

SMALL SCALE LNG FOR SHIPPING



Go LNG Conference

Vilnius, 26th of April 2016

Managing Director Knut Fjørland, Liquiline LNG

Company Profile

- A Norwegian based gas technology company with history back to 2005. An independent provider of services and innovative solutions for transporting and storing of liquefied gases:
 - ✓ Technical consultancy services
 - ✓ Terminal construction company
 - ✓ Specializing in the small-scale LNG market
 - ✓ Strong focus on ship bunkering solutions



Company Profile

- Portfolio of innovative and flexible distribution technologies provided as part of our services
- Privately held and member of the Network LNG Norway (www.networklngnorway.com)
- Winner of the Norwegian Regional Innovation Prize 2013
- Technical cooperation re-located with LMG Marin AS (www.lmgmarin.no)



Company Profile

Strong focus on Small Scale Ship Bunkering Solutions



CREATING ENERGY LINES

A Scandinavian based company with partner in Singapore



Some of our reference customers

Both the old Liquiline and Liquiline LNG



GEXCON

cmr

e-on

ATCO
Gas



Rolls-Royce



CREATING ENERGY LINES

An LNG Midstream partner



LNG bunkering Solutions

A. Loading from LNG truck

- Using tank container or semitrailer to bunker ships
- Ships can be bunkered at place of preference instead of having to detour to bunker somewhere else
- No need for quayside construction
- A flexible bunkering solution
- Early-bird solution to get started
- Good alternative in a start up phase, or when ships have small fuel tanks



LNG Bunkering Solutions



Photo courtesy: Liquiline



B. Multiple loading from truck

- Bunkering solution where two or more containers/semitrailers can discharge simultaneously (max flow for 2 trucks 1200l / min)
- Reduces total bunkering time for the ship
- Minimal need for quayside construction
- Flexible and cost-effective
- This solutions enables a quicker start-up for distribution of LNG. Can build a bunkering terminal with a storage tank later on

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LNG Bunkering solutions



C. Stationary Bunkering Terminal

- Onsite storage tank(up to 1000m³)
- Cryogenic pump (600 l/min to 5000 l/min)
- PBUC
- Local control rom(can be a 20`contaienr)
- Automatic loading and unloading process
- Fire, gas and leak detection
- ESD and Safety System
- CE and Authority approvals
- Civil work and cabling
- Demand for power

LNG Bunkering Solutions

D. Flexible but stationary solution



- Flexible/ mobile
- Little civil work
- Can easy be expanded (stacking of ISO Containers or side by side solutions)
- Shorter bunkering time (can start cooling of pump from ferry)
- Installed pump on dock- no need for pump at trailer/ container
- Storage volume : 50m^3 x Y Containers/ trailers
- No use for external personal
- Demand for power

LNG Bunkering Solutions



E. Ship to ship bunkering

- Bunkering boat
- Need facilities for bunkering the bunker boat
- Gives more flexibility in the harbor according to bunkering
- High CAPEX and OPEX



Construction of Danmarks first LNG Bunkering Terminal

Some key information:



- **Customer: Fjord Line AS**
- Two LNG-fueled cruise ferries
- 1,500 passengers - 600 cars
- 4 x 5,600 kW gas engines
- Trading between Norway and Denmark on daily basis

What was the alternative for bunkering ?

1. Onshore terminal on the dock
2. Loading from trucks
3. Loading from LNG carrier (sea to sea)

Liquiline`s Feed study concluded that the best solutions for this customer was an onshore terminal on the dock.

The terminal was built in 2015:

- 500m³ horizontal storage tank
- LiquiStation™ Bulk bunkering solution
- High speed bunkering (3500 l/min)
- Automatically operations
- Possibility for truck loading to ship
- Possibility for loading storage tank from truck and LNG carrier

Liquiline to Construct Denmark's First LNG Bunker Terminal

By George Backwell

Tuesday, August 19, 2014

*Liquiline says it has entered into a contract with Fjord Line to design, construct and commission an **LNG ship bunkering** terminal for Fjord Line AS at the Port of Hirtshals, Denmark.*

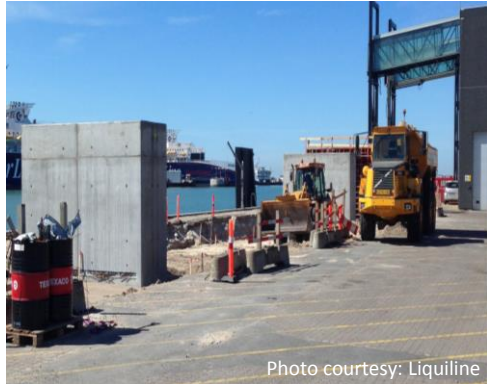
The terminal will be constructed at the Port of Hirtshals, where Fjord Line operates a daily service with one of its two LNG-fuelled cruise

ferries *MS Stavangerfjord* and *MS Bergensfjord*. This will be the first LNG ship bunkering terminal in Denmark.



Port of Hirtshals scene: Photo Liquiline

Pictures from the work on site



LNG Logistics



- By road



- By sea



- By rail



 **Liquiline**

LNG Logistics

LiquiSys® (www.liquisys.com)

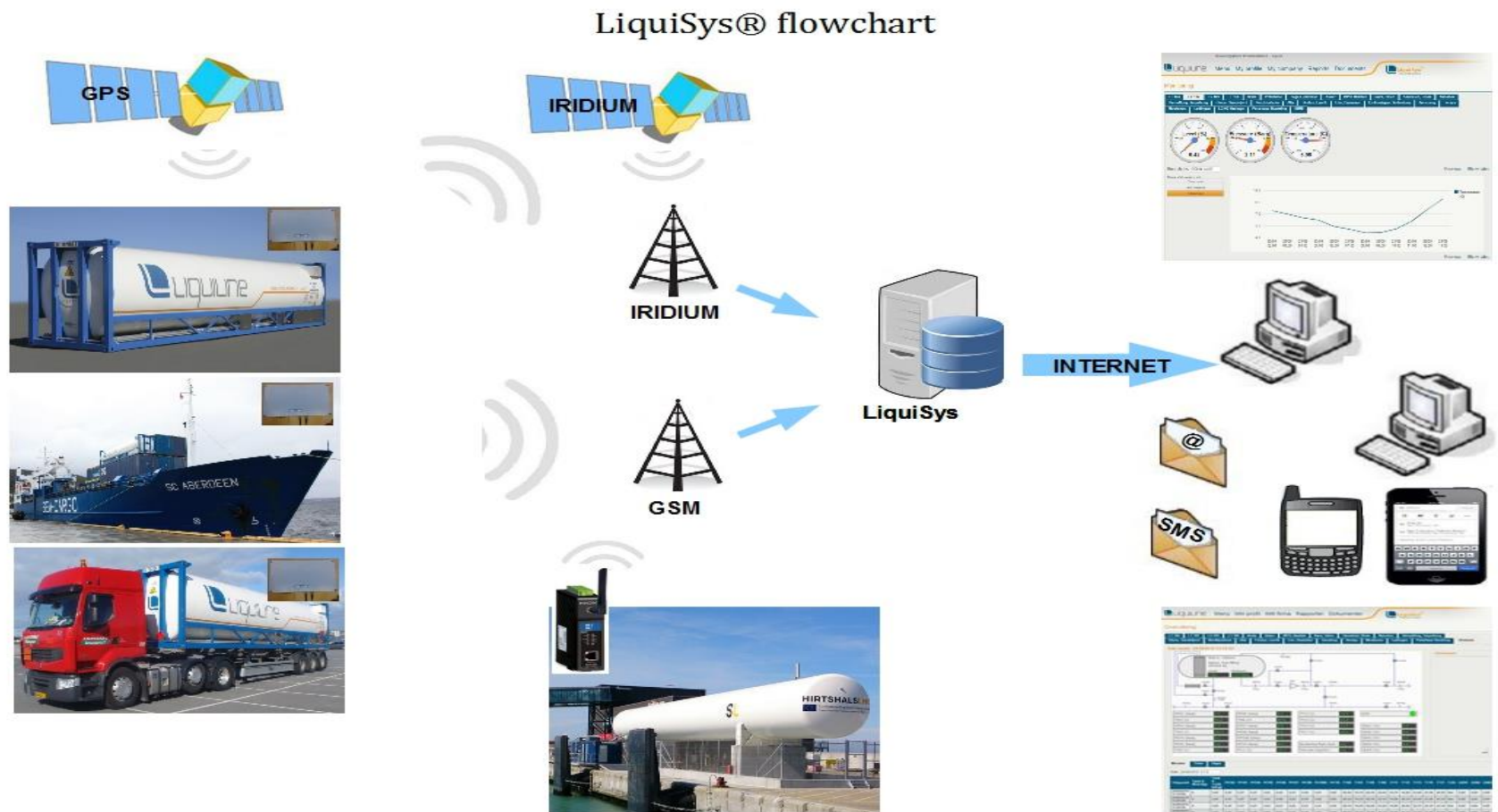
LiquiSys is a remote monitoring solution for the LNG industry and provide web access to terminals and containers

Monitoring process values and equipment status

- Remote control of equipment
- Alarms displayed on screen
- Alerts sent by SMS or e-mail
- Historical data displayed as trends and digits




LiquiSys® - Flowchart



LNG training





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