TINV / MarTech LNG
LNG Bunkering – From idea to operations
Copenhagen, 22 October 2013
About Liquiline

- LNG Midstream operator
  - Leading LNG container operator
  - Designer and supplier of terminals
- Technology developer
  - 20% of resources used on R&D
  - Provided as part of our LNG services
- Independent of LNG suppliers
- ISO 9001:2008 certified by DNV
An LNG Midstream partner
LNG from point-of-source to point-of-use

LNG Wholesaler → LNG Sourcing → LNG Transport → Receiving Station → Gas use

Wholesaler X → Bunkering solution → Shipping

Wholesaler Y → Filling station solution → Transport

Wholesaler Z → Regasification solution → Industry
Geographical presence

- **Head office**: Bergen (HQ)
- **Regional offices**: Bergen (HQ), Vancouver, Singapore
- **Geographical focus areas**: North America, Europe, Asia Pacific

**Legend**:
- Orange dot: Head office
- Black dot: Regional offices
- Blue circle: Geographical focus areas
Some reference projects
LNG supply and LNG Logistics

Photo courtesy: Liquiline

Photo courtesy: Liquiline

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Some reference projects
LNG Terminals
LiquiTainers

- ISO pressure tanks with super insulation and vacuum
- The inner tank stainless steel or aluminium
- The outer tank steel (carbon)
- 45’ (55m3, 22 tons load LNG)
- 40’ (43m3, 17 tons load LNG)
- 20’ (20 m3, 8 tons load LNG)
- Holding time until 80 days
- Extremely robust to physical damage
Some of our clients

gas producers and distributors, transportation comp., offshore supply bases, industrial companies, shipping, ferries etc
LNG Bunkering
From Idea to Operations
Liquiline’s LNG terminal process

1) FEED (Front-End Engineering & Design)

2) Turn-key delivery/EPCIC-contract
   i. E – Engineering
   ii. P – Procurement
   iii. C – Construction
   iv. I – Installation
   v. C – Commissioning

3) Operations
   i. Training and LNG exercise
   ii. Daily operations
   iii. Service and Maintenance
FEED
Front-End Engineering & Design

- PFD: Process Flow Diagram
- EFD: Electrical Flow Diagram
- MCL: Mechanical Component List
- ECL: Electrical Component List
- GA: General Arrangement/2D
- CL: Conceptual Layout/3D
- CCE: Complete Cost Estimate
- EX: Ex zones
- RA: Risk Analysis
- DB: Design Basis
Detailed Engineering

- PID: Piping & Instrument Diagram
- Hazop: Hazardous Operations
- GA: General Arrangement/2D
- GA: General Arrangement/2D
- CL: Conceptual Layout/3D
- EX: Ex zones
- TCL: Total Component List
Procurement
Construction

- Civil Work
- LiquiStation™/ Process building
Installation

- Mechanical installation
- Electrical installation
Commissioning

- Testing of LiquiStation™ process system in work shop
- First time bunkering of LNG from the terminal
Take-over – Having a satisfied customer
Bunkering solutions

Direct loading
Bunkering solutions
Multiple loading facility

• Engineered solution for direct loading from containers/trailers to ship
• Can fill from two containers/trailers simultaneously
• Designed by Liquiline
Bunkering solutions
Onsite storage tank

- Bunkering terminal with onsite storage tank
- Civil work and process system etc built for tank no 2
- Turn-key delivery by Liquiline, i.e Engineering, Procurement, Construction
- Liquiline has maintenance contract for facility
- Liquiline provides LiquiSys for all parties involved

Photo courtesy: Liquiline
LNG Operations
Training and LNG exercise
LNG Operations
Daily operations

- Monitoring of terminal by use of LiquiSys® Terminal system
- Planning logistics by use of LiquiSys® Logistics system
- Daily operations normally done by trained local company or customer
- Prepare and carry out the bunkering work
- Look through the terminal (see, smell, hear)
LNG Operations
Service and Maintenance

- Monthly Service
- LiquiSys Terminal System
Terminal possibilities
Supply gas locally

- Set up vaporisation solution in connection with bunkering terminal
- Deliver natural gas to local consumer
- Deliver natural gas to local gas distribution pipeline
Terminal possibilities
Supply CNG and LNG as fuel

- LCNG station in Häggvik Stockholm, Sweden
- Delivering CNG to cars, taxis and garbage trucks
Still some challenges – but we have the solutions....
What comes first?

- Challenge:

  *Without bunkering terminals, no LNG-fuelled ships.*
  *Without LNG-fuelled ships, no bunkering terminals*

**Early bird solution:**

- LNG can be supplied directly to the ship from tank containers.
- LNG can be supplied from quay-side or from bunker barge.
- If required and as volume picks up, a bunker terminal can be established nearby.
Unpredictable volumes

- **Challenge:**

\[
\text{The LNG volume will be unpredictable}
\]

- **Flexible volume solutions**
  - As LNG volume increases, several tank containers can be connected to a manifoil to supply LNG directly to the ship.
  - Pumping solutions can be designed for future discharge increase
Lack of LNG tanker ship

• Challenge:
  – There are no LNG tanker ships available. It is therefore not possible to get LNG to our ship.

• Logistics solutions:
  – LNG can be supplied with containers
  – Liquiline’s tank containers are approved for road, rail and sea transport
  – Can find the most cost-efficient distribution solution
  – Liquiline has developed LiquiSys® Track-and-Trace™, which allows for remote monitoring of the tank container
Possible high opex

• Challenge:

The economics of the bunkering terminal does not allow for a large operational organisation etc

• Opex solutions:

– Start out with tank containers
– The bunkering terminal can be designed for unmanned operations
– The terminal can be supplied with a remote monitoring system. LiquiSys® Terminal system is one such system
– The safety system of the terminal can be designed so that it goes into shut-down in case of ESD, and alarm system reports to relevant personnel
Lack of competence

• Challenge:

We have little or no knowledge in cryogenic gases in general and LNG in particular

• Training solutions:
  – Give proper in-house training in LNG and natural gas
  – Carry out exercises with actual LNG
  – Carry out emergency exercises prior to start-up of operations
Summary

- LNG for ships is a proven concept
- It is a thorough process to go from idea to operations
- There are various solutions for setting up a bunkering solutions
- And...with a bunkering terminal in place, one can also supply gas locally, supply CNG or LNG as fuel for cars, taxis, buses, trucks etc.
Liquiline offers

• LNG Sourcing
• LNG Transportation
• LNG Storage and «Plug & Play» process stations for terminals
  – LiquiStationBulk
    • Bunkering terminal for shipping industry
  – LiquiStation Fuel
    • Filling stations for transport industry
  – LiquiStation Vap
    • Vaporisation terminal for process and energy industries
• LNG technical consultancy services
Thank you!

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