to determine the NO_x emissions of moving ships through onshore measurements (development of classified onshore emission factors) and the emissions of the berthing ships, which allow a better estimation of the emission quantities.

All deliverables and results of CLINSH can be found at www.CLINSH.eu, inquiries or requests can be made at clinsh@pzh.nl.



2. Objectives

The environmental problem targeted by the CLINSH project is air pollution by Nitrogen Oxides (NO_x) and Particulate Matter (PM) caused by the emissions of the Inland Waterway Transport (IWT) sector. These emissions affect the air quality of the areas along rivers and canals and since many inland ports are situated in or close to cities, the air quality of urban areas is directly affected.

Through a series of air quality measurement programmes on the Lower Rhine and modelling, a very extensive database has been created, which provides a good basis for assessing the existing air quality and the effects of emissions from moving and berthing ships.

Over a period of two years, CLINSH has demonstrated and monitored the environmental benefit of emission reduction technologies for inland shipping. The measurement results have been used as input for policy recommendations on emission reduction of the IWT fleet to improve air quality. The main objectives of CLINSH were on the one side to develop policy recommendations for policy makers at different public organisations and stakeholders for the IWT sector.

On the other side to advise shipping entrepreneurs about effective measures to reduce the air polluting emissions.

3. Overall main project outcome

The overall main outcome is that the social benefits of the investments in emission reduction techniques according to the CLINSH-scenario, that is advised in the Policy report of CLINSH, are significantly higher (€ 4,9 billion) than the costs of these investments and the additional costs (€ 1,1 billion). These investments are therefore very much beneficial from a socio-economic point of view and should be facilitated in the coming years. At the same time, solutions with zero-emission technology are being developed and implemented that improve the air quality and in the longer term and reduce climate change. The socio-economic analysis shows that investments in reduction techniques are socially optimal for many ships in the next 10-15 years. The challenge is to align the individual decision making of the shipowners with the social benefits.

4. Long term CLINSH effects

This project aimed for long term potential and sustainability, which was to be reached by the demonstrations in CLINSH in combination with the models and tools (see CLINSH.eu) that inform and support the decision-making process by shipowners, authorities and policy developers at various levels. Applying this package after the project has ended creates what we call the 'CLINSH-effect'. The CLINSH approach includes providing hard data on emissions and air quality in combination with wide dissemination. This underlines the long-term potential of the project.

Focus during the project was on developing and testing the models and tools that are based on real-life data and give insight into which techniques work best in which cases and at what costs (Total Cost of Ownership approach). The partners are well-positioned to disseminate the models and tools throughout the sector after the project, with specific attention to several target groups. The TCO approach and the modelling of emission scenarios and air quality results offer valuable insights into the possible (social) costs and (social) benefits of the different techniques to both the end-user (shipper/ship owner), his financiers, his customers and authorities and policy developers at various levels. The partners guarantee that the TCO tool will remain available for use for the coming five years. The tool is made applicable to a range of end-users (ship owners) and other parties so that it can be directly applied to their situation. Furthermore, the modelling offers governments, port authorities as well as other authorities the ability to influence (increase) emission reduction with their policies.

The main goal of the After Life plan is to contribute to the realisation of the CLINSH goals as described and the follow up of the recommendations after the project period.



5. After Life measures

1. The CLINSH project has delivered the first comprehensive estimate of IWT emissions and reduction techniques and alternative fuels based on real-life emissions measuring and of vessel movement monitoring in West-Europe. The monitoring of real-time NO_x emissions of the 43 CLINSH ships will continue to at least December 2026. A company is contracted to keep the monitoring equipment functional. These data will be added to the CLINSH database.

After LIFE measure:

The CLINSH database will be kept updated with real-time NO_x data of the 43 CLINSH ships for five years after closing the project and the data is available at request for research purposes.

2. CLINSH has developed emission factors for all the studied techniques and fuels. A comprehensive model was developed to predict the emissions of the West European IWT fleet and can be used to analyse emission reduction scenarios of different fleet compositions. For four big metropolitan areas models were developed to calculate the resulting air quality effects. Also, the air quality in Duisburg, Europe's largest inland port, and another large inland port was studied in-depth with regard to NO_x and PM pollution. The measurement results of the automatic measuring stations used for CLINSH for NO_x pollution in the port areas made it possible to record and quantify NO_x emissions of the ships sailing on the Rhine and in the ports.

Valuable additional results could be determined as emission factors measured onshore. In combination with real ship traffic recorded via AIS signals, a new methodology for the estimation of NO_x emissions from inland vessels was developed. For the CLINSH project, a total of more than 18,000 valid emission factors were available, which were used to calculate the ship emissions arising on the Lower Rhine between Neuss and Duisburg, taking into account ship size, direction of travel and speed.

After Life measure:

The complete methodology for emission scenarios and air quality is available for port authorities, local and regional authorities to assess the effect of measures for greening of IWT in their own regions and to answer policy questions.

The measurements of the CLINSH station in Duisburg will be continued until 2023. The evaluation of the measurement results of the year 2021, added 8,000 valid emission factors to the database, which confirm the previous results. These classified emission factors (ship size, direction of travel (upstream/downstream), speed over ground) form an important basis for the upcoming update of the emission register "Inland vessels" of the state of North Rhine-Westphalia. In combination with the new method for a more realistic determination of the emissions of ships at berth, there are new possibilities to better quantify the emissions of inland vessels in the future.

3. There is a potential discrepancy between the policy measures for climate change mitigation and air quality improvement, in the short term at least. While future technologies should evidently be zero emission, CLINSH calls for a transitional period to invest in readily available measures for the existing IWT fleet that improve air quality in the short term, although with limited effect on greenhouse gas emissions unless biofuels are applied.

After Life measure:

The involved partners in CLINSH will actively promote the message of improving air quality with emission reduction in the short term and developing zero emission techniques for the longer term.

4. The "CLINSH scenario" shows that the investments have a significantly higher societal benefit (€4.9 billion) than the technical investment costs (€1.3 billion) and the additional total costs for ship owners (€0.76 billion) as compared to the Baseline scenario. The preferable options from a societal point of view (social cost-benefit analysis) do not correspond with the preferred options from the individual entrepreneur's perspective (investments and total cost of ownership). The challenge lies in synchronizing the societal and individual interests. This requires policy intervention through investment support to ship owners and / or differentiated tax schemes that support low emission technologies. The EU and Member States should provide incentives for this accelerated adoption through an IWT Greening Fund.

Given the scarce capital availability in the IWT sector it is recommended to seek permission to provide investment support up to 80% over the price difference befitting State aid laws conform with the EU taxonomy, combined with low interest loans.

After Life measure:

At the CLINSH final conference on 25 November 2021 the need for an IWT greening fund was an important message that is presented to the attending policy makers of different EU DG's, national and regional governments, harbours, knowledge centres etc. This message and the plea for an investment fund will be actively promoted in the coming years by the CLINSH partners.

5. CLINSH developed recommendations on how to reduce emissions of the existing fleet. At the CLINSH final conference, workshops were organised with shipping entrepreneurs on different approaches to reduce emissions.

The socio-economic analysis shows that Stage V (including marinized Euro VI) engine renewal is optimal from a societal perspective for many ship types in the next 10-15 years. The relatively high investment costs for Stage V engines are partly compensated by improved fuel efficiency and low emissions as demonstrated for the Euro VI engines in the monitoring fleet. SCR-DPF (with lower investment costs than engine renewal) and GTL (especially for smaller vessel types with lower fuel consumption) also score well.

After Life measure:

A tool was presented to give shipowners an insight in the investment costs, the total cost of ownership and the monetised emission costs for different ship types and emission reduction techniques and fuels. This tool continues to be available on the CLINSH website for all shipowners to support their decision-making process.

6. The monitoring on the ships demonstrates that it is possible to reach the Stage V emission limits with retrofit after-treatment technologies and alternative fuels under real-life sailing conditions, however this requires optimal management of the systems. The performance of after-treatment technologies should therefore be monitored to ensure that they work well in practice.

After Life measure:

The CLINSH partners and the shipping entrepreneurs are made aware that the greening technologies need to be monitored and optimised regularly. The CLINSH partners will continue to bring this point to the attention of relevant parties in the coming years.

7. 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. This can only be achieved when the proposed Greening Fund is in place. Such a standard gives a clear target to the IWT sector and makes and leads to a more consistent perspective. Also corresponding local urban or harbour regulations can support the transition. Emission labelling may be used as the basis for local regulation of IWT vessels. Using Input from the CLINSH consortium, the Netherlands have developed an emission labelling method that rates both air pollutant and climate emissions. This so-called Binnenvaart Emissielabel (IWT emission label), launched on 15 November 2021, could be used for differentiating port dues and for environmental zoning. The aim is to have the labelling method applied across Europe.

CLINSH also endorses policies for promoting Zero Emissions technology. A target of zero-emissions in 2050 is ambitious considering that the technology is not yet mature. Zero emissions technology can be a mainstream option after 2030/2035 and should be stimulated once market ready as the next step for the mainstream of the fleet.

After LIFE measure:

The CLINSH scenario and transition path is brought to the attention of relevant government organisations and relevant IWT stakeholders. The CLINSH partners will continue to underline the need for a clear perspective for the IWT sector that can be stimulated by the perspective of an EU-wide Stage V consistent regulation and local regulations, supported by the use of the IWT emission label. In Flanders the deployment of an emission label is prepared through a Green Deal.

8. The best practice guide on onshore power supply (OPS) recommends prioritizing investments in OPS where air quality and/or noise concerns are most pressing and where the cost effectiveness of euros spent to reduce emissions is highest. The top-3 type of locations are river cruise berths, waiting docks and overnight mooring, and tanker berths. CLINSH recommends developing funding mechanisms to realise OPS in at least Core and Comprehensive ports.

The introduction of an EU-wide permanent tax exemption for OPS in accordance with Article 15 of the proposal for a reviewed Energy Taxation Directive would encourage the deployment and use of OPS. Such an exemption would also level the playing field in the maritime sector as the fuel used for onboard generators is today also untaxed.

After LIFE measure:

The involved CLINSH partners will continue to actively stimulate the use of OPS funding mechanisms and tax exemptions in line with the recommendations.



Onshore Power Supply Unit

9. As part of CLINSH, an Energy Scan Campaign was held in Flanders. The energy scan campaign is a best practice example of policy support for OPS. This campaign leads to an increased awareness of skippers about the energy management on board their barge.

After LIFE measure:

The follow up of the participating shipowners to the energy scan. They need to indicate/motivate to what extent they will consider each of the suggested energy saving measures in the coming five years. Also a communication campaign towards ship owners to stimulate the use of OPS is currently being drafted and will be used.

5. General after LIFE approach

The CLINSH legacy will be kept energetically alive in the coming years after the formal ending of the project. Besides the above described specific After Life measures and actions some supporting general activities will be organised:

- Lobby activities, based on the policy support document and the underlying reports.
- The project website with all the deliverables will be kept online for five years after the closure of the project.
- The IWT knowledge centre EICB will play an active consulting role for the IWT sector with the CLINSH findings and recommendations in mind.
- The CLINSH database and methodology will be kept available for scenario building and other research activities.
- The upcoming update of the emission register for inland vessels of NRW will be based on the further development of the methods developed within the framework of CLINSH to determine the emissions of moving vessels by means of onshore measurements and to determine the emissions of vessels berthing in ports.