Small Scale LNG Solutions for distribution in Indonesia

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GTT in brief

- An engineering company with more than 50 years of experience in the design of the Membrane Cargo Containment Systems

- GTT is a public company listed on the Euronext Stock Exchange (Paris)

- 111 projects (LNGC, VLEC, FSRU, FLNG, barge and GST) currently on order

- Around 380 highly qualified people (1), present worldwide

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GTT solutions over the LNG value chain

- From small scale to large scale

- Tanks for land based terminals
  - Regasification and liquefaction plants
  - In-ground
  - Above ground

- Floating storage solutions
  - Regasification and liquefaction plants
  - Open sea
  - Quay side

- Shipping
Small Scale LNG

- **Eastern part of Indonesia**
  - Projects for power generation
  - Very small demand in many islands
  - Remote locations
  - Interest in small-scale network

- **Constraints**
  - Compatibility with loading / unloading terminals
    - Dedicated pier for small LNG?
    - Existing jetty:
      - Maximum ship length
      - Fenders: minimum flat part for the side shell
      - Manifold arrangements
    - Water Depth / shallow draft issues
    - Tug assistance
  - Distance between terminals
  - Operating pressure (BOG management)
Ship concepts
Key features

- Better economics
  by maximizing scale effects

- Flexibility in operations
  by allowing any LNG quantity to be delivered to multiple clients

- Shallow water constraints
  by proposing innovative low draft solutions

- Safety and reliability requirements
  by relying on proven systems
Shallow Draft LNG Carrier

- Modularity of membrane systems for flexible and optimized solutions

- Tank shape customized to fit a particular hull

- A design of a small scale LNG Carrier with a shallow draft is then possible, with a large cargo capacity

- A shallow draft carrier is fit for regional distribution:
  - Easy access to many harbours
  - Coastal and river access
  - Large LNG volume

15,000m³ LNGC « standard » design
Draft = 6.5m

16,500m³ LNGC shallow draft design
Draft = 4.8m
Shallow Draft LNG Carrier

**HULL:**
- $L_{bp} = 126\text{m}$
- $B = 28\text{m}$
- $D = 11.7\text{m}$
- $T_{max} = 4.8\text{m}$

**CARGO TANKS:**
- Capacity = $16,500\text{m}^3$
- Number of tanks = 2
- BOR (LNG) = 0.200%V.p.d.

**PROPULSION:**
- DF-DE
- Speed = 12.5kts
- Twin-screw / Fixed pitch

**Manoeuvring:**
- Twin propeller solution with high-lift rudders
- Forward thruster with high thrust for independent manoeuvring
- “Crabbing” possible if reduced tug support

**Visibility:**
- Forward wheelhouse for better visibility

**Design Approved by ABS and CCS**
Shallow Draft LNG Carrier – 6,000 m³

**Hull:**
- $L_{bp} = 92.55\text{m}$
- $B = 20.7\text{m}$
- $D = 12.20\text{m}$
- $T_{des} = 3.7\text{m}$

**Cargo Tanks:**
- Capacity = 6,200 m³
- Number of tanks = 2
- BOR (LNG) = 0.250\%V.p.d.

**Propulsion:**
- DF-DE
- Speed = 11 kts
- Twin-screw / Fixed pitch

▶ **Manoeuvring:**
- Twin propeller solution with high-lift rudders
- Forward thruster with high thrust for independent manoeuvring

▶ **Forward wheelhouse for better visibility**

▶ **Partial fillings possible**
Design parameters - Sloshing

- Indonesian waters navigation conditions
- China sea navigation condition
- Partial fillings: between 10%H and 70%H

Small scale membrane vessels can be operated at all filing levels in South East Asia
Design parameters - Sloshing

Any volume of cargo can be transported with membrane small scale ships

- Adequate cargo tank reinforcement
- Suitable for milk run operations

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<th>Mark</th>
<th>NO96 Max Ultra</th>
<th>NO96 Max Giga</th>
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<td>70H</td>
<td>10H</td>
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<tr>
<td>210kg/m³</td>
<td>10H</td>
<td>70H</td>
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Tug and Barge: combining shipping and storage

**Principle “Drop and Swap”:**
- Barge loaded at the conventional LNG plants
- Loaded unit shipped in with a tug and moored
- The barge provides storage
- As the barge is emptied, another full one could be shipped in

**Remarks:**
- Very shallow draft
- But limited sea-keeping ability and speed
- No need for onshore tank, but two barges
- Less cargo transfer operations (only at loading terminal)
- Crew of a tug boat, not the one of an LNG carrier
2,200 m³ LNG barge

Main parameters:
- LOA: 64.6 m
- B: 14.8 m
- Draft: 2.6 m
- Tonnage: 1,440 GT
- Speed: up to 8 knots

Cargo:
- 2,200 m³ (100%)
- 2.066 m³ deliverable volume
- 4.5 hour full transfer time

Late February 2015, GTT received an order from Conrad Orange Shipyard for this 2,200 m³ LNG barge for the US market

AIP Received from ABS and DNV-GL
FIRST LNG Bunker Barge in the US

Bunkering Services to TOTE's New 3100 TEU LNG-fueled container ships.


Shipyards involved:
- GTT North America
- GAS Entec
- Clean Marine Energy
- CONRAD SHIPYARD

Designer:
- ABS

Class Society:
- United States Coast Guard

Shipowner & LNG Customer:
- TOTE Marine

Safety Excellence Innovation Teamwork Transparency
Barge under construction

Pictures: courtesy of CONRAD SHIPYARD
Indonesian yards and GTT membrane tanks

The following industrial scheme can be envisioned:

- Indonesian yards able to propose GTT membrane tanks for the LNG projects
- Indonesian yard responsible for the steel works, accomodations, HVAC, general integration…
- Cargo tanks construction is subcontracted to an outfitting company
Role of the outfitting company

“Outfitters” provide service for membrane erection to shipyards interested in proposing membrane solutions without any investment

The outfitting company is in charge of:
- Engineering works linked to the tanks and cryogenic equipments (from GTT)
- Procurement of cargo tank components
- Qualified workers for special tasks (flatness, welding…) of containment system
- Supervision of local workforce for insulation works
- Cryogenic piping outfitting (eventually)
- QA/QC
- ...
- The interface between the yard and GTT

Local company can be considered for membrane testing during construction
Conclusion

Several constraints to be considered for small scale LNG

- Cost effective, compact designs
- Best ratio of Cargo volume vs Gross tonnage
- Improved Harbour access
- Compatibility with existing infrastructures (jetties, storage tanks…)
- Full cargo-range : any LNG quantity can be delivered
- Pressure-rise (up to 0.7 bar) can be implemented for more flexibility

Several options to be investigated for efficient small scale LNG chains

- Milk-run deliveries
- Shallow draft vessels
- Barges for transportation and storage
- Modular onshore tanks

GTT membrane solutions are well adapted to small and mid scale applications
Thank you for your attention

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