Innovation and challenges in small scale and LNG bunkering in South-West Europe

The Spanish company, Enagás, is the coordinator of CORE LNGas hive project, co-financed by the European Commission, with the leadership of Puertos del Estado, it involves 42 partners from Spain and Portugal: 8 state-owned institutions; 13 port authorities; and 21 industrial companies such as ship owners, Liquefied Natural Gas (LNG) operators and suppliers of different services in the value chain. The total budget of the project is €33.3 M and its execution is planned to last until 2020.

The aim is to develop a logistics and supply chain for LNG that will allow it to be used as a transport fuel, particularly for maritime transport. Fostering the use of LNG in the Iberian Peninsula as the project will contribute to the decarbonisation of the European Mediterranean and Atlantic corridors. The

CORE LNGas hive

Iberian Peninsula is geostrategically located and has key gas infrastructure with which to consolidate its position as the European leader in this field.

LNG is the most environmentally friendly fuel, given that it generates about 30% fewer emissions of CO2 than oil. Moreover, it reduces emissions of sulphur oxides (SOx), particulate matter (PM) and nitrogen oxides (NOx), which will allow complying with increasingly tight environmental regulation demanded by the International Maritime Organization and the European Union, particularly improving the air quality of port environments.

The project aim to accomplish two specific objectives: one already done, the contribution to the National Policy Framework fulfilling the requirements of the directive 2014/94/EU on the deployment of alternative fuels infrastructure (Clean Power for Transport); and the other, to provide a roadmap and investment plan to scale up the results, in order to reach a larger commercial roll out of LNG infrastructure and equipment for maritime transport and port services.

CORE LNGas hive involves 14 studies and 11 studies with integrated pilot. The first ones are being considered the "software" of the project. They will allow, for example, identifying the standards needed to develop LNG as a fuel. They include:

- The prediction on the demand of LNG as a marine fuel both in Portugal and Spain, including and special study for the Gibraltar Strait since it is one of the most important bunker areas in the world.
- The identification of safety, environmental and technical national standards in order to assure an adequate frame in LNG bunkering operations, supported by the experience of Enagás. Taking into account the regulation that is being developed by international organizations, the project will go further, giving right inputs to the national regulators.
- The deployment of different kind of actions aiming to improve LNG social perception.
- The identification of the training needs in the whole logistic chain, and the definition of the training actions and accreditation processes. Training is vital in LNG as a new alternative fuel, to assure safety and security in operations. A whole structure needs to be defined, and the project helps the national regulators to construct it.

Regarding the studies with integrated pilots, known as the "hardware" of the project, they will test real parts of the LNG logistic chain, including the adaptation of LNG Terminals, and the:

- Development of the logistic chain, including the retrofitting of two bunker barges in order to supply LNG as marine fuel. Moreover, the project develops a pilot to test the multimodal transportation of LNG, by means of an ISO container, since it is necessary to increase the capillarity of the logistic chain and this solution can provide huge benefits.
- The use of LNG within the port environment. For example, it will perform the retrofitting of a straddle carrier (to move containers around the terminals) or the construction of a tugboat powered by LNG.

Note that in addition, the project will include in this "pilot testing" a real tank-to-wheel analysis that should confirm the better position of this alternative fuel with respect to others.

We believe that natural gas is the fuel of the future of transportation. Especially in maritime transportation, LNG is a down-to-earth alternative fuel to oil that also allows to comply with emissions regulations with the potential to produce saving to ship owners.

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LNG as an alternative fuel for the Transportation Sector
The Inland Shipping Sector

The Transportation sector will grow enormously in the coming years. Today freight transport - especially on the road and on the waterways - has been mainly depended on mineral oil as an energy source. This would lead to an even higher air pollution and noise level as much as to an increase of CO_2 emissions for the climate. According to the climate protection plan of the state of North Rhine-Westphalia, a part of the expected growth in freight transport should be shifted from road to rail and inland waterways. In general inland waterway vessels generate lower CO2 emissions compared to road and rail transport, based on the transported goods and distance kilometers (emissions / t * km). Although a ship can replace many trucks, the old diesel engines blow a lot of pollutants into the air. Especially the emissions of nitrogen oxides (NOx) and particulate matter (PM10) in marine engines are now higher than those of road and rail.

Concerning possible measures to reduce emissions from the European barge fleet (about 14,000 vessels), there is a lot to be done in comparison to advanced engine and exhaust gas technologies in road traffic. Already air pollutants such as particulate matter, sulfur and nitrogen dioxides are causing a high air pollution, especially in cities along the waterways. This is also confirmed by the emission cadastre of the State Office for Nature, Environment and Consumer Protection of North Rhine-Westphalia (LANUV NRW). The measurement cadastre showed that in 2014 only 12% of the measuring stations moved within the limits of the EU according to Directive 2008/50 / EC. The increased air pollutants can lead to health damage to the population, especially in agglomerations. The consequences are respiratory diseases, especially asthma, bronchitis and cancer. In the case of an increase in inland waterway transport, the deterioration of air quality, especially in the cities near to the ports, is to be feared when the engines currently in operation are used.

LNG Barge, source: Shell

Liquefied natural gas (LNG) could be a climate and environmentally friendly alternative to diesel and heavy fuel oil. LNG is produced when natural gas is cooled and compressed at -162 ° C with constant pressure. Compared to the compressed gas (CNG = Compressed Natural Gas), the considerably higher energy density allows ranges of up to 1500 km for trucks and enables the use of an alternative fuel in heavy-load traffic and in shipping. The advantage of LNG is that there are no particulate matter emissions, no SO2 emissions (sulfur), 80-90% less NOx emissions (nitrogen oxides) and a CO_2 savings potential of 10-20%. The addition of biomethane could even reduce CO_2 emissions by up to 80%.

On the other hand there is almost no infrastructure in North-Rhine-Westphalia nor in Germany at all. Technical and legal standards and framework conditions must be harmonized and established across Europe. In the autumn of 2016, two European projects have been launched to promote LNG as an alternative fuel for heavy duty vehicles and inland vessels (LNG PILOTS) and

measures for clean inland waterways (CLINSH).

The EU-funded project LNG PILOTS (INTERREG V A Program) is supporting the development of innovative solutions for the transport (heavy duty vehicles and Inland Shipping) as well as the industrial sector in LNG. Under the leadership of the Stichting Energy Valley (Groningen, Netherlands), a consortium of 36 partners from North Rhine-Westphalia, Lower Saxony and the Netherlands has formed to promote the introduction of LNG as an alternative fuel in cross-border freight transport and support building up an infrastructure.

The EU Life project CLeanINlandSHipping (CLINSH) is a European consortium promoting clean inland waterway transport. Within CLINSH dutch, belgian, german and english public and private organizations are working together. The main objective of CLINSH is to improve air quality in urban areas by accelerating emission reductions in Inland Waterway Transport. Despite several improvements Inland Waterway Transport is still a major source of air pollution. The performance of various emission reduction techniques (e.g. after-treatment of exhaust gases) and alternative fuels (LNG, GTL) will be tested on 30 ships. Before and after these adjustments the ships emissions (NOx and PM) will be monitored under real life conditions. Also the chances for further introduction of on-shore power supply will be investigated. The Measurement results are collected in a database that provides a tool for local, regional, national and European governments for (new) policies on the greening of waterways. Also, these data provide skippers with more insight into the most cost effective environmental measures for their ship.

For a transit state like North-Rhine-Westphalia with a high population density the need to reduce CO_2 emissions and to improve the air quality especially in the cities along the waterways is crucial. The Fuels and Drives of the Future Network of the EnergieAgency.NRW has supported the project initiation and accompanies the relevant projects to support the introduction of climate and environmentally friendly fuels in freight transport. To implement an alternative fuel for the transport sector international cooperations are needed. Together with the Gas and Heating Institute Essen (GWI = Gas- und Wärme-Institut Essen e.V.) the EnergyAgency.NRW organizes an international workshop the„4th LNG Roadmap- LNG as a driving force for cross-border cooperation within Europe" on the 31st of May 2017 in Düsseldorf, Germany. The event will highlight the development of the LNG as an alternative fuel for inland navigation and for heavy-duty commercial vehicles as well as for industrial applications. The 4th Workshop "LNG Roadmap" is a follow-up event, which gathered in 2014, 2015 and 2016 more than 100 guests each year from all over Europe (Germany, Austria, Belgium, France, Norway, Great Britain, the Netherlands and Switzerland).

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LANUV- press conference at the laboratory ship Max Prüss during the Kick off event of the EU Life Project CLINSH on 27th of Octobre 2016 in Düsseldorf, Germany

Kick off event of the EU- INTERREG VA project LNG PILOTS at 18th of November 2016 in Papenburg, Germany

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