SEA-LNG

LNG for Maritime Transportation: a Global Perspective

AAPA – Harbors & Navigation Committee
18th November, 2020
Our Membership

Industry-leading companies from across the globe who share our vision for and are committed to LNG as a marine fuel for cleaner shipping.
Whole Value Chain Represented
Our Strategy

1. Develop independent, fact-based analysis on the commercial, environmental and operational benefits of LNG as a marine fuel

2. Communicate our work to all stakeholders in the global shipping industry

3. Undertake targeted engagements with key decision-makers in industry, the finance sector and regulatory bodies

We do this by working collaboratively with our highly impactful membership, other industry associations, academic institutions, policy makers and the wider maritime community
Providing Answer to Key Issues

- Emissions
- Decarbonisation
- Commercial
- Availability
- Bunkering
- Safety
- Consumer Pressure
- Global Fleet
Key messages
Drawn from our research

• Unparalleled local emissions benefits (SOx, NOx & PM)
• Delivers immediate GHG emissions reductions, now
• Methane slip is a recognized issue and is being addressed
• Commercially viable and operationally proven
• Provides a pathway for long term decarbonisation via liquefied bio- and synthetic methane
• No magic bullet for shipping industry decarbonisation – all options need to be on the table
• LNG is complementary to the development of other Alternative Fuels such as ammonia and hydrogen
LNG uptake as a marine fuel is accelerating

LNG: increasing BV capacity

Bunker Vessel Development

Bunker Vessel Capacity m3

Waiting no option

LNG engine technology is:

- safe, with millions operating hours experience
- mature, used as a marine fuel for over 50 years
- commercially viable, readily available
- scalable, bunkering available at major ports
- fully compliant with ECAs around the world
- no ocean contamination from marine fuel spill accident
- eliminates SOx pollution preserving human health
- reduces NOx emissions by 95%, Particulate Matter emissions by nearly 99%
- cuts GHG emissions by up to 21% on well-to-wake basis, 28% on a tank-to-wake basis
- zero-emissions potential through bio and synthetic sources of gas
LNG offers immediate GHG emissions reductions

- Up to 28% reduction in GHG emissions on a Tank-to-Wake basis inclusive of methane slip
- LNG plus EEDI improvements can meet IMO 2030 decarbonisation target for new builds
- Further reductions available with bioLNG as a drop-in fuel

### 2-stroke slow speed engines: WtW - GHG IPCC -AR5

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<th>Fuel Type</th>
<th>Engine Type</th>
<th>Supply</th>
<th>Combustion</th>
<th>Total CO(_2) eq/kWh engine output</th>
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OEMs addressing CH$_4$ slip

GHG emission reductions 1998-2018

Efficiency improvement and methane slip development on medium speed 4-stroke Otto combustion low-pressure gas engines and some of the enabling technologies. (Source: SGMF, Wärtsilä, MAN ES, Caterpillar & WIN GD)
LNG offers a decarbonization pathway via liquefied biomethane & synthetic methane

- Liquefied biomethane (LBM) is scalable
- LBM is globally available
- Availability of liquefied synthetic methane (LSM) will depend on build-out of renewable electricity capacity
- LBM and LSM are likely to be commercially competitive
- LBM and LSM can be used now

Source: CE DELFT study, https://sea-lng.org/our-work
LNG is already competitive as a marine fuel

Compelling Investment Case: most financially effective long-term

Best ROI on NPV basis over conservative 10 year time horizon

- Diminishing CAPEX hurdle
- Competitive energy costs
- Cost of LNG is stable
- Modelled investment case for 14K TEU newbuild container vessel

Fast pay-back period – under 2 years

LNG can offer competitive finance advantage

Average of +7 years compliance with Poseidon Principle loan requirements

Source: LNG AVERAGES 7 EXTRA YEARS ADDITIONAL COMPETITIVE ADVANTAGE FOR POSEIDON PRINCIPLE LOANS, https://sea-lng.org/news-views/
The Value of LNG as a Marine Fuel

- LNG is a clear winner on Air Quality essentially eliminating SOx and dramatically (90%+) reducing NOx and PM thereby improving human health
- LNG offers a Decarbonization pathway with EEDI to 2030 and through Bio and Synthetic Methane to 2050
- Proven Safety record over 50 years operationally
- LNG is Available Now and Scalable
  - Global Supply far exceeds marine fuel demand
  - Existing global bulk infrastructure well aligned with major shipping routes
  - “Last Mile” bunkering infrastructure building out fast in most major bunkering ports
  - Bunker vessels - Over 30 expected in operation in the next two years
- LNG is the only alternative fuel that can enable the shipping industry to remain competitive while phasing-out emissions this century.
LNG: a cleaner future

✓ LNG continues to be the only viable option that is safe, available, competitive, improves air quality while reducing carbon

✓ The pathway to the future using BioLNG and eventually synthetic products is clear

✓ Alternatives are decades away and “waiting is not an option.”