TGE Marine Gas Engineering

Company Presentation

2018

Company introduction

- TGE Marine Gas Engineering is one of the world's leading engineering contractors specialising in gas carriers, offshore units and LNG fuel gas systems
- Almost 40 years of experience with more than 200 gas carrier and fuel gas systems contracted
- The Group was founded in 1980 as "Liquid Gas International" (LGI) and in 1993, was acquired by Tractebel/Suez operating as "Tractebel Gas Engineering". Since an MBO in 2006 supported by Caledonia Investment and Gasfin Investment, the Group has been called "TGE Marine AG" ("TGE Marine Gas Engineering GmbH").
  In September 2015 Mitsui E&S acquired TGE Marine from Caledonia Investment plc. and Gasfin Investment S.A.
- Shareholder: Mitsui E&S
- Address: Mildred-Scheel-Str. 1, 53175 Bonn, Germany
- Web: www.tge-marine.com

Business activities and expertise

- **Cargo handling systems and tanks for gas carriers**
  - LPG carriers
  - Ethylene carriers
  - LNG carriers
  - LNG bunker vessels

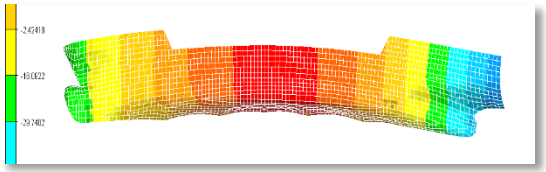
Cargo handling systems & tanks

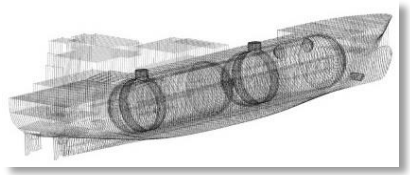
- **Cargo handling systems and tanks for offshore units**
  - FSO / FPSO for LPG
  - FSRU, FRU, and FPSO for LNG

Key expertise & process know-how

Ship design packages

Fuel gas systems





- **Ship design packages**
  - Basic ship classification drawings
  - Complete design package including steel drawings

- **Fuel gas systems**
  - Type C LNG tanks or vacuum insulated type
  - Gas processing system

Tank fabrication expertise

TGE Marine is a world leading contractor for fabrication and delivery of cargo tanks

More than 400 cylindrical, bi-lobe or prismatic cargo tanks 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)

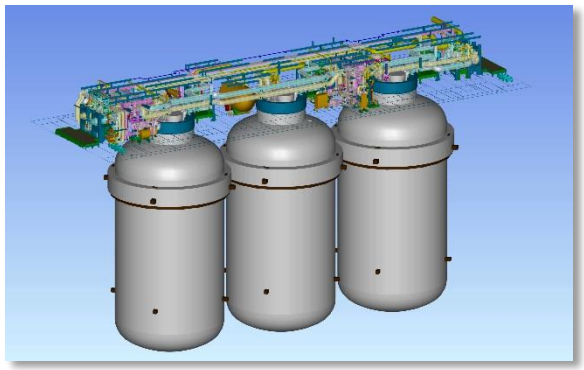
Total net steel weight more than 120,000 tons

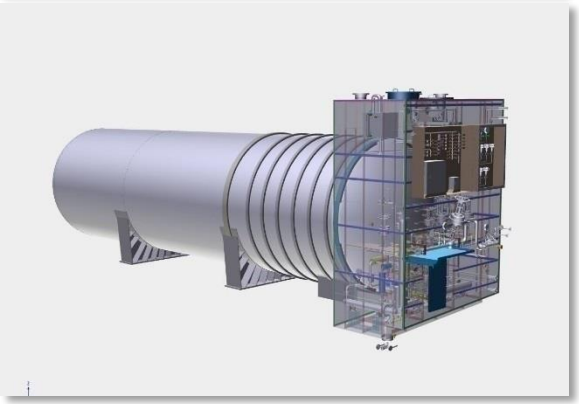
In close co-operation with its fabrication partner - CSSC Jiangnan Shipyard (Group) Co., Ltd. - TGE Marine has delivered tanks from China to Korea, Japan and Europe

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
- Supervision of fabrication
- Delivery of tanks with classification certificate to the shipyard





Industry firsts

World's first high pressure LNG fuel supply system

World's largest LNG carrier based on type C tanks

World's first combined 7,500 m³ LNG / LEG carrier

37,000 m³ ethylene/ethane carrier, the largest ethylene ship in the world

World's first 16,000 m³ LNG-FLSU

World's first LNG bunker new building

Selected recent and on-going project case studies

		Size	Owner	Yard	Classification	Completion	Scope
LNG / Ethylene carriers		7,500 m³ LNG / LEG carrier	Anthony Veder *The Netherlands*	Remontowa *Poland*	BV	2009	• Complete gas handling system • Cargo tanks • Ship design
		18,000 m³ LNG carrier	Anthony Veder *The Netherlands*	Meyer-Werft *Germany*	BV	2018	• Complete gas handling system and fuel supply system
LNG carriers		30,000 m³	CNOOC *China*	Jiangnan Shipyard *China*	CCS (ABS)	2015	• Complete gas handling system • Cargo tanks
		5,800 m³ LNG bunker	Anthony Veder *The Netherlands*	Bodewes *Poland/The Netherlands*	BV	2017	• Complete gas handling system • Cargo tanks
LNG-FLSU		16,000 m³	Exmar Group *Belgium*	Wison Offshore & Marine Ltd *China*	BV	2016	• Complete gas handling system for loading and unloading • Cargo tanks
LNG fuel gas systems		260,000 m³ (conversion)	Nakilat (Qatargas) *Qatar*	Nakilat Keppel Offshore & Marine *Qatar*	ABS	2015	• Pre-fabricated high pressure LNG fuel gas system for 2-stroke dual fuel MAN ME-GI main engine
		37,000 m³ Ethane carrier	Navigator Gas *UK*	Jiangnan Shipyard *China*	Germanischer Lloyd	2016	• LNG fuel gas tanks and high pressure fuel gas system for MAN ME-GI dual fuel main engine

Operational footprint

Bonn, Germany

- Headquarters
  Personnel: c. 100
- Technical centre of excellence
- Core competencies in design and engineering

Shanghai, China

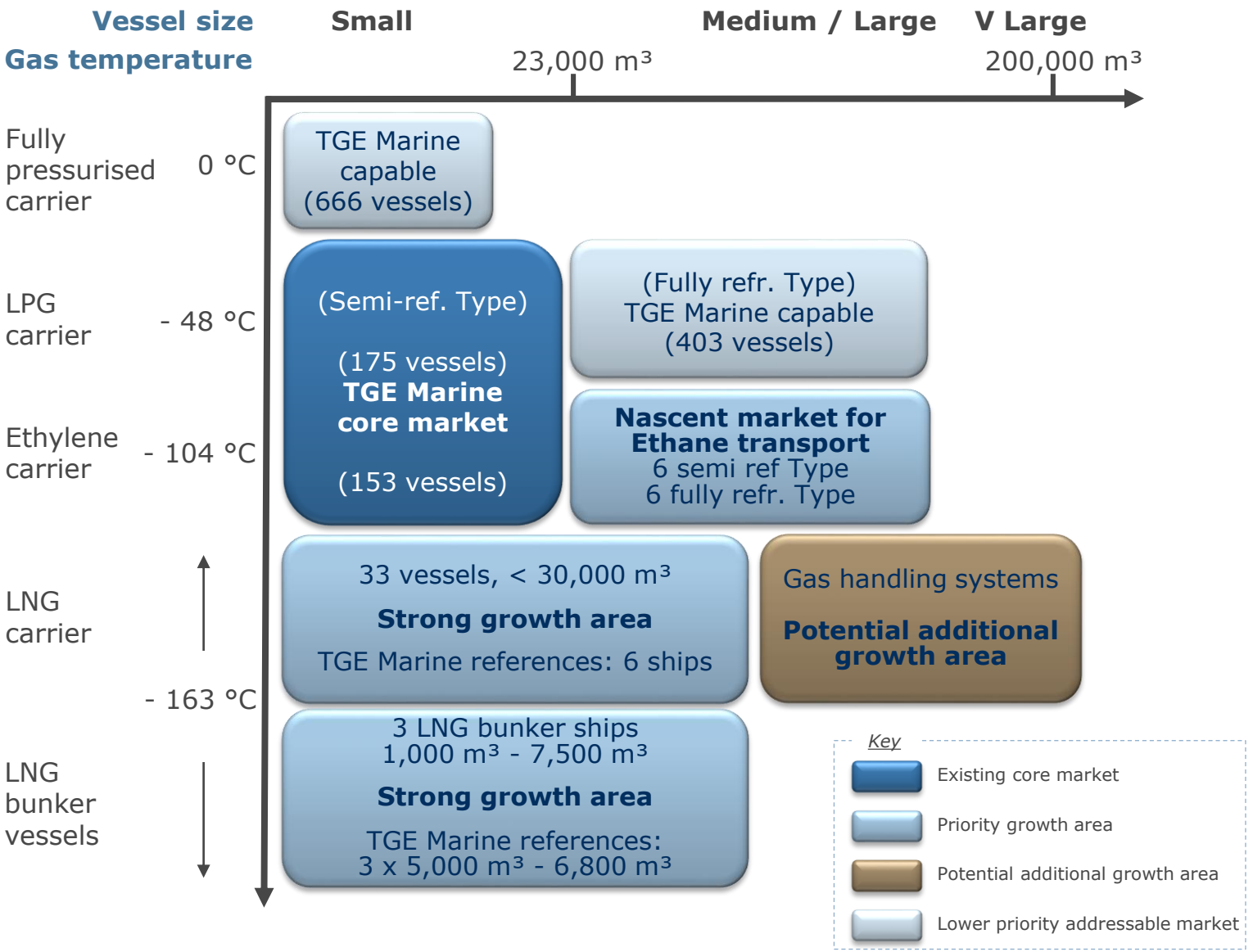
- Local service for core customers
  Personnel: c. 15
- Supports marketing, site supervision and project management activities for major clients in China, Korea and Japan

Competitive positioning

Summary

- TGE holds a leading position in the small and medium sized segments of the gas carrier market:
  - c.55% share of the Ethylene carrier market
  - c.30% share of the semi-ref LPG carrier market
  - c.25% share of the small scale LNG carrier market
  - 100% market share of the global LNG bunker vessel market

Market positioning



Loyal blue chip customer base with a track record of repeat business

Shipyards

CSSC
DSME
Hudong Zhonghua
Hyundai
Jiangnan
Keppel AmFels
MAN Diesel & Turbo
Meyer Werft
Remontowa
Rolls-Royce
Samsung
Sanoyas
Sasaki
Sembcorp Marine
Sinopacific
STX
VT Halter Marine
Wison

Ship owners

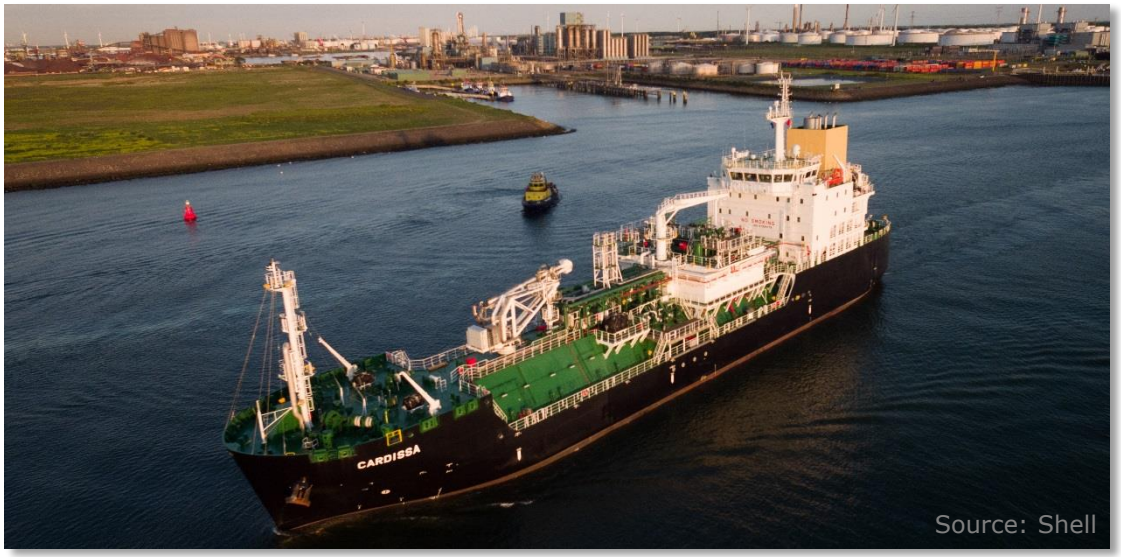
AIDA
Anthony Veder
Benelux Overseas
CNOOC
Crowley
Eletson
Engie
Eships
Exmar
Geogas
Hartmann
Heerema
Hyproc
Lauritzen Kosan
Naftomar
Nakilat
Navigator Gas
Pertamina
Qatar Shipping
Schulte Group
Sloman Neptun
Ultragas

in alphabetical order

Key references: LNG bunker vessels

6,500 m³ LNG bunker vessel "Cardissa":

- Owner: Shell, United Kingdom
- Yard: STX, Korea
- Classification: LR
- Completion: 2017
- Scope: Cargo handling system with cargo tanks, LNG fuel supply system



5,800 m³ LNG bunker vessel "Coralius":

- Owner: Sirius Veder Gas AB, Sweden/The Netherlands
- Yard: Royal Bodewes, The Netherlands
- Classification: BV
- Completion: 2017
- Scope: Cargo handling system with cargo tanks, LNG fuel gas system

Key references: LNG/Ethylene carriers (with LNG propulsion)

7,500 m³ LNG/LEG/LPG carrier "Coral Methane":

- Owner: Anthony Veder, The Netherlands
- Yard: Remontova, Poland
- Classification: BV
- Completion: 2009
- Scope: EPCS-contract, gas handling system, fuel gas system & cargo tanks, ship design development

18,000 m³ LNG carrier "Coral EnergICE":

- Owner: Anthony Veder, The Netherlands
- Yard: Neptun-Werft, Germany
- Classification: BV
- Completion: 2018
- Scope: Complete gas handling system and fuel gas system

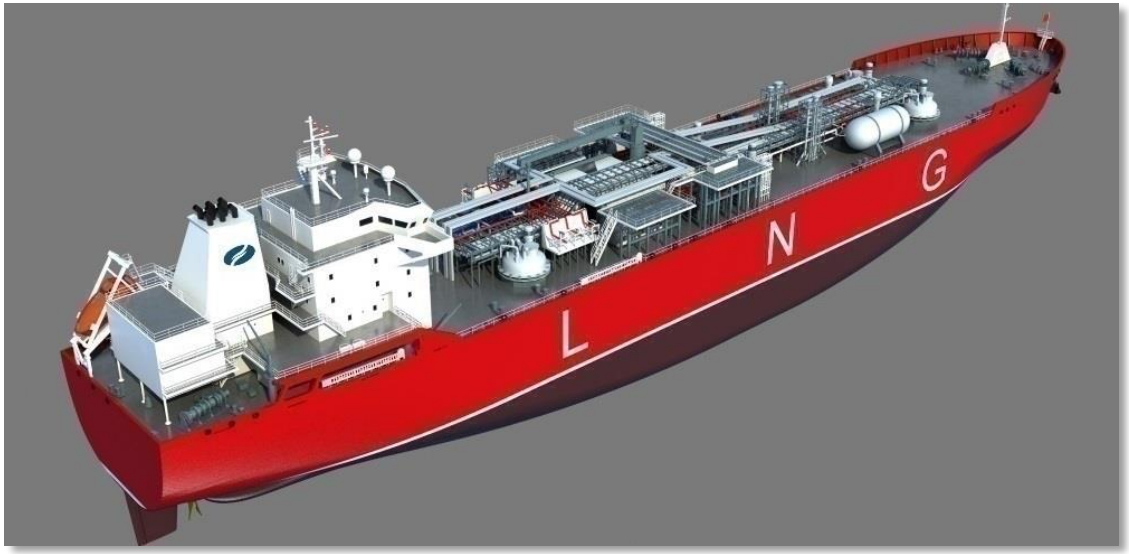
Key references: LNG carriers

30,000 m³ LNG carrier:

- Owner: CNOOC, China
- Yard: CSSC Jiangnan Shipyard, China
- Classification: CCS (ABS)
- Completion: 2015
- Scope: Complete gas handling and fuel supply system, cargo tank design and material package

28,000 m³ LNG carrier:

- Owner: Dalian Inteh Group, China
- Yard: COSCO Dalian, China
- Classification: CCS
- Completion: 2017
- Scope: Complete gas handling and fuel gas system, cargo tank design and material package



Key references: Ethylene carriers

4 x 17,000 m³ LEG/LPG carrier:

- Owner: Harpain Shipping, Germany
- Yard: Meyer-Werft, Germany
- Classification: DNV-GL
- Completion: 2009-2010
- Scope: EPCS-contract, gas handling system

5 x 21,000 m³ LEG carrier:

- Owner: Navigator Gas, United Kingdom
- Yard: CSSS Jiangnan Shipyard, China
- Classification: DNV-GL
- Completion: 2014-2015
- Scope: Complete gas handling system and cargo tanks

Key references: LNG-FLSU

16,100 m³ Caribbean FLNG:

- Owner: Exmar, Belgium
- Yard: Wison Offshore & Marine, China
- Classification: BV
- Completion: 2016
- Scope: Complete gas handling system for loading and unloading, cargo tanks
- Process liquefaction package: Contracted to Black & Veatch by Wison

Key references: LNG fuel gas systems

260,000 m³ LNG carrier (conversion):

- Owner: Nakilat, Qatar
- Yard: N-KOM, Qatar
- Classification: ABS
- Completion: 2015
- Scope: pre-fabricated high pressure LNG fuel gas system for 2-stroke dual fuel MAN ME-GI main engine
- Contract: MAN Diesel & Turbo (MDT)

37,000 m³ Ethane carrier:

- Owner: Navigator Gas, United Kingdom
- Yard: CSSC Jiangnan Shipyard, China
- Classification: ABS
- Completion: 2016
- Scope: EPCS-contract, gas handling system incl. cargo tanks and LNG fuel gas system for ME-GI engine and LNG fuel tanks

Key references: LNG fuel gas systems

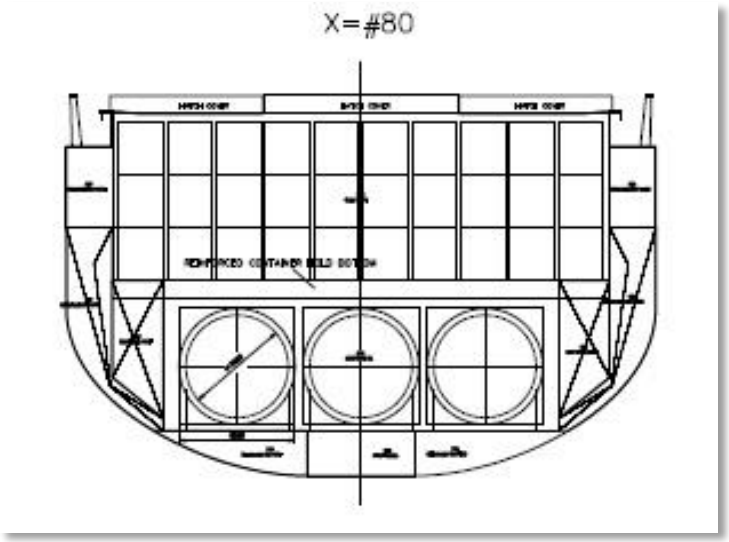
Conversion of 3,750 dwt Product Tanker:

- Owner: Bergen Tankers, Norway
- Yard: Noryards, Norway
- Classification: BV
- Completion: 2015 (for conversion to gas propulsion)
- Scope: LNG fuel tanks (vacuum insulated) and fuel gas system
- Rolls Royce gas engines, 4s/Otto

Key references: LNG fuel gas systems

2 x 26,500 dwt ConRo vessel:

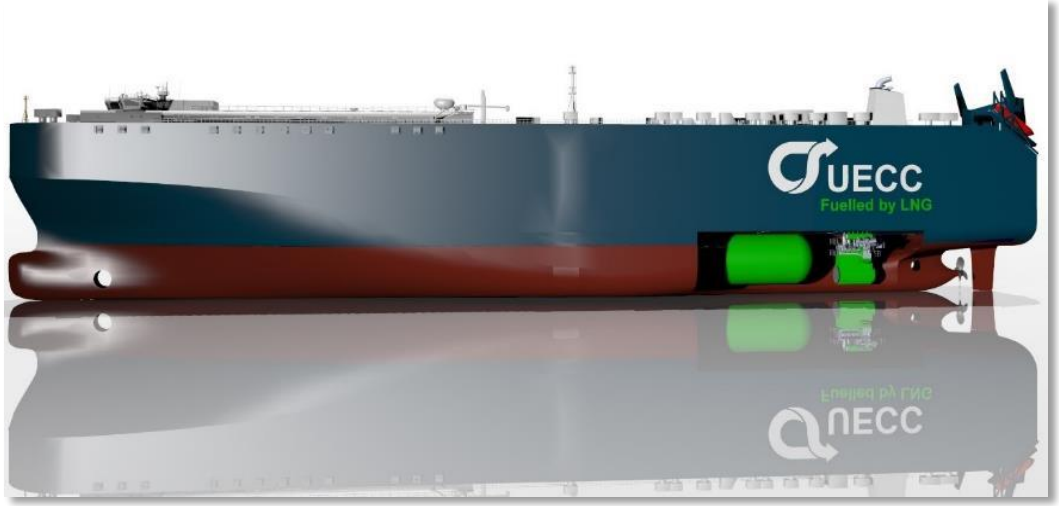
- Owner: Crowley Maritime Corp., USA
- Yard: VT Halter Marine, USA
- Classification: DNV-GL
- Completion: 2017
- Scope: LNG fuel tanks (vacuum insulated) and high pressure fuel gas system for MAN-ME-GI dual fuel main engine



Key references: LNG fuel gas systems

2 x 3,800 Pure car carrier:

- Owner: UECC (Wallenius/NYK), Norway
- Yard: NACKS, China
- Classification: LR
- Completion: 2016
- Scope: LNG fuel tanks (type C) and high pressure fuel gas system for MAN-ME-GI dual fuel main engine



Key references: LNG fuel gas systems

124,000 GT Cruise vessel:

- Owner: Aida, Germany
- Yard: Mitsubishi Heavy Industries, Japan
- Classification: DNV-GL
- Completion: 2016
- Scope: Fuel gas system for LNG supply by truck in harbor

1,000 TEU Container vessel:

- Owner: Wessels, Germany
- Yard: German Drydocks
- Classification: BV
- Completion: 2017
- Scope: LNG fuel gas system with 480 m³ foam insulated tank

Key references: LNG fuel gas systems (under construction)

New semi submersible crane vessel:

- Owner: Heerema, The Netherlands
- Yard: Sembcorp Marine, Singapore
- Classification: LR
- Completion: 2018 (under construction)
- Scope: Low pressure fuel gas system for 4-stroke dual fuel engines with eight vertical foam insulated tanks and four parallel fuel gas processing trains

Key references: LPG carriers

2 x 23,000 m³ LPG carrier:

- Owner: Qatar Shipping, Qatar
- Yard: STX, Korea
- Classification: DNV-GL
- Completion: 2003 - 2004
- Scope: Complete gas handling system and cargo tanks

8,600 m³ LPG carrier:

- Owner: Geogas, Switzerland
- Yard: Sasaki/Sanoyas, Japan
- Classification: BV
- Completion: 2007
- Scope: Complete gas handling system and cargo tanks

Key references: LPG FSOs

78,000 m³ LPG FSO "N'Kossa II":

- Owner: A.P. Moller Group, Denmark
- Yard: Odense Lindo, Denmark
- Classification: BV
- Completion: 1996
- Scope: Chilling units, booster pumps, cargo heater and deck piping
- Vessel: Conversion of LPG carrier

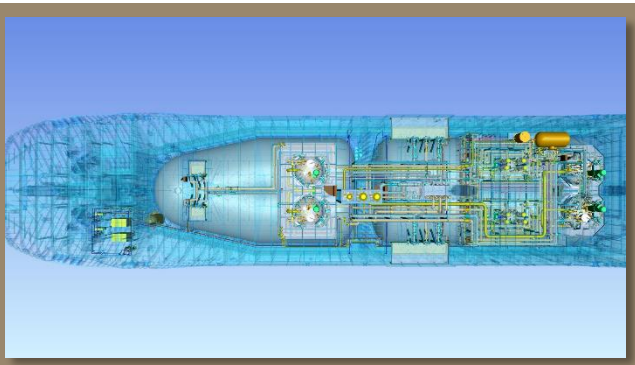
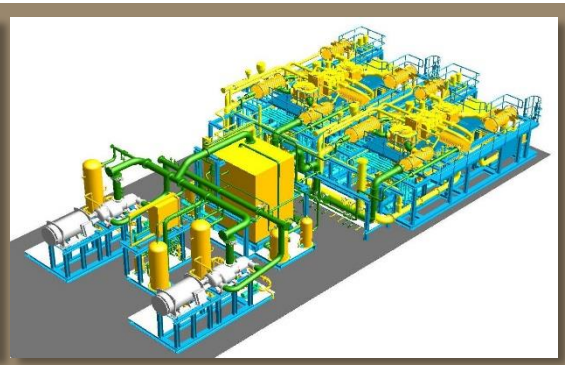
95,000 m³ LPG FSO "Liberdade":

- Owner: Conoco Philips, Australia
- Yard: Samsung HI, Korea
- Classification: LR
- Completion: 2003
- Scope: Complete gas handling

TGE Marine - pioneer in new technologies

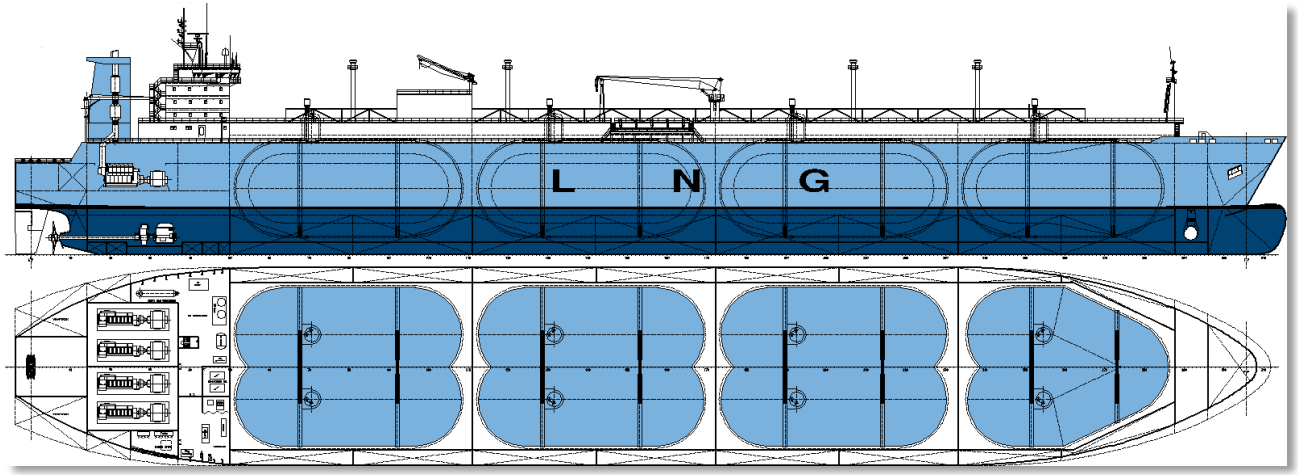
TGE Marine has significantly invested in R&D activities to support small scale LNG technologies and identified a new potential market in addition to its core business:

- Small to medium-sized LNG carriers with IMO type C tanks
- FLNG solutions from 5,000 to 80,000 m³ with type C tanks for FSRU and FPSO projects (→ utilising "stranded" gas reserves; target market: isolated energy centres)
- Efficient LNG BOG reliquefaction based on cascade technology for MAN ME-GI dual fuel engine and for small LNG shuttle carrier as well as for LNG bunker vessels
- LNG-To-Power

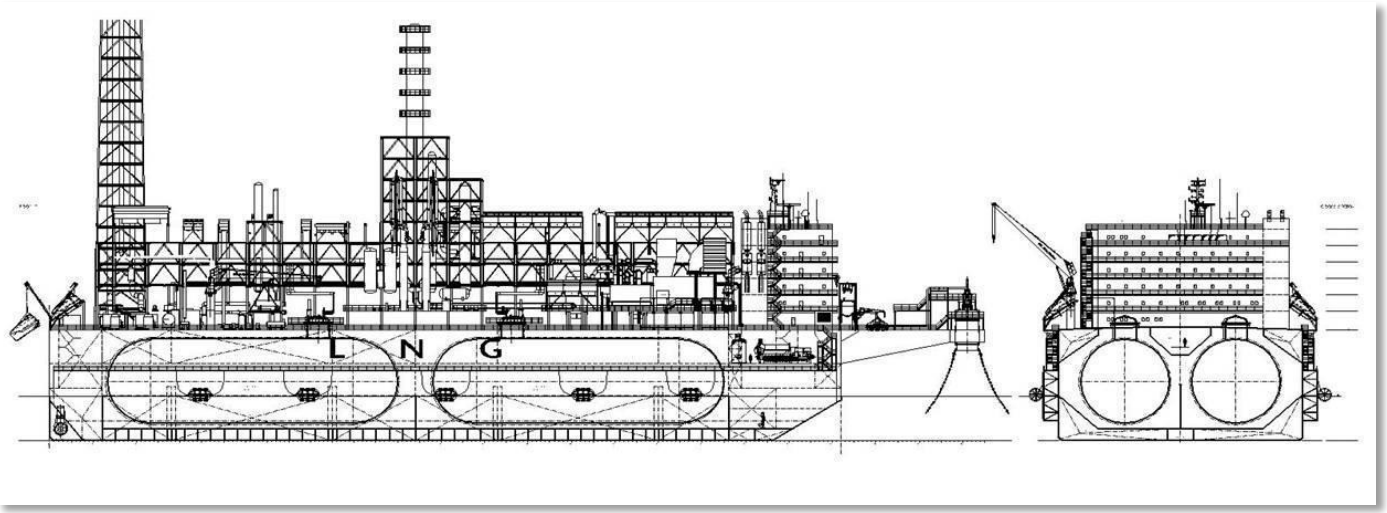

Small to medium size LNG carriers

- Capacities: 5,000 m^3 up to 70,000 m^3
  - 6 vessels delivered
  - Current tenders: 5,000 m^3, 10,000 m^3, 12-15,000 m^3, 20,000 m^3 and 30,000 m^3
- Ship design packages available
- Cargo tanks: Cylindrical or bilobe type C pressure vessels
- More operational flexibility due to pressure built-up technology
- Tank material: 9% Ni steel or stainless steel



Small scale LNG-FPSO

- Capacity: 0.5 mtpa liquefaction
- Conceptual design, pre-FEED and cost estimates for undisclosed client
- Process: SMR
- IMO type C tanks
- 40,000 m³ storage capacity
- 4 cylindrical storage tanks
- LxBxD: 145 m x 43 m x 24 m



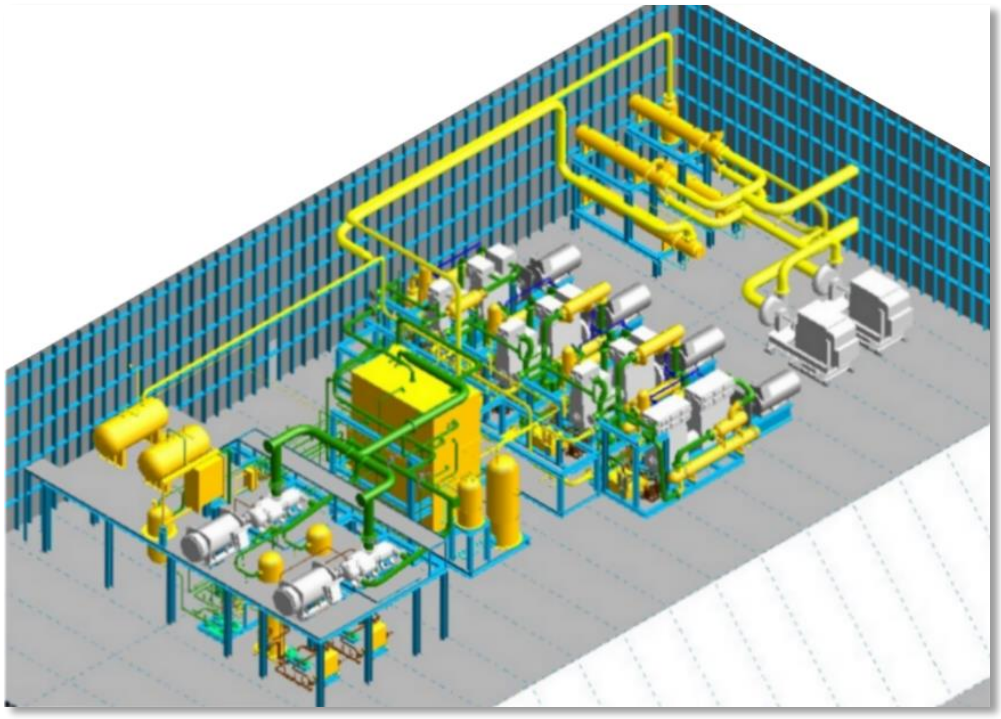
Small scale LNG-FSRU

- Required storage capacities for isolated energy centres much smaller than existing LNG carriers (→ conversions not economical)
- Floating solutions faster to implement
- Barge concepts with same reliable tank technology (IMO type C pressure vessels)
- Designs available for varying processes and heating sources, based on in-depth knowledge from large LNG import terminals
- Conceptual design and FEED package for 25,000 m³ LNG-FSRU for GASFIN Group destined to provide gas supply for the islands of Guadeloupe and Martinique
- Basic design for a highly flexible 20,000 m³ LNG FSRU with up to 200 t/h send-out at max. 100 bar

Efficient LNG-BOG reliquefaction

For the MAN ME-GI dual fuel engine
(2-stroke, high pressure injection)

- Ship capacity up to 210,000 m³ LNG
- Design based on TGE Marine's vast experience of cascade systems
- Superior efficiency compared to nitrogen cycles
- 2 x 75% BOG/ethylene compressor (Laby®-GI)
- 2 x 75% refrigerant compressors
- 1 cold box (plate fin heat exchanger)
- 1 refrigerant condenser



LNG-To-Power

Combining small to mid-scale LNG Floating Storage and Regasification Units (FSRU) with floating power barges provides flexible and easy access to emerging energy markets.

Power Barges 60-150 MW

- High Efficiency Reciprocating-Engine-Based
- Proven Power Plant design with arrangements based on BWSC's* vast experience in engine based power plants
- Industrial installation on marine classed deck barges
- Natural Gas, Dual-Fuel or HFO/LFO fuels
- Full EPC (including onshore scope) and Operation & Maintenance contracts
- Project Development (IPP), Financial Engineering & Equity support

FSRU's 5,000-80,000 m³

- Flexible solutions for diverse technical- and environmental requirements
- Nominal send-out from 5-250 MMSCFD (4-200 t/h)
- Send-out pressure: 8-300 bar
- Tank type: type C cargo tanks with high operational flexibility
- Closed loop vaporisation with waste heat from power barge
- Electrical supply from power barge
- BOG handling

* Burmeister & Wain Scandinavian Contractor A/S, part of Mitsui E&S Holdings

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