TGE MARINE

Fuel Gas Supply Systems (FGSS): Enabling the Transition to Cleaner Marine Fuels



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Greener Shipping Summit – November 2026

THE GAS EXPERTS | Innovations for Greener Shipping

Agenda

1. Company Introduction
2. LNG Fuel Supply Systems
3. Bio LNG, SNG and Ammonia Fuel Supply Systems
4. Summary

Company Introduction

THE GAS EXPERTS – Innovations for Greener Shipping
YOUR RELIABLE PARTNER FOR LIQUID GAS SYSTEMS

Over 45 years of experience with more than 250 gas carriers and 100+ fuel gas systems contracted.

Shareholder: Mitsui E&S Holdings Co., Ltd. Japan

Address: **TGE Marine Gas Engineering GmbH** Bonn • Germany

TGE Marine Gas Engineering Technology (Shanghai) Co. Ltd., Shanghai • China

Web/LinkedIn: https://www.tge-marine.com / https://www.linkedin.com/company/tge-marine

A Strong Team: Combined Innovation Power

Shareholder

MITSUI E&S













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Our Product Range

FGS Fuel Gas System



Gas Carrier Gas Carrier



Bunker Vessel Bunker Vessel



Floating Unit Floating Units



CO_2 CO_2 Carriers



NH_3 NH_3 Carriers & FGS



Fuel gas systems	Cargo handling system and tanks			CO_2 Carrier	Ammonia Carrier & FGS
• Type C LNG tanks or vacuum insulated type • Gas processing system • LNG, LPG, Ammonia and alternative Fuels	• LPG carrier • Ethylene carrier • LNG shuttle tanker • Other Gas carrier	• Bunker vessel	• FS(R)U and F(P)SO	• Shipping of and floating solutions for CCS	• Ammonia shuttle tanker • Ammonia fuel gas systems

- Class Approvals
- Type C Tanks
- Naval Architecture
- Engineering
- Procurement
- Construction Supervision
- Project Management
- FEED Studies
- Training
- After Sales
- Service & Support
- Operation Support

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TGE's Tank fabrication expertise

TGE Marine is a world leading contractor for fabrication and delivery of cargo tanks.
More than 480 cylindrical, bi-lobe or prismatic cargo tanks are contracted to date.

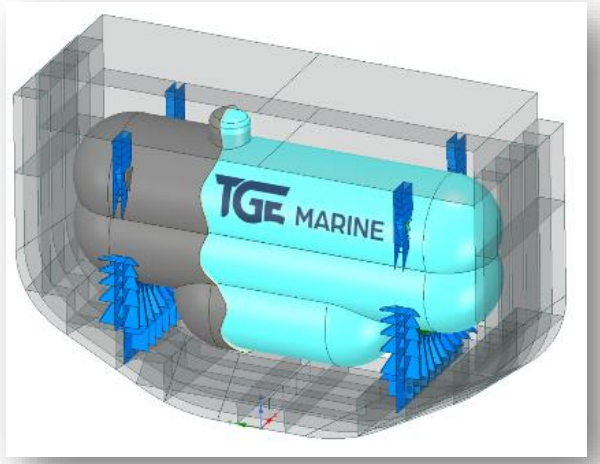
Tank materials: 9% Ni steel, 5% Ni steel, 0,5% Ni steel, LT-carbon steel, high strength steel, stainless steel (304L, 316L)
Total net steel weight more than 120,000 tons.

In close co-operation with its fabrication partners TGE Marine has delivered tanks from China to Korea, Japan and Europe.
TGE Marine co-operates for vacuum insulated tanks with experienced tank suppliers.

TGE Marine's scope of services for type C tanks:
- Tank design with classification approval
- Supply of all materials (if requested)
- Supervision of fabrication
- Delivery of tanks with classification certificate to the shipyard









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LNG — The fuel, with many ways forward

Cleanest fossil fuel

Good availability

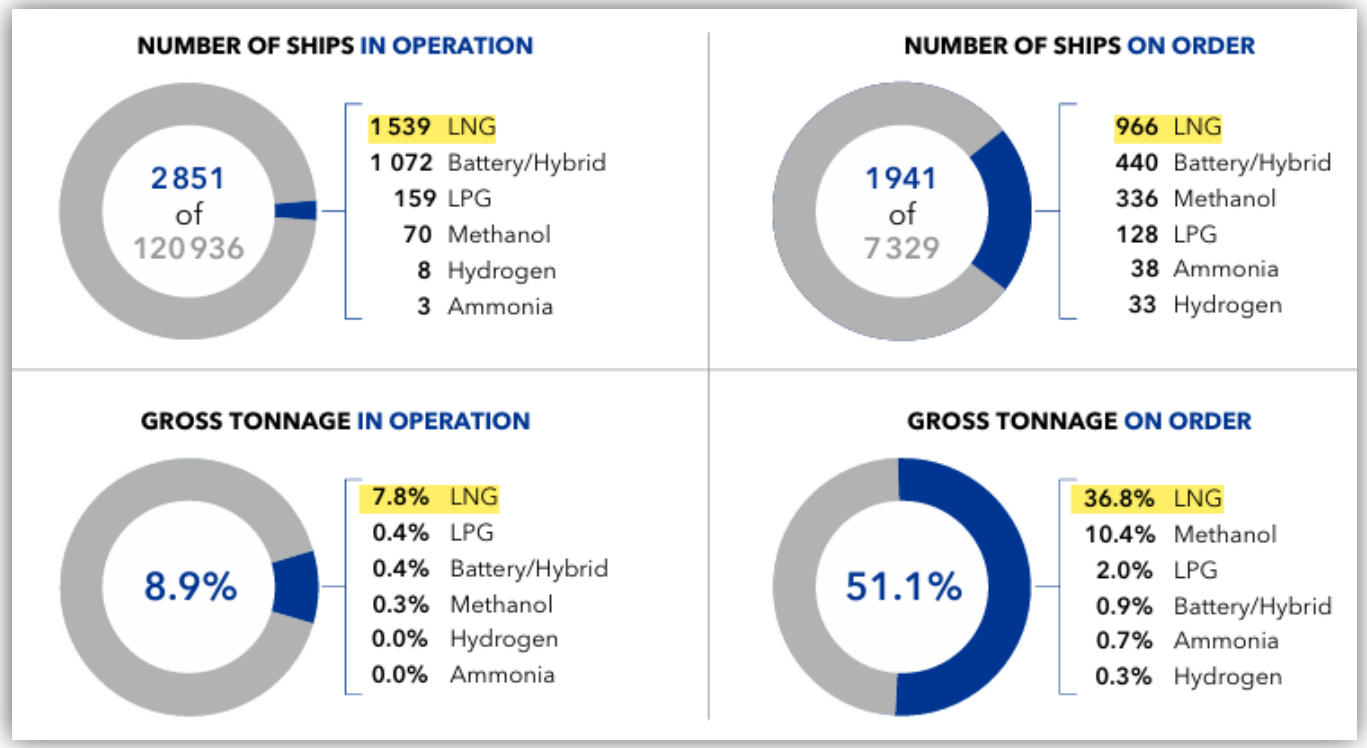
Less CO2 emissions
(compared to oil-based fuel)

Bio-LNG and SNG are becoming increasingly available (blending possible)

FGS NH3 Gas Carrier Bunker Vessel Floating Unit CO2

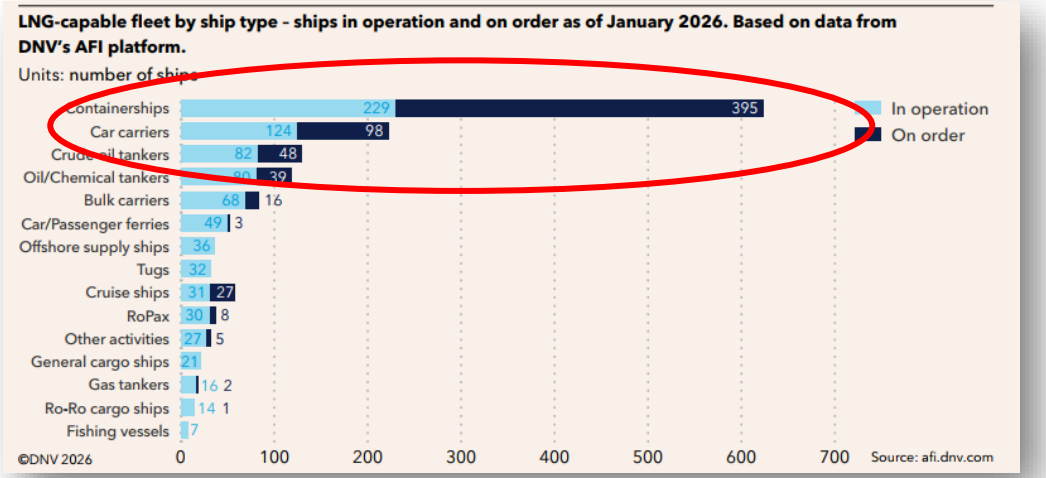
LNG as Fuel is state of the art

Alternative fuel technology uptake in the world fleet



Sources: DNV Maritime Forecast to 2050, S&P Global, Alternative Fuels Insight (AFI) - afi.dnv.com, as of August 2025

LNG fueled fleet by vessel type



Source: DNV 2026

Containerships
229 in operation
395 on order

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First Mover with Fuel Gas Supply Systems…

References for 100+ Fuel Gas Supply Systems

- LNG low pressure systems (4- stroke)
- LNG medium pressure systems (WinGD)
- LNG high pressure systems (Everllence ME-GI)
- LPG systems
- Ethane system
- 5 conversion projects from oil-based fuels to LNG















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Bio-LNG vs. Renewable SNG / e-LNG

Same onboard methane platform — different upstream pathway, scale and carbon case



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COMMON SHIP INTERFACE — **LNG fuel tanks • FGSS • engines • bunkering infrastructure** — *Drop-in methane pathways*

COMPARISON	BIO-LNG — Liquefied biomethane	SNG / e-LNG — Renewable synthetic methane
PATHWAY	Biogas → upgrading → liquefaction	Renewable H_2 + captured CO_2 → methanation → liquefaction
LIFECYCLE GHG	**Low to potentially negative***	**Near-zero potential***
MATURITY / SUPPLY	Commercial today; sustainable feedstock limits scale	Early scale-up; low volumes and high renewable-power demand
COST DIRECTION	Lower near-term premium	Higher near-term cost; power price and conversion efficiency are decisive
KEY RISKS	Feedstock certification • methane leakage/slip • competing biomass uses	Electricity additionality • sustainable CO_2 source • methane leakage/slip
SCALING LOGIC	Practical near-term volumes where certified feedstock is secured	Larger theoretical scale where abundant low-cost renewable power is secured

In Short:

Bio-LNG = practical near-term decarbonization where certified supply is available.

SNG / e-LNG = strategic scale pathway where renewable power and sustainable CO_2 are secured.

** Actual well-to-wake performance is pathway-, engine- and certification-dependent; methane leakage and engine slip remain material for both.*



Ammonia (NH_3) as clean fuel for the future

Green & Blue NH_3: Zero CO2 emissions

As 450+ LPG carriers have NH3 on the loading list, it can be assumed the bunker infrastructur can be errected

Toxicity can be managed through robust safety systems

FGS | NH_3 | Gas Carrier | Bunker Vessel | Floating Unit | CO_2

Aurora Class PCTCs – from LNG to Ammonia fuelling

Same tank concept (bi-lobe 3,400 m^3) for all Aurora class vessels





Cooperation with Höegh Autoliners

- Höegh Autoliners ordered 8 LNG powered PCTCs (vessels 1-8) at CMHI Jiangsu with DNV class notation "Ammoina & "Methanol Ready"
- All vessels are multi-fuel capability since fuel tank can receive LNG, Ammonia and Methanol
- In addition to the LNG powered vessel 4 Ammonia powered vessels will follow
- If synthetic pilot oil is used, the main engine's operation is carbon neutral

Aurora Class PCTCs – from LNG to Ammonia fuelling

TGE Marine inked first order for AFSS in April 2025

- One of the first projects with Everllence main engines (7S60ME-LGIA)
- Same tank concept (bi-lobe 3,400 m^3) as the 8 „Ammonia Ready“ vessels before
- Boil-of-Gas handling via reliquefaction system (first device) and gas combustion unit (second device)



Timeline

- First vessel delivery is scheduled for mid of 2027
- TGE Marine equipment to be delivered in July 2026

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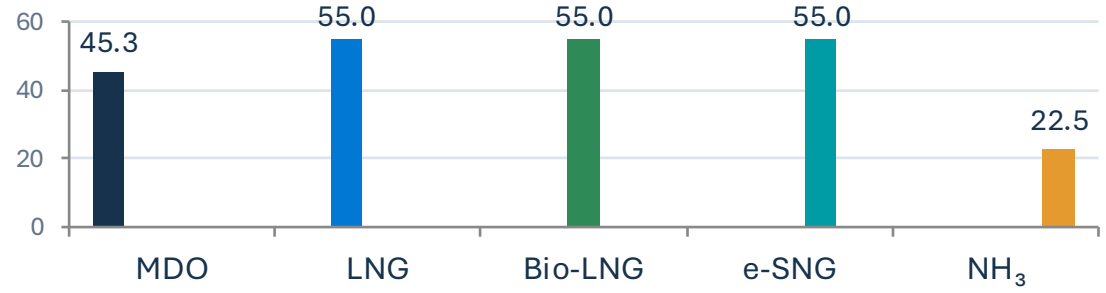
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Maritime fuel comparison

MDO = marine diesel | e-SNG = renewable synthetic methane | NH_3 = green ammonia

Gravimetric energy density

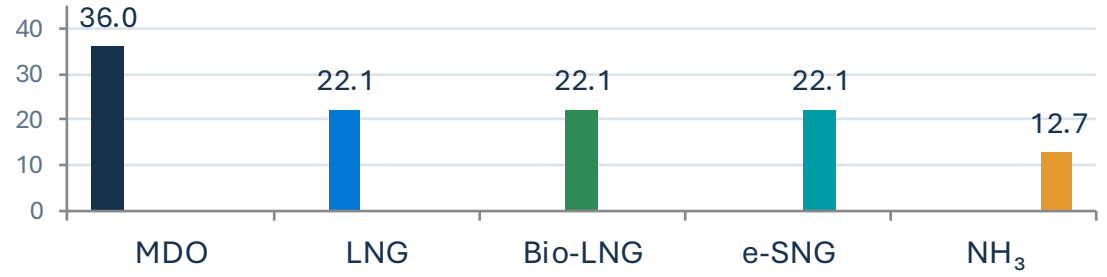
Chemical Energy Content • MJ/kg



Source: Energy Density of some Combustibles | The Geography of Transport Systems

Volumetric energy density

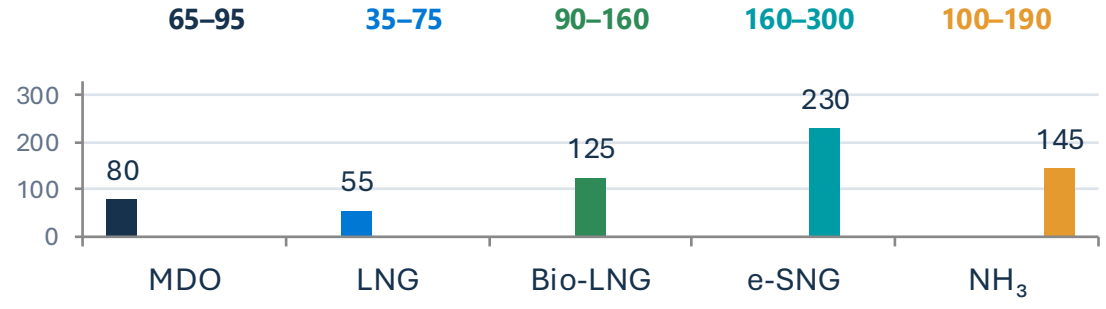
Liquid at representative storage conditions • MJ/L



Source: What could be the best fuels to decarbonise shipping? | Global Maritime Hub

Indicative fuel cost

Representative midpoint; labeled range • €/MWh LHV

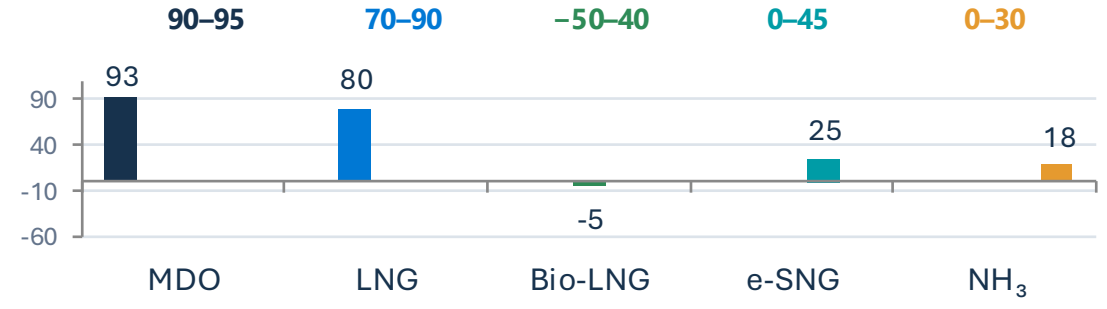


Source: Fuel prices - Future Fuels and Technology - Future Fuels and Technology

Well-to-Wake GHG emissions

Bio-LNG can be net-negative with eligible waste/manure credits.

Representative midpoint; labeled range • gCO_2e/MJ LHV



Source: Maritime sector pathways toward net-zero emissions within global energy scenarios | Scientific Reports

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Summary

- ✓ As a marine fuel, LNG offers many advantages, such as significantly lower levels of air pollutants and CO_2 emissions. Furthermore, LNG is available worldwide and will continue to serve as a transition fuel for the decarbonisation of shipping for decades to come in the form of Bio LNG and SNG
- ✓ SGMF LNG 3rd LCA (Live Cycle Assessment) underlines the suitability of LNG as a fuel



- ✓ Ammonia contains no carbon — burning it produces zero CO_2 emissions
- ✓ Ammonia is one of the world's most widely produced chemicals, with mature production and distribution infrastructure
- ✓ N_2O emissions are mitigated by engine-internal measure



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