

Liquefied Gas Tankers  
Offshore Units  
LNG Fuel Gas Systems  
Naval Architecture



# Introduction

## TGE Marine Gas Engineering:

- 30 years of experience
- An approx. 70% market share of highly sophisticated ethylene carrier segment
- More than 120 gas tankers supplied with cargo handling systems and cargo tanks
- Patented tank concept for LNG carriers of up to 35,000 m<sup>3</sup>
- Experience in FSOs, FPSOs and FSRUs (LPG, LNG)
- Competence in innovative LPG and LNG offshore projects
- State-of-the-art design packages for all types of modern gas tankers
- Customised LNG fuel gas systems for merchant and passenger vessels

TGE Marine Gas Engineering GmbH (hereinafter referred to as "TGE Marine") is a market-leading provider of engineering services for the design and supply of gas carriers and offshore units. We deliver turnkey solutions for engineering, design, procurement and construction supervision (EPCS) of marine gas handling and storage systems as well as vessel designs. We specialise in the containment and handling of cryogenically stored gases (these are often both highly toxic and flammable), and are the market leader in the ethylene carrier segment.

Most of our customers are commercial shipyards which build gas carrier ships. To date we have supplied gas handling and storage systems to more than 120 gas carriers. Since 1989 we have been operating in China and have supplied gas plants for virtually all gas carriers built for international shipowners.



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### **Strategic goals:**

#### **Providing technical excellence at highly competitive prices:**

Our two most important goals are technological excellence and execution efficiency in delivering outstanding value to shipyards and shipowners alike.

#### **Capturing new opportunities in LNG and CO<sub>2</sub>:**

We have committed substantial research and development expenditure toward evolving our core products in order to address new markets (e.g. small LNG and CO<sub>2</sub> carriers) and utilise new technologies.



# History

TGE Marine was founded in 1980 in Bonn under the name Liquid Gas International Ingenieurgesellschaft GmbH (LGI) by Mr. Horst Schierack and Mr. Vladimir Puklavec. The company was an engineering contractor for the design and supply of gas handling systems for gas carriers which were primarily delivered to small shipyards in northern Germany and Holland. At the end of the 80s the scope of services was extended to cover the onshore cryogenic terminal business. In 1989 the first contract for a gas handling system for the mainland China's first ever gas carrier was signed with Jiangnan Shipyard Group. Since then TGE Marine has become the dominant engineering contractor for gas handling systems and cargo tanks in China, with more than 38 gas plants contracted to date.

In 1993 LGI was acquired by the Belgian Tractebel Group and renamed Tractebel Gas Engineering GmbH (TGE). With a strong industrial group as shareholder, TGE's business was expanding and at the end of the 90s all gas engineering activities within Tractebel Group were merged with TGE Group. At the same time the product range was extended to cover LNG storage and logistics systems. During 2005 Tractebel Group decided to divest the contracting entities and TGE proposed an MBO which was concluded in 2007. As a strong financial partner, Caledonia Investment (UK) became the majority shareholder and management controlled 40% of shares. The company was renamed TGE Gas Engineering GmbH and operated with two core business units: Offshore/Gas Carrier and Onshore Terminal & Storage. In 2007 management decided to demerge the onshore business into a separate company and found an industrial partner as major shareholder in CIMC Group. At this point the company was renamed again, becoming TGE Marine AG – as the holding company – and TGE Marine Gas Engineering GmbH as its operating counterpart.

**2007**  
TGE Gas Engineering GmbH is renamed TGE Marine AG (holding company)/TGE Marine Gas Engineering GmbH (operating company) after split of onshore and offshore business

**2007**  
After MBO, TGE is renamed TGE Gas Engineering GmbH

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# Product Lines

## Gas Carriers

To date TGE Marine has designed and supplied complete cargo handling systems and cargo tanks to more than 120 gas tankers and gas off-shore units built at more than 20 shipyards across Europe, Asia, and South America for all major gas shipping companies and pools.

Over the last 15 years TGE Marine has become the industry leader for sophisticated ethylene carriers holding a market share of approx. 70%. Our references include pioneering projects such as

- Navigator Mars – the biggest ethylene carrier ever built

- Isabella Kosan – the 8,000 m<sup>3</sup> ethylene carrier was named “Ship of the Year” in 2008 by Lloyd’s List in recognition of its environmentally-friendly design which was developed by TGE Marine in close cooperation with the owner
- Liberdade – when delivered in 2003, the LPG FSO for the Bayu-Undan gas field was the world’s biggest floating LPG storage solution
- Coral Methane – the world’s first combined LNG/ethylene carrier with capacity of 7,500 m<sup>3</sup> with a dual fuel electric propulsion system

## LNG as fuel

TGE Marine has developed LNG fuel gas systems which ensure fuel gas is delivered at conditions and quantities required by ship engines, thus meeting the requirements of environmentally friendly ship propulsion. The LNG fuel gas system of the sophisticated dual fuel propulsion plant of the Coral Methane demonstrates TGE Marine's competence in this new technology. Based on its vast experience in supplying IMO type C cargo tanks, TGE Marine can deliver LNG fuel tanks of any size meeting specific customer requirements.

TGE Marine's technical solutions for LNG fuel gas systems can be implemented with 4-stroke or 2-stroke main engines of any size. Thanks to a cooperation agreement with MAN Diesel & Turbo, TGE Marine offers optimum solutions for gas-fuelled ships.

Delivering LNG onboard the ship requires new infrastructure for the bunkering industry. TGE Marine's naval architects and engineers have developed sophisticated designs for new bunker ships and safe LNG transfer systems.





## Small-scale LNG

Based on its extensive experience in the design of gas handling systems for ethylene carriers, TGE Marine has developed cost-efficient and innovative offshore storage and shipping solutions for the evolving small-scale LNG market.

- LNG tankers with IMO type C tanks: The Coral Methane convincingly demonstrates the advantages of IMO type C tanks as cargo containment systems for small LNG ships due to improved operational flexibility at highly competitive prices. TGE Marine has a patent for the tank support structure of this type of LNG containment system. Ship designs with appro-

val in principle from a classification society are available for LNG carriers up to 30,000 m<sup>3</sup> and above with bilobe cargo tanks.

- LNG floating storage units with IMO type C tanks: The advantages of TGE Marine's design approach for small to medium size floating LNG storages can be used for FSRUs (regasification barges) and FPSOs (LNG production units). TGE Marine is currently carrying out a FEED (front end engineering and design) study regarding an LNG import project to the Caribbean islands consisting of two FSRUs plus a shuttle tanker, all with IMO type C tanks.



## CO<sub>2</sub> liquefaction and shipping

Carbon capture and storage schemes (CCS) are being closely investigated in order to reduce CO<sub>2</sub> emissions. Liquefaction and shipping of CO<sub>2</sub> to depleted oil and gas fields is a very flexible option compared to pipeline transportation. TGE Marine has worked out new concepts for CO<sub>2</sub> liquefaction and transportation. In order to save energy TGE Marine has developed a liquefaction process at a pressure level of 18 bar and has investigated special high-strength steel for low temperature fabrication of CO<sub>2</sub> storage tanks. A patent application is pending.





## Naval architecture and marine engineering

TGE Marine's naval architects and marine engineers offer sophisticated design packages ranging from feasibility studies to complete sets of class-approved design documents for all types of modern gas tankers.

TGE Marine provides its clients with solid technical expertise and state-of-the-art software tools throughout the entire construction phase.

- Ship theoretical evaluations in respect to hydrostatics such as longitudinal strength, intact and damage stability

- Optimisation of principal particulars and ship lines for highly efficient hydrodynamic speed/power performance and low fuel consumption
  - Steel structure classification documents based on finite element calculations
  - Propulsion machinery and auxiliary systems
  - Outfitting and safety systems
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# References

## 7,500 m<sup>3</sup> LNG/Ethylene/LPG Carrier "Coral Methane" for Anthony Veder

Shipyard: Remontowa, Poland

Year of completion: 2009

Classification: BV

TGE Marine's scope: EPCS-contract, gas handling system & cargo tanks, ship design development



## 10 x 8,000 m<sup>3</sup> Ethylene/LPG Carrier "Isabella Kosan" for Lauritzen Kosan (Lloyd's List Ship of the Year 2008)

Shipyard: Sekwang Heavy Industries, Korea

Year of completion: 2007-2010

Classification: BV

TGE Marine's scope: EPCS-contract, gas handling system & cargo tanks, ship design development

**23,000 m<sup>3</sup> LPG/NH<sub>3</sub>-Carrier "Almarona" for Qatar Shipping Company**

Shipyard: STX Offshore & Shipbuilding, Korea

Year of completion: 2003/2004

Classification: DNV

TGE Marine's scope: EPCS-contract, gas handling system & cargo tanks ship design development



**95,000 m<sup>3</sup> LPG-FSO "Liberdade" for ConocoPhillips (Bayu-Undan gas field)**

Shipyard: Samsung Heavy Industries, Korea

Year of completion: 2003

Classification: LRS

TGE Marine's scope: EPCS-contract, gas handling system



## 4 x 17,000 m<sup>3</sup> Ethylene/LPG Carrier "GasChem Nordsee" for Harpain Shipping

Shipyard: Meyer Werft, Germany

Year of completion: 2009-2010

Classification: DNV

TGE Marine's scope: EPCS-contract, gas handling system



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