



# Paper 41 - LNG Masterplan for Rhine-Main-Danube corridor - Lessons learned from a highly innovative and complex transport innovation project to facilitate LNG as fuel and as a cargo on Europe´s main inland waterway artery

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## ABSTRACT:

The LNG Masterplan for Rhine/Meuse-Main-Danube (2013 - 2015) functions as cooperation platform for authorities and industry stakeholders for facilitating the use of Liquefied Natural Gas (LNG) as fuel for inland vessels as well as a cargo. The project is coordinated by Pro Danube Management and Port of Rotterdam Authority and brings together 33 project partners from 12 EU Member States and one associated partner from Switzerland. Due to its high innovative character and its relevance for major objectives of the European transport policy, the project is co-financed by the European Union from the Trans-European Network for Transport Programme. It receives a grant of more than € 24 million.

The LNG Masterplan will provide the basis for turning LNG into a major fuel for inland vessel as well as paving the way for LNG to be transported by barge on the most important European waterway axis, the Rhine/Meuse-Main-Danube corridor. The project actively contributes with innovative concepts and deployments for vessels and on-shore LNG infrastructure and ensures the environmental competitiveness of the inland navigation sector together with improved efficiency of vessel operations. The project not only provides important inputs to a concise regulatory framework but delivers a high number of innovative concepts and concrete investments in LNG fuelled vessels and on-shore infrastructure.

Together with key industry stakeholders, the project partners elaborate a comprehensive strategy for the deployment of LNG. This strategy encompasses an Action Plan with concrete measures in identified areas, such as market & financing, vessels & equipment, jobs & skills, infrastructure and governance aiming to provide guidance for future policy actions on national and EU level. All in all, the LNG Masterplan project plays an important role in reaching a wide spread use of LNG in inland shipping on a mid to long term perspective

## 1 INTRODUCTION

Transport uses more than 30% of EU primary energy, produces about 24% of EU CO<sub>2</sub> (2012) emissions and is 94% supplied from oil. The European Commission therefore introduced in 2013 the Clean Power for Transport Strategy with the Directive on the deployment of alternative fuels infrastructure as main instrument. This Directive demands that an appropriate number of refuelling points for LNG is put in place at maritime and inland ports along the TEN-T Core Network at least by the

end of 2025 and 2030, respectively. Refuelling points for LNG include i. a. LNG terminals, tanks, mobile containers, bunker vessels and barges. The CEF - Connecting Europe Facility 2014-2020 provides EU funding for LNG projects on the Trans-European Transport Networks.

Whereas the Emission Control Area (ECA) regulation constitutes a strong push for the European maritime sector to switch to LNG as fuel, a more comprehensive approach will be needed for inland shipping. The European Commission is aware of the strategic importance of inland shipping



for its overall LNG energy and fuel strategy as this sector can ensure cost-effective LNG supply chains for many European industries and markets.

LNG is emerging as attractive option for European inland shipping and has the potential to increase environmental performance and efficiency of the sector. With inputs from the LNG Masterplan consortium the regulatory framework will be further developed, accommodating new rules for LNG as fuel and as cargo: As of January 2015, the amended ADN enables the transport of large quantities of LNG on inland waterways and therefore allows safe investments into LNG tank vessels. With regard to LNG as a fuel, the Central Commission for the Rhine Navigation (CCNR) elaborated an amendment to the Rhine Vessel Inspection Regulation (RVIR) which shall enter into force mid-2016. The update of the respective European Directives is expected to follow soon.

## 2 FACILITATING A WIDE-SCALE USE OF LNG AS FUEL AND CARGO FOR INLAND SHIPPING

The activities within the project are carried out in clearly defined areas. Framework and market analyses look into the current LNG implementation, regional markets situation, LNG sourcing scenarios and identification of pioneer customers. As part of the technologies and operational concepts, existing and emerging technical concepts for LNG engines, tanks and equipment are reviewed. Various missing operational concepts for LNG bunkering, (un-) loading and other safety related topics are being elaborated. As part of the regulatory framework activities, the project contributes to modifications of necessary regulations to enable LNG on inland waterways. Moreover, new vessel and terminal concepts are elaborated, with some of them being implemented as pilot deployments. Last but not least, knowledge gained and lessons learned in the project result into a comprehensive strategy for the deployment of LNG as fuel and cargo.

Important to note, the project also generated strong interest among stakeholders: industries searching for alternative energy supply, logistic providers looking for greener and efficient transport solutions, municipalities exploring low carbon public transport options. And the LNG Masterplan project made sure that LNG will be considered as a serious option for many future applications.

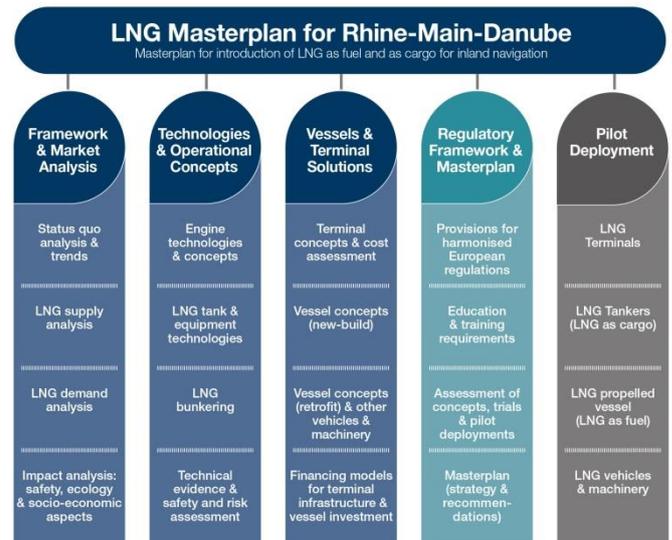
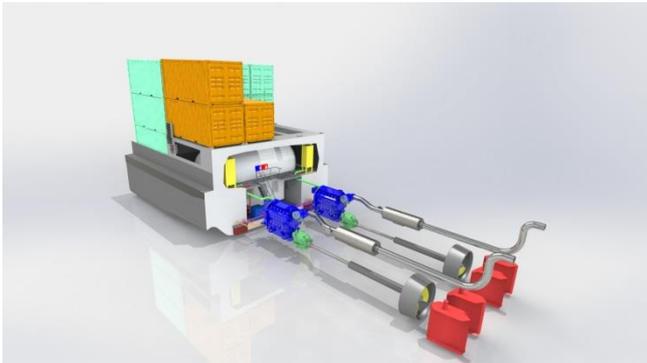


Figure: Project organisational structure

The LNG Masterplan not only provides important inputs to a concise regulatory framework but delivers a high number of innovative concepts and concrete investments in LNG fuelled vessels and on-shore infrastructure. In addition, together with key stakeholders the project will elaborate a comprehensive strategy for the deployment of LNG as fuel and cargo on Europe’s main waterway axis. This strategy encompasses an Action Plan with concrete measures in identified areas, such as market & financing, vessels & equipment, jobs & skills, infrastructure and governance aiming to provide guidance for future policy actions on national and EU level.

## 3 SUCCESS STORIES OF VESSEL AND TERMINAL DEPLOYMENTS

In June 2014, **DCL Barge (Danser Group)** fitted its vessel “Eiger” as the first inland waterway container vessel in the world to LNG propulsion. Danser commissioned the turn-key project to the companies Crynorm Systems, Koedood and Wärtsilä, which completed works within the planned three months. Equipped with a Wärtsilä dual-fuel drive system, the vessel gets 95 to 99% of its power from LNG. The 60 m<sup>3</sup> vacuum multilayer LNG tank is installed below deck in front of the engine room, in a tank compartment equalling six 20ft containers.



Picture 1: Retrofitting of the container vessel “Eiger” of DCL Barge to run on LNG



Picture 4: Outfitting of “Sirocco” of Chemgas Barging



Picture 2: Retrofitted dual-fuel container vessel “Eiger” of DCL Barge

In September 2014, **Chemgas Barging** finished its conventional gas tanker “Sirocco”. The vessel is equipped with a dual-fuel engine from Wärtsilä and holds a vacuum insulated LNG fuel tank with a capacity of 88 m<sup>3</sup>. It is the first newly built inland tanker with the fuel tank located below deck inside the cargo area, a construction that ensures the highest safety requirements.



Picture 3: LNG fuelled inland chemical tanker “Sirocco” of Chemgas Barging

The third vessel built in the project, the LNG propelled chemical tanker “Ecoliner” of **DAMEN Hardinxveldt**, will be put in operation in the second half of 2015. It is the first purely LNG powered inland waterway tanker equipped with dedicated gas engines using the newly developed “Air-Lubricated Hull”. The EcoLiner is designed to deliver highest fuel economy by reducing fuel costs up to 25%, while at the same time cutting emissions. The complete LNG installation, including two fuel tanks with bunker capacity of approximately 45 m<sup>3</sup> each is located aft of the accommodation, thus ensuring that the configuration can be tailored to customer-specific requirements to transport any commodity.



Picture 5: 100% LNG fuelled inland chemical tanker “Ecoliner” of Damen

The LNG/MGO inland bunker vessel of **Argos Bunkering** is another highly innovative vessel that is expected to be delivered within the framework of the project.



Picture 6: Combined LNG/MGO tanker of Argos Bunkering

Besides investments into pilot vessels, the project deploys a small scale LNG on-shore facility. The Bulgarian company **Bulmarket** is building the first LNG terminal in the Danube region, in Ruse, with a capacity of 1.000 m<sup>3</sup>. The terminal will be equipped with a truck fuelling station and a pontoon for future fuelling of inland vessels. The start of operations is expected in October 2015. Due to the difficult LNG sourcing in the Danube region, Bulmarket will ship in some initial volumes in LNG ISO containers via the Bulgarian seaport Burgas. The LNG containers will be then transported to Ruse with LNG fuelled trucks, thus creating a unique multi-modal LNG supply chain.

In addition to this, Port of Antwerp elaborated a detailed concept for a LNG bunker station and will launch a tender for its construction and operation in the third quarter of this year. Other investigated locations for LNG on-shore infrastructure include the Ports of Mannheim and Switzerland on the Rhine as well as Linz (Austria) and Komarno (Slovakia) on the Danube. Special attention is paid to the sea-river port in Galati and the LNG break-bulk terminal foreseen in the Port of Constanta (both Romania)



Picture 7: Visualisation of the LNG terminal in the port of Ruse, Bulgaria of Bulmarket



Picture 8: Visualisation of the LNG fuelling station in the port of Ruse, Bulgaria of Bulmarket

#### 4 LESSONS LEARNED FROM THE PROJECT LEAD INTO LNG STRATEGY

From all alternative fuels, LNG is the most promising for inland shipping. It provides a medium term option to reduce air emissions bridging to a widely decarbonised inland shipping sector. With LNG as an important element in a more diversified European energy supply, new cargo potentials for inland shipping will arise.

The LNG Masterplan clearly demonstrates that LNG neither is a self-run nor able to solve all evils in inland shipping. A comprehensive strategy is needed together with favourable framework conditions especially an attractive LNG price. Among many lessons learned are:

LNG infrastructure investment in ports requires a multi-client strategy combining LNG demand of all transport modes and especially from industrial users to ensure a viable business case. Public support for LNG infrastructure will stay crucial over the next years. The next calls in the CEF Program should facilitate combined energy and transport projects offering funding opportunities along the entire LNG value chain.

Technical viability of LNG for new-built vessels as well as for retro-fitting is proven. But, the extremely high costs of LNG equipment require innovation and economies of scale involving standardisation. A dedicated Horizon 2020 project for advancing gas engines, fuelling systems and modular logistics concepts as well as many LNG deployment projects are needed.

These and all other lessons learned will be part of the LNG Strategy delivered by the project together with recommendations and guidelines

#### 5 CONCLUSION

The LNG Masterplan was initiated to facilitate the deployment of LNG for inland shipping in line with European transport policy priorities. It addresses barriers typical for pre-mature markets such incomplete regulatory framework, technical innovation needs, lack of standardisation, high prices for equipment and low awareness among decision makers.

Significant changes in market conditions, especially the drop in prices of traditional fuels, and the limited time-frame for EU-funding required modifications of the initial work program. Some promising and highly innovative pilot activities had to be postponed to follow-up projects to prepare sounder business cases or to improve technical solutions.



Despite these challenges, the LNG Masterplan writes its success stories by delivering many innovative technical designs, deploying pilot infrastructure and putting forward important guidelines and best practices for safe LNG operations. It will take considerable efforts to overcome all barriers for LNG to become the dominant fuel for inland shipping. But, the LNG Masterplan represents an important step into this direction.

## 6 REFERENCES

Pictures by courtesy of project partners

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