LNG AS TRANSPORT FUEL

Lauran Wetemans
GM | Downstream LNG | Gas to Transport

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No single alternative to oil based heavy duty transportation...

MOSAIC OF FUEL AND VEHICLE OPTIONS

There is no “silver bullet”

Countries and regions will choose different portfolios

Fuel and drive train options will also vary within countries

Oil currently dominates the transport sector

All fuel options and drive trains will be needed – Including Hydrogen, and E-mobility

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For energy density & handling reasons, LNG fits best with long-haul heavy duty commercial fleet segments, while CNG is preferred side-by-side for private & small commercial applications.

Claims on GHG reductions are based on well-to-wheel analysis done by GIAT taking into account: Combustion engine type, source of gas and the supply chain distance. The W2W data is market specific and therefore varies under specific conditions.

- LNG fuel enables switch to engine technology that lowers local emissions (SOX, NOX, Particulate matter)
LNG AS TRANSPORT FUEL OFFERS MATERIALITY...

1. Different scenarios indicate material demand:
   - 10 - 45 MTPA (2020)
   - 30 - 160 MTPA (2030)

2. By 2030, LNG penetration between 6-16% of all transportation fuels across key segments.

3. D-LNG ambition is 6-10 MTPA (2020)
   - 15-25% of traditional LNG volumes
... LNG CAN SERVE MULTIPLE MARKET SEGMENTS...
SHELL’S INTEGRATED MODEL IS A GAME CHANGER

- LNG Project
- Stranded Gas
- Coal Bed Methane
- Pipeline Gas
- Extended Well Test
- Small scale liquefaction
- Existing LNG Infrastructure
- Global Marine, ECA
- Heavy Duty Road Transport
- Mining
- Rail
- Stationary Power

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LNG OFFERS COMPELLING ENVIRONMENTAL BENEFITS...

**WELL-TO-TANK**
- Key factors:
  - Gas Origin
  - Liquefaction Efficiency
  - Transport Distances

**TANK-TO-WHEEL**
- Key factor: Engine Efficiency
- 65% - 85%

**WELL-TO-WHEEL**
- Lifecycle CO₂ emitted by the energy supply chain
- 100%

1. **INTERNAL STUDIES**
   - (By up to 25% savings)

2. **COLLABORATION WITH OEMs**
   - (e.g. Volvo / Wartsila)

3. **INFLUENCE POLICY MAKING**
   - (TNO report in NL)

SAE paper published in collaboration with Volvo, outlines up to a 25% savings in GHG emissions

**Regulation of SOx emissions**

1. **VIRTUALLY ZERO SOx / PM**

2. **REDUCED NOx**

Source: Worldo

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DIFFERENT MARKET ARCHETYPES EXIST...

Regional Drivers

Price arbitrage

Environmental regulations

Growth

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SOLVING THE CONVERSION DILEMMA...

Age of Fleet
Funding
Refuelling Infrastructure
Operating Standards
Pricing
Reliability
Fuel Cost
Maintenance
Emissions
Compliance
Reputation

DELAY
ACCELERATE

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WHAT ENABLERS WILL FOSTER ADOPTION?

1. CUSTOMER ECONOMICS
2. REGULATIONS
3. POLICY & INCENTIVES
Q & A