LPG: the green pathway demystified

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Safety of LPG fueled ships

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Move Forward with Confidence
Two philosophies for E/R design

GAS SAFE ENGINE ROOM

EMERGENCY SHUTDOWN
LPG pipes are smaller and non-cryogenic
Double-walled gas piping system

- **Design 1** – No leakage

- **Design 2** – Leakage to inert gas

- **Design 3** – Leakage to air
  Ventilation 30 air changes/hour. Air inlet is to be from the open deck. LPG detector at the fan discharge

- **Design 4** – Leakage to vacuum
  Vacuum in the annular space
Tank location – Deterministic rule IGF §5.3.3

- Minimum distance from ship side B/5 or 11.5 m whichever is less
- Passenger ships: B/10 but greater than 0.76 m.
- Minimum distance from bottom line: B/15 or 2 m whichever is less

Distance from side shell greater than 800 mm
Filling limits for LPG tanks

► The filling limit of an LPG tank must ensure that the inlet of the pressure relief valve(s) will always remain in the vapor phase at list of 15 degrees, trim 0,015L.

► Shape of the tank, arrangement of the pressure relief valve(s), accuracy of level and temperature gauges and the difference between loading temperature and reference temperature (@ vapor pressure at the set pressure of the relief valve) must be considered.

► LPG has high volumetric expansion which is why LPG storage tanks and should never be allowed to become liquid full.

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\text{filling limit} = 98\% \frac{\rho_R}{\rho_L}
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Philosophy of a safe design for LPG-fueled ships

- Risk based approach-ISO 31010, – Risk assessment techniques
- Achieve safety level equivalent to the conventional oil-fueled vessel.
- Minimize connections, tight joints. Increase reliability and redundancy.
- Passive protection: No ignition sources
- Active protection: gas detection, ventilation, isolation, air locks
- LPG vapor management & LPG bunkering
THANK YOU FOR YOUR KIND ATTENTION

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LPG
the green pathway demystified

Webinar Riviera
– Tuesday 24th. of November 2020, 14:00 GMT

SEACRP
Retrofit Projects
MAN PrimeServ Copenhagen
2020

MAN PrimeServ
The Very Large Gas Carriers (LPG) take lead
- lowering all emission types significantly

Vessel FACTS:
BW Gemini, 84,000 cbm VLGC, Owner BW LPG
Main Engine 6G60ME-C9.2 - 12,400 kW,
- built in 2015 to be fueled with HFO
- converted in 2020 to be fueled with LPG
- first LPG fueled vessel in the world
- 11 sister vessels will also be converted to LPG

Compared to OIL - LPG provide significant emission reductions:
- SOx by 99%
- CO2 by 15%
- NOx by 10%
- PM by 90%
Bunker Fuel Price

$/GJ

Fuel Price
$/GJ

$/GJ

HFO (Rotterdam)
MGO (Rotterdam)
Ammonia
(Yuzhnny Export)
ULSFO 0,1%
(Rotterdam)
VLSFO 0,5%
(Rotterdam)
HFO (Rotterdam)
LNG (US Export)
LNG (Asia Import)
VLSFO 0,5%
(Rotterdam)

Data retrieved end September 2020, Dept. EELC

Source: Bunkerindex, Ship&Bunker, Clarksons & EIA

*Ammonia’s calorific value is 17.2 MJ/kg
Could other vessel types benefit from LPG as fuel?

- Tankers would be the natural choice due to already established EX zones on deck

**Vessel data according to Clarkson**

- Crude Tankers (2179 vessels)
- Pan/Aframax (757 vessels)
- Product tankers (9222 vessels)
- LR2 and LR1 (767 vessels)

**LPG conversion possible:**
- + 300 tankers - engines as the VLGS’s
- + 200 tankers - delivered after 2016

**New Building – LGIP engine types ready:**
- Crude >> Pan/Aframax
- Product >> LR1/LR2

○ “Converting or building a new vessels with LPG as fuel - will lower CO2 emissions with app 3000 tons per year per vessel
○ 150 LPG fueled vessels develop a 1Mt LPG market and save the world for 450,000 tons CO2 emissions per year”
LPG bunker supply chain in place

Two options:

- SIMOPS at combined Product/LPG piers
- STS bunker WW + 350 LPG carriers with a capacity of 2k – 5k cbm
- WW pricing index available in $/ton (Argus)
Thank you

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2020
Disclaimer

All data provided in this document is non-binding. This data serves informational purposes only and is especially not guaranteed in any way. Depending on the subsequent specific individual projects, the relevant data may be subject to changes and will be assessed and determined individually for each project. This will depend on the particular characteristics of each individual project, especially specific site and operational conditions.
LPG as Marine Fuel

The alternative bunker fuel for the next decades

- LPG non-Renewable – Already a long way ahead on the Green Pathway
  - Compared to 2020 compliant fuels
    - 99% less SOx
    - 15% less CO2
    - 10% less NOx
    - 90% less particular matter PM
  - Meets IMO 2020
  - Not a GHG, greatly supports IMO 2050 GHG strategy
  - More than 40 VLGCs being prepared now for LPG propulsion
LPG as Marine Fuel

Only advantages

Source: Bureau Veritas
LPG as Marine Fuel

Renewable LPG, BioLPG – Already in the Market

• A “drop in” fuel replacement, same molecule, no equipment changes

• World: 50% at least of 2050 non-chemical demand to be covered by rLPG

• Europe: 100% of 2050 non-chemical demand to be covered by rLPG
LPG as Marine Fuel

The alternative bunker fuel for the next decades

- Renewable LPG, BioLPG: Produced through a variety of technologies, primarily HVO at present
- Feedstock: A mix of wastes, residues, sustainably sourced vegetable oils
LPG as Marine Fuel
Renewable LPG, BioLPG

Up to 80% of carbon emissions can be reduced by switching to (bio)LPG

Why BioLPG is better fuel choice for the environment
LPG as Marine Fuel

Worldwide production and availability - although still limited
LPG as Marine Fuel

In Summary

- LPG, the proven alternative marine fuel for the next decades - a transition fuel forever
- A pathway to net zero carbon future
  - Zero carbon with carbon capture
  - Zero carbon with potential simple transition to ammonia
- Renewable LPG, BioLPG – the great cherry on the cake
- WLPGA – the support for all stakeholders
LPG as Marine Fuel

Thank You

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