Port of Helsingborg; LNG in south of Sweden

Roland Brodin, HELGA, Sweden
HELGA, Helsingborg Liquid Gas Association, four companies and two associations in a joint effort to establish a LNG/LBG infrastructure in the area of Helsingborg southern Sweden. The work started in 2011.

Companies

- Öresundskraft – energy company
- Kemira – large industry and site owner
- Port of Helsingborg
- NSR – producer of biogas

Associations

- Sveriges hamnar
- Energigas Sverige
Projects in Helsingborg:

**HELGA I**, studies, the project was finished in 2014, a report is available. HELGA I was an activity in the project LNG in Baltic Sea Ports I *). (Co-financed by EU).

**HELGA II**, design of a multi functional bunker ship suitable for the market area in Helsingborg. The work that was co-financed by EU was finished December 2015. The dialog with ship owners and other stakeholders is still ongoing. HELGA II was an activity in the project LNG in Baltic Sea Ports II*). (Co-financed by EU).

**HELGA III**, design and construction of step I in the building of a LNG terminal in Helsingborg, starting with a liquefaction plant with a filling station. The work has started. The project is a part of project HEKLA that is a co-operation between HELGA, Klaipedos Nafta and Actia Forum. (Co-financed by EU).

**LNG Filling station** for heavy trucks installed 2014.

*) More info can be found at http://www.lnginbalticseaports.com
Why Helsingborg?

Helsingborg is a **strategic site**
- 3 million heavy goods vehicles passes by every year
- Appr. 50 000 ships passes by every year
- Good conditions in Öresund for bunkering
- Industries that could use LNG/ CNG

- City of Helsingborg has a **great environmental awareness**
  - The air quality in the centre of Helsingborg is a problem
  - LBG production in a large scale
HELGA can serve both off shore and on shore transport with LNG/ LBG. Market changes between transport on shore and off shore can be handled because of the strategic location.

Main corridors where modal shift may occur due to new IMO regulations
Source: COMPASS The COMPetitiveness of EuropeAn Short-sea freight Shipping compared with road and rail transport, commissioned by European Commission DG Environment, 2010
Goal

To investigate if it is possible to establish a LNG/LBG infrastructure in the south of Sweden
Performed work in Helsingborg:

- Market, Profitability analysis, sourcing, location and stake holder’s analysis.
- Basic Design of the terminal and quay and investment calculation.
- Risk assessment project and check of process for permits
- Design of terminal and quay
- Preparation of permits and tender documents
Key success factors

- Location that fulfill all parameters
- The shipping segment is crucial for critical volumes
- Control of the value chain before a final decision of business model
- The terminal must be established in steps and co-financing from EU is required.
- Co-operation with partners and stakeholders necessary for making an reliable infrastructure.
Step 1,
✓ A liquefaction plant condensing LNG/ LBG from the grid with limited storage capacity.
  *LNG to heavy vehicles and small ships.*

Step 2,
✓ Extended storage capacity of 3000 – 5000 m³ (steel tanks)
✓ Rebuilding of existing berth
✓ A multifunctional bunker vessel
  *LNG to heavy vehicles, industry and ships*

Step 3,
✓ A full 15 000 m³ storage (full containment type)
✓ Decommissioning of steel tanks
  *LNG to heavy vehicles, industries and ships*

Step 4,
✓ New Jetty suitable for feeder vessels up to 40 000 m³
  *LNG to heavy vehicles, industries and ships*
Step one - HEKLA, Liquefaction plant
Step three
Step four
Project activities:

Activity 2. LNG in Helsingborg:

- Develop a design for a multi-purpose LNG bunker ship in the area
  - The objective of this activity is to design a multifunctional bunker ship solution in south of Sweden
  - The multi-function ship will be able to provide – LNG bunkering; MGO bunkering & Other ship supply services
  - LNG bunker ship study will describe the following: size, number fuel tanks, type of bunker fuel that the ship shall carry (the ship shall be running on LNG), type of other services that should be performed by the ship and crew, etc.
Work process:

1. Identify market demands and possibilities
2. Establish basic design criteria's
3. Identify different bunker ship concepts
4. Calculations different bunker ship concepts
5. Selection of bunker ship concept
6. Establish final design criteria's
7. Design of bunker ship
8. Final report
9. Negotiations with bunker operators
10. Bunker ship operations in Helsingborg

Included in this report
Not included in this report
The market area for a bunker vessel in Helsingborg was changed after in depth discussions with bunker operators and ship owners.

**Conclusion:**
Ship owners find Helsingborg to be an attractive location for bunkering. The don’t want to bunker in the port. The want to bunker ship to ship close to the Kemira site (Råå’s Redd). The prefer to bunker both LNG and MGO at the same operation. It would a benefit if they also can get ship supply simultaneously.
Identify different bunker ship concepts

Initially the HELGA project decided to look into following concepts:

A) Retrofitting existing bunker ship, so it can carry MGO, ECO fuel, and LNG. Total tank volume 2000 - 3000 m³.

B) Retrofitting existing bunker ship, so it can carry MGO, ECO fuel, and LNG. The machinery shall be converted/replaced to LNG propulsion. Total tank volume 2000 - 3000 m³.

C) A new bunker ship carrying LNG, MGO and HFO with high flexibility to adjust to new markets conditions. Total tank volume 2000 - 3000 m³.

D) A new self-propelled bunker barge for LNG and MGO (classed for inland waterways).

E) Retrofitting an existing bunker barge to carry MGO and LNG. An existing tug boat will transport the barge. LNG tank appr 500 m³, MGO tank appr 500 m³.

The Danish company OMT was selected for making "PRICE CALCULATIONS FOR LNG TRANSPORT SOLUTIONS". During the discussions OMT suggested that an additional concept should be considered, and this was accepted by the project:

F) A 2nd hand transport barge is acquired and equipped with 40" ISO insulated LNG containers in the deck.
After considering the price report and new discussions with tug operators, bunker operators and OMT, the project decided to **develop following bunker ship concept**:

A self-propelled barge/vessel with one or two LNG tank(s) with a total volume of 500 m³ on the deck or in hull depending on design (assumed to be type-C) and a number of ISO 40” LNG containers as space allows. MGO tank(s) shall be included in the hull on say preferably 300 m³ in order to allow supply of ignition oil to dual-fuel engines.

Length = appr.100m  
Breadth = 24m  
D = 5.6 m  
Speed = 7-9 knots  
Hull shape = Barge like shape suitable for local operational area.

The accommodation shall be made for 6 persons as regular crew but also be able to hold a number of trainees on-board.  
The vessel shall be easy to modify after changed market conditions.  
Dual fuel machinery (LNG and MGO).
During the design phase the final design criteria's was constant under revisions all to find a market and business orientated final design.

The bunker ship shall perform full service to the ship owners (LNG, MGO, Supplies.)
The design shall allow for full competition between European ship builders, no in-house LNG competence shall be required.
Standard barge concept allows for low investment cost.
Flexibility allows for low operational cost.
High residual value allows for low Capex.
ETC

The design is based on making a versatile ship allowing to:

- Carry a large amount of diesel, also larger than the normal volume considered for a LNG bunker tanker
- Allows diesel trade in the beginning until the LNG market develops
- Allow scaling of the LNG volume as market develops by adding more tanks on the deck
Final design of the bunker ship

SHIP - GENERAL

The purpose of the vessel has been to design a highly flexible platform that enables the operator to:
- Start with a small number of LNG storage tanks and increase the number of LNG storage tanks as the market develops
- Transport a large amount of diesel bunker on-board enabling a diesel bunker trade in the beginning (more tanks than the shown can be installed if requested)
- Carry a number of 40” ISO gas containers on the upper deck enables the operator to provide LNG to ports very fast e.g. between a ferry departure and arrival. The containers are designated as “swift containers”
- The open deck installation allows a high degree of independent design of the top-side

The vessel shall be designed and constructed as an environmentally friendly, all welded steel ship with gas/diesel electrical twin thruster propulsion.

The engine room is located below the superstructure aft. The forward mooring platform is located on the foc’sle deck.

Co-financed by the European Union
Trans-European Transport Network (TEN-T)
**LNG BUNKER VESSEL**

**MAIN DIMENSIONS (ALL APPROX):**

- LENGTH OA MAX. : 95.30 m
- LENGTH PP APPROX. : 93.10 m
- RULE LENGTH : 92.44 m
- BREADTH (MLD) : 18.00 m
- DEPTH TO UPPER DECK (MLD) : 6.00 m
- DESIGN DRAUGHT : 3.50 m
- DWT (DESIGN DRAUGHT), GROSS GAS : 2000.0 m³
- DWT (DESIGN DRAUGHT), DIESEL : 2028.0 t
- SERVICE SPEED (SCANTLINGS DRAUGHT) ABT. : 8.0-10.0 kn
- CREW, SINGLE CABINS : 8-9
- GROSS TONNAGE : 3,700

**CLASS NOTATION:**

ABS ★ A1 LIQUEFIED NATURAL GAS CARRIER WITH INDEPENDENT TANKS, ACCU, ICE-CLASS 1C

FOR DIESEL BUNKER VERSION OIL CARRIER (FLASHPOINT >60°C)
Final design of the bunker ship

DEADWEIGHT
Deadweight at design draft
Abt. 2,082 t

SPEED
The speed is subject to final power predictions but is expected to provide a service speed on 8-10 knots with 15% sea margin, on the design draught 3.5, in calm weather and with clean hull.
MANOEUVRING MACHINERY AND EQUIPMENT

401 RUDDER
The ship is equipped with two (2) steerable thrusters with integrated gearbox serving as rudders.

404 THRUSTERS
One (1) bow thruster:
- El-motor 690 kW with frequency drive
- Fixed pitch propeller, diameter app. 1.2 m

DIESEL ENGINES FOR PROPULSION

601 MAIN ENGINE
Two (2) 4-stroke generator sets are installed for supplying power to the electrical propulsion system and auxiliary systems. The engines are of the dual-fuel type with integrated double wall piping designed for running on natural gas with pilot diesel fuel or running on diesel.
When running on natural gas the engines fulfils TIER III. The engines also serves as BOG removing devices.

FUEL
Natural gas or diesel.
The engines are capable of running at low sulphur DO with a viscosity of minimum 1.8 cSt at engine inlet.
Final report HELGA II, Roland Brodin, PO Jansson

Final design of the bunker ship

Propellers

Two (2) steerable thrusters are installed each with a 4-bladed propeller with a diameter on approx. 1500mm. The blades are manufactured in accordance ISO484-1981 class 1 and the surface according to ISO484-1981 class 2. Around each propeller a nozzle is installed. The nozzle is of steel welded construction.
LNG BUNKER TANKER
SUITABLE THE MARKET AREA OF Helsingborg

Designed by OMT based on the result from in depth discussions with project HELGA and after a scenario investigation.
HEKLA – Development of LNG bunker Network

HEKLA – Helsingborg & Klaipėda LNG Infrastructure

Real investment;

Helsingborg – Construction of LNG liquefaction plant
Klaipeda – Construction of on-shore LNG reloading station

An important step forward towards creating the LNG bunkering infrastructure network in the BSR.
LNG demand forecast
Base scenario HBG terminal

FEASABILITY STUDY
2012
Helsingborg
The volumes for on shore transports are significantly delayed. Compared to the info that was available in 2014.
Today’s situation with unexpected (in 2014) low oil price is the reason why:

- Ship owners are awaiting due to reduced operating costs when MGO prices are lower than LNG.
- Converted ship with dual-fuel machinery is using MGO instead of LNG.

The situation for bunkering ships in Helsingborg with LNG is illustrated below:

LNG on board the ship is today 30 – 40 % more expensive compared to MGO.

Maritime market, main scenario, based on the situation in 2016-01-14.
Assumption 2014
Reality 2016

HELSINGBORG
REALITY Jan 2016