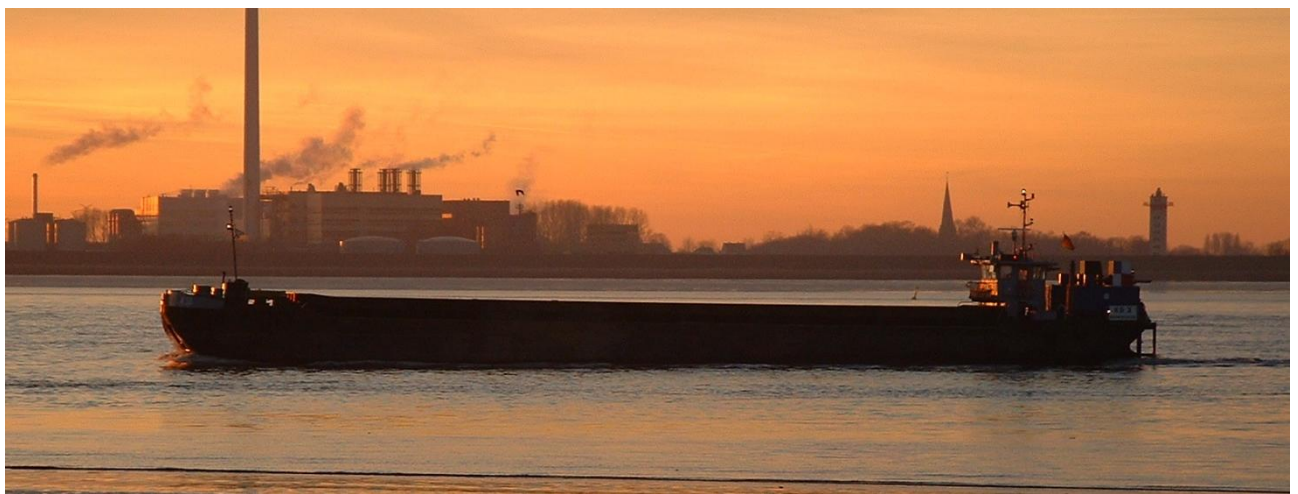


IAPH Environment Award 2015

“Innovative new building of a LNG-powered dredging barge in the ports of Bremen and Bremerhaven”



The project covers the replacement of the existing dredging material transport fleet consisting of six conventionally fuelled hopper barges operated by the port infrastructure management company bremenports GmbH & Co. KG in the ports of Bremen and Bremerhaven in Germany.

With respect to the international regulations in accordance with the IMO MARPOL Annex IV Convention regarding the sulfur content of fuel (0.1%) and therefore for sulfur oxides (SOX) in the emissions for marine vehicles in designated areas of the North and Baltic Sea and the English Channel, bremenports is planning to replace the existing barges by LNG-powered dredging barges in the next years.

bremenports has taken appropriate action and ordered the first German new building of an inland vessel with pure LNG driven engines in January 2015. The transferability of the project to other ports throughout the world is very high and the operational area of the new vessel is huge. It is assumed that this measure will have a high multiplier effect. Also the findings and solutions obtained in the course of the project could come to fruition in addition to all types of inland vessels.

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“Innovative new building of a LNG-powered dredging barge in the ports of Bremen and Bremerhaven”

1. Background and description of the project:

The bremenports GmbH & Co. KG (bremenports) is the port infrastructure management company in the ports of Bremen and Bremerhaven. The so called twin-ports of Bremen and Bremerhaven – the Bremen ports – are both category A ports of the future core TEN-T network.

bremenports manages the port infrastructure on behalf of the Free Hanseatic City of Bremen and is responsible for providing intact infrastructure; in other words, bremenports plans, constructs and maintains the port infrastructure and leases the port properties and quay facilities to terminal operators and other logistic companies.

The map below shows the location of the ports of Bremen and Bremerhaven with respect to the international context and the position in the sulfur emission control area (SECA) of the North and Baltic Sea.



Image 1: Location of the seaports of Bremen and Bremerhaven (source: google maps, 2013)

Besides ensuring a smooth waterway within port areas, an essential part of the port management is the provision of necessary water depths and the creation of necessary future water depths as well as widths of navigation channel and berths. For these tasks, bremenports uses its own devices, e.g. bucket-ladder-dredger, barges and water injection gear. Due to its pollution, those dredged sediments that are contaminated must be disposed on land. For this purpose, the Free Hanseatic City of Bremen operates its own dredging material landfill in Bremen-Seehausen.

In July 2008, the World Ports Climate Declaration (WPCD) was signed for the Bremen ports by the Ministry for Economic Affairs, Labor and Ports. To reduce the emission in the Bremen ports and to support the use of LNG as ship fuel in the neighboring North Sea, bremenports has decided to support the use of liquefied natural gas (LNG) as a marine fuel intensively.

2. Purpose/Objective:

From 1 January 2015 on, even more stringent limits for sulfur content of fuel (0.1%) and therefore for sulfur oxides (SOX) in the emissions for marine vehicles in designated areas of the North and Baltic Sea and the English Channel in accordance with the IMO MARPOL Annex IV Convention have to be met. The use of LNG as an alternative fuel makes it possible to comply with these statutory emission limits required in the future without additional measures. In addition, the particulate matter emissions are avoided in the same proportion to the sulfur emission reduction (up to 100%). Furthermore, through the use of LNG significantly about 90 % less nitrogen oxides (NOx) and up to 25% less carbon dioxide (CO₂) is being discharged than by conventional oil-based fuels.

The Global climate change, the rising sea levels and the species becoming extinct at an alarming rate, are indications for the fact that the Earth is badly in need of intensive care. Nature and the environment do not inevitably have to lose the battle against economic interests. People all over the world are increasingly recognizing their responsibility for our endangered planet. The ports in Bremen and Bremerhaven have taken appropriate action – at regional, national and international level.

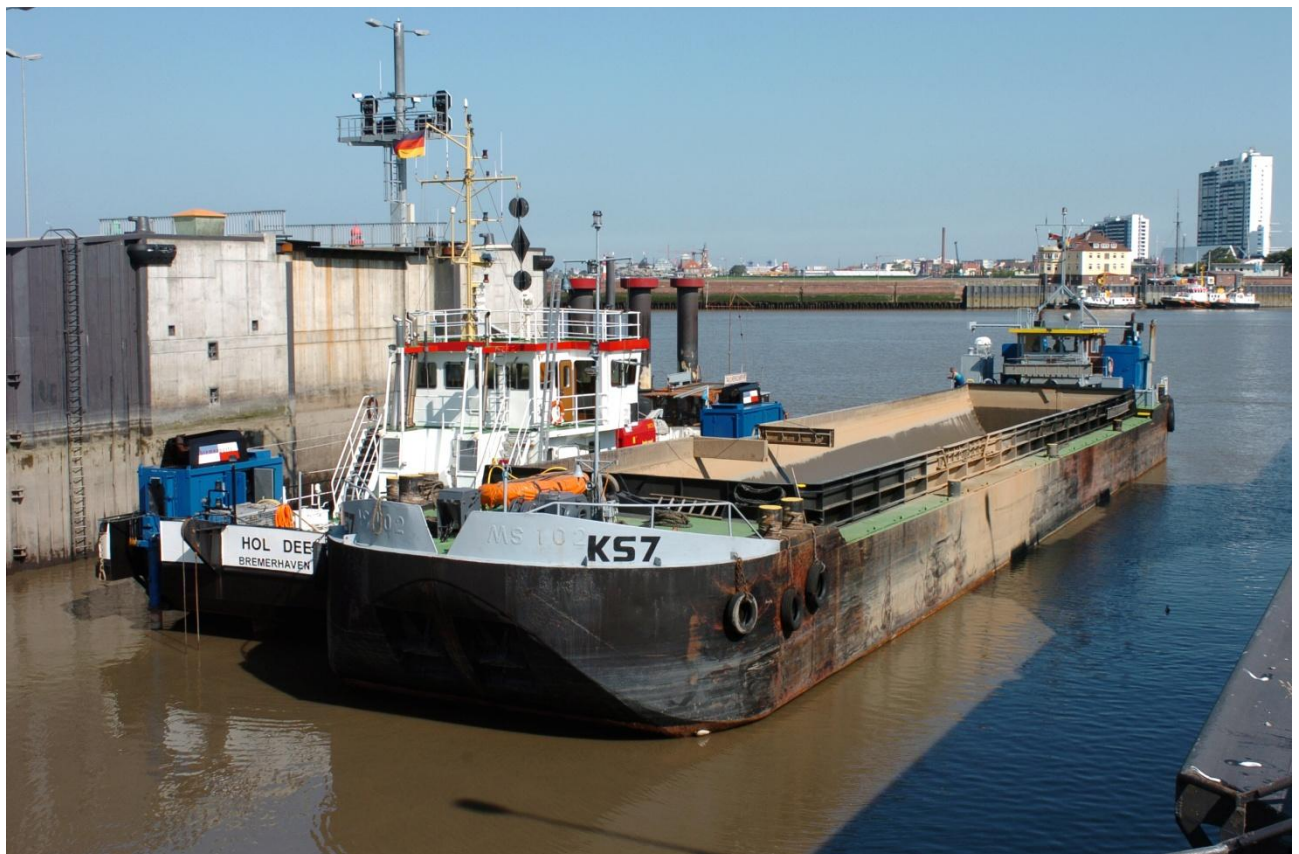


Image 2: Dredging barge in the Seaport of Bremerhaven (source: bremenports)

In September 2009, bremenports published the *greenports* sustainability strategy for the ports of Bremen and Bremerhaven in a brochure entitled *greenports – sustainable management – successful performance*. The 100-page brochure impressively shows what the port industry and public sector have already undertaken to maintain and raise the standards of marine environment protection. On adopting its *greenports* philosophy, the Bremen ports have committed themselves to acting responsibly and proving that economy and ecology need not be a contradiction in terms.

Green issues already play a central role at bremenports today. The engineers, environment planners and sustainability managers have implemented many measures to promote the protection of nature and the

countryside, ranging from sophisticated ecological projects to compensate for quay and lock construction, right through to the search for intelligent solutions for environment friendly port operations.

The business enterprises in and around the port have also responded to the challenge. The port operators use modern technology to keep the noise level at Bremerhaven Container Terminal to a minimum, and the shipyards collect and treat the washing water used in dock operations – just two examples of systematic ecological commitment in an industry which has realized that going green is essential in this day and age.

Since 2009 the *greenports* strategy was continued and deepened. bremenports has certified its environmental management under the PERS-standard of ESPO and its sustainability in general under the GRI standard of Global Reporting Initiative (Amsterdam) and is regularly publishing correspondent (sustainability) reports.

As part of the *greenports* strategy of bremenports, sustainable management is one of the main objectives of port development in the Bremen ports. Here, the implementation of LNG as a marine fuel in the bremenports fleet is an important future component.

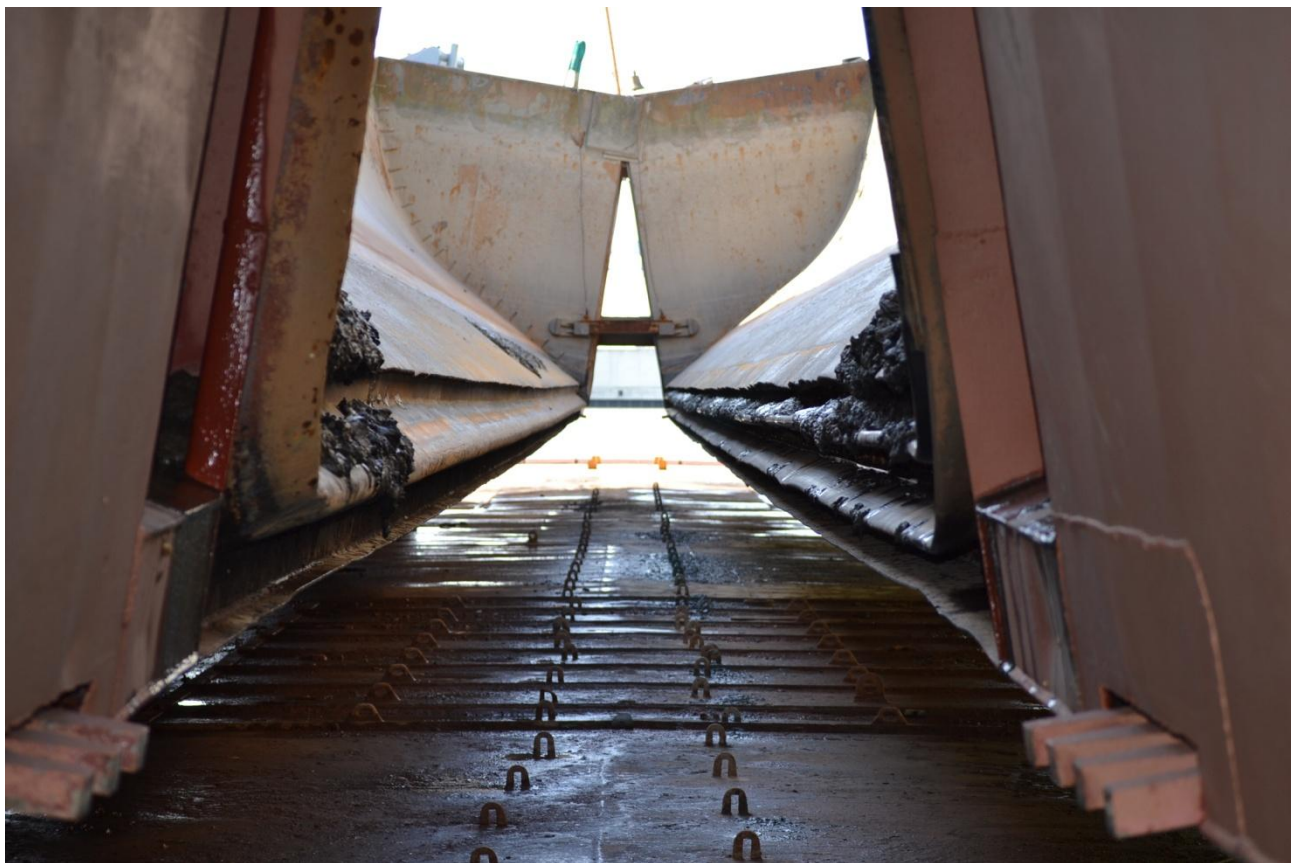


Image 3: Damper mechanism of the current dredging barges (source: bremenports)

Until 2020, bremenports plans to renew its fleet of harbor craft fundamentally. This includes a total of up to five new barges, which could all be powered by LNG. A central aspect is the reduction of pollutants and the economic operation of the fleet. The key project is the successful construction of the first LNG powered barge. As well this will be the first LNG powered barge in a European seaport and the first LNG-powered inland-barge in Germany. The project is to be implemented by the end of 2015. It has won European subsidies from the TEN-T program by the European Commission from the 2013 TEN-T call. This money will help realizing the barge.

The port vehicles must be used in both cities - Bremerhaven and Bremen - in close vicinity of the housing areas. Therefore, a reduction of sulfur oxides (SOX), nitrogen oxides (NOx) and particulate matter (PM) is urgently needed.

3. Beneficiaries and status quo of water depth management:

As multi-modal transshipment junctions, the Bremen ports represent a major transfer intersection in the TEN-T network and along key transportation corridors. In 2012 85 million tons of goods were handled in both ports together, mainly containerized cargo and automobiles. In addition to Germany, the core hinterland of the Bremen ports is the Central and Eastern European market. Approximately 60-65% of the containers, handled in Bremerhaven are shipped via feeder traffic to ports in the North Sea and Baltic Sea regions, which are SECA areas. The modal split in the continental hinterland traffic is one of the best in Europe: nearly 52% of all hinterland traffic is transported by rail (47%) or by inland waterway (5%).

One of the most important basic requirements for the continued existence of a modern and competitive seaport is to ensure the water-side accessibility. To be able to cope with ships of future generations, which become deeper, wider and longer, capacity measures in hydraulic engineering are essential. The water depth management of ports is a very central part of this water-side accessibility.



Image 4: Integrated dredging material landfill in Bremen-Seehausen (source: bremenports)

Also in the future, large amounts of silty sediments (approximately up to 350,000 m³ per year) will be dredged in the Bremen ports. In 2013 73.000 m³ of uncontaminated sediments have been relocated in the Weser estuary. 140.000 m³ have been transported to the landfill in Bremen-Seehausen and another 137.000 m³ were disposed at other dredged material dumping grounds e.g. at the Lower Rhine or at the Slufter in Rotterdam.

In addition to the silty sediments, approximately 300.000 m³ of sand are being dredged in Bremen and Bremerhaven per year. For the mentioned transports, ships with appropriate approvals for the required driving ranges are needed.

The equipment used for dredging operations consists of a bucket-ladder-dredger for filling a total of 6 barges with a mud treatment capacity of 840 m³, a barge unloading dredger to empty the barges and flush the dredging material in the dewatering fields of the dredging material landfill in Bremen-Seehausen and a tug boat for moving and deploying the anchor for clamping the excavator.

The current barges have been built in the years 1970 to 1980 and have increasingly high repair costs. Moreover, the diesel engines used as traction drives and the noise protection facilities are to be renewed within the scheduled renewal period until 2020, when the operating time of approximately 15 to 20 years will be reached.

4. Methodology and realization of the project:

Taking into account the expected amount of dredged material, the fleet size and configuration, an own annual transport capacity of approximately 500,000 m³ dredged material is planned. The number and size of barges needed are determined by several factors, such as the possible excavator performance in relation to potential transport volume of barges, the length and width of the barges in proportion to the use in relatively cramped harbour basins and locks, and the limit of the loading height of barges by the limited tilt capability of the loading chute of the existing bucket-ladder-dredger.

To meet the above mentioned prevailing and future environmental regulations, the dredging barge is an appropriate project, to install a gas driven propulsion system in an inland waterway vessel. By the way: The LNG powered barge will be the first German new building of an inland vessel with pure LNG driven engine.

bremenports had to do some pioneering work: At present, there are no standards for the approval of a gas drive on inland vessels. Every new building or conversion has to be approved separately. The admission authority in charge for the hopper barge is the German ZSUK (Zentralstelle Schiffsuntersuchungskommission). But in this case the ZSUK referred to the Central Commission for the Navigation of the Rhine (CCNR) of the European Commission.



Image 5: Draft of the new LNG-powered dredging barge (source: bremenports)

The new dredging barge is therefore a German contribution to the development of appropriate regulations by responsible national and international commissions. The transferability of the results of the project to other ports throughout the world is very high, because most other ports deal with comparable issues regarding the sedimentation in ports. It is assumed that this measure will have a multiplier effect, since frequent dredging is required in the sand-rich North Sea and inland ports. The use of vessels with LNG propulsion would help to reduce the impact of transport industries on the environment. The findings and solutions obtained in the course of the project could come to fruition in addition to all types of inland vessels.

Starting in 2012, bremenports has teamed up with German engineering firms, engine manufacturers and classification society *Germanischer Lloyd (GL)*, to investigate the feasibility of a LNG-drive including a safety assessment for operation. This study to investigate the safe operation (HAZID) was supported by the Ministry for Environment, Construction and Transportation of the Free Hanseatic City of Bremen (SUBV).

Finally the entire configuration of the technical components of the barge was approved for inland waterway operation by CCNR in early 2014. In regular meetings at European level in Strasbourg the member states/national delegations raised comments, claims and questions, which had to be answered by the involved parties (bremenports, engineering firms and class society)

Most of the questions and claims focused on the specific operation mode of the dredging barge as this type of vessels are opened throughout the entire length. Storage tanks, supply units and engines as well as the operational handling had to be planned and constructed in consideration of the maximum opening angle.

The propulsion system will be divided into two separate storage, supply, power and propulsion units in each ship's half. The storage tanks will be located in the forecabin, engines and propulsion units in the aft part.

The vessel will have a gas-(diesel)-electric propulsion system: two pure gas main engines (400 kW each) and one diesel auxiliary engine (150 kW) supply the power for the two ruder propellers.

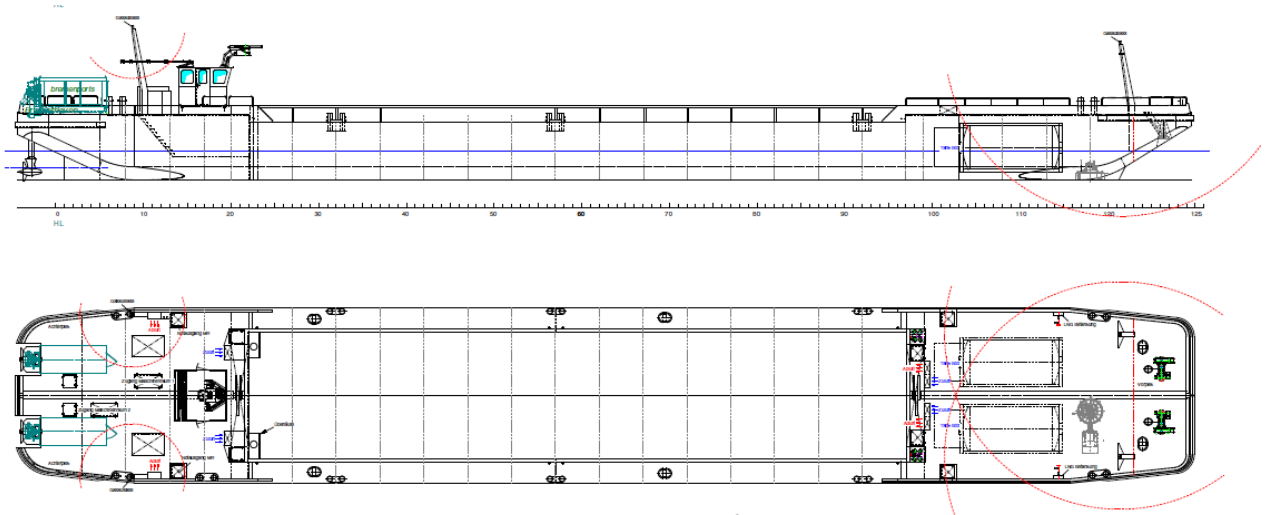


Image 6: General plan of the LNG-powered dredging barge (source: bremenports)

Due to the angle occurring during opening process for discharging the capacity of the storage tanks will be reduced to 80 %. Otherwise the liquid would flood the filling level sensors. To make sure, the ship does not have to be longer than the needed 70,5 m over all, and the necessary loading capacity will not be smaller than 850 cbm, the maximum tank size will be 6 cbm each.

In average the hopper barge will have to be bunkered twice a month. When the hopper barge will be launched at the end of 2015 it will be bunkered by truck. But this shall be an interim solution until fix bunker terminals start operations (see Supply structure).

5. Actual implementation of the project:

The tender for the realization of the barge was created, so that the effective tendering could be made in late 2014 and contract award in January 2015. The vessel will be build at a very experienced shipyard in the Netherlands and delivered by the end of 2015.

This project is of great interest to shipyards as it is the first of its type and a unique reference both as a LNG driven ship in general but also as a dredging unit. Especially in the North Sea – SECA, a huge dredging fleet is permanently keeping the necessary water depth in navigation channels and port basins at the needed level. Most of the ports located in the wadden sea region are affected by high sedimentation. The project has potential to be a trend-setting investment, because its findings can be adopted in ports all over the world.

(6. Supply structure in the Bremen ports:)

The LNG supply structure in the Bremen ports is supported and promoted by bremenports in close cooperation with the Harbour Master's Office (HBH), the Ministry for Economic Affairs, Labour and Ports and the Ministry for Environment, Construction and Transportation of the Free Hanseatic City of Bremen.

Since ports do not have the role of bunker suppliers, bremenports reached out actively for fuel companies and found private companies which were willing to invest in LNG supply infrastructure at both port locations Bremen and Bremerhaven. Both projects at both locations have been granted EU-funding, but only one is currently pursued, the other one was recently unfortunately stopped by the investor. The only reason was and is the lack of demand, shipping companies hold off investing in LNG-driven new buildings; a viable reason for the ports of Bremen and Bremerhaven to realize the hopper barge project.

As operator of LNG-powered port vehicles bremenports itself acts as LNG consumer in the market, which will push the technology development in this area. bremenports wants to provide a secure and predictable supply with LNG in the Bremen ports in the foreseeable future, so that LNG as fuel for ships will have a permanent place in the ports of Bremen and Bremerhaven.

Stefan Färber