LNG as Marine Fuel
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LNG already has 6% of marine fuel market

> 300 LNG ships use 12 MMt/yr LNG

Bunker market potential
(180 MMt IFO + 55 MMt MGO) = 185MMt/yr LNG
Objectives

- Examine drivers
- Alternatives to meet MARPOL Annex VI
- Availability and cost of LNG as marine fuel
- Potential LNG demand
- Alignment on issues
- LNG Marine fuel business model
MARPOL Annex VI Sulfur rules should drive to LNG, but are creating uncertainty
For the ship owner LNG has to be cheaper than low sulfur diesel and scrubbers

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<th>MDO MGO</th>
<th>IFO + scrubbers</th>
<th>LNG</th>
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- Major hindrance
- Slight hindrance
- No issue
Largest bunker ports: located on busy shipping routes

- 1 Barrel = 5MMt
- ECA Zone
..but limited overlap of LNG facilities and bunker ports

Ports with access to pipeline gas can use small scale liquefaction to produce LNG – but increases costs
Price difference between gas price and fuel oil is a driver in North America and western Europe.

**Fuel Oil vs. Natural Gas Prices Projection**

- Brent
- Asia Long-term LNG
- Natural Gas
- Henry Hub
- MDO
- IFO

Economic driver more powerful when Sulfur rules imposed

*Source: Poten & Partners*
LNG competitive in the North America

![Chart showing LNG costs and comparisons](chart.png)

- **USA**: Lower LNG costs compared to Europe and Asia.
- **Europe**: Higher LNG costs but with significant port Capex/Opex.
- **Asia**: Highest LNG costs, impacting overall competitiveness.

Legend:
- MGO Price Rotterdam
- IFO Price Rotterdam (inc. scrubber)
- Port Capex/Opex
- Cost of LNG for Newbuild
- Feedgas Cost/ LNG Cost
“Chicken-and-Egg Problem”
Ship owners and ports need to invest

MARPOL

Port Developer
- MGO / IFO bunkering
- Construct LNG facilities

Ship Owners
- Shift to MGO
- IFO + Scrubber
- LNG Fueled ships

What is stopping them?
Projected LNG fuel demand impacted by Annex VI implementation

- Low (No Global Sulfur Limitation)
- Base (Global Sulfur Limitation by 2025) (regional initiatives)
- High (Global Sulfur Limitation by 2020)
LNG supply can meet marine fuel demand

LNG bunkering fuel consumption projection

- LNG short term trade
- LNG long term contracts

LNG bunker requirement
Alignment on issues will increase LNG demand

- Regulatory Regime
  - 2020 or 2025?
  - New ECAs?

- LNG Infrastructure
  - Bunker facilities
  - Small scale LNG
  - Shared facilities

- Economics
  - Global or Regional LNG prices?
What business model will make LNG a viable marine fuel?