

GTT Inside

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NOTE FROM THE CEO

Jean-Baptiste Choimet

CEO of GTT Group



We are navigating a period of profound transformation, where energy efficiency and sustainability have become critical priorities across industries. At GTT, our commitment is to provide innovative technological solutions that empower our clients in their transitions toward a more sustainable future. By consistently pushing the boundaries of technical excellence and demonstrating boldness, we position ourselves as a key player in the decarbonization journey. An ambition fuelled by the dedication of our teams, who are the cornerstone of our collective success.

Reflecting this vision, we have also chosen to revamp GTT Inside, our Group newsletter. This transformation goes beyond a simple change in format; it underscores our renewed commitment to our core mission : to channel our passion for innovation and technical excellence into building a sustainable world.

In this edition, you will discover insights into recent milestones, such as the successful delivery of the world's largest onshore LNG storage tanks at the BGG Tianjin Nangang LNG terminal in China, and the progress of our Mark III 'Multifuel Ready' technology. You will read about our pioneering partnership with Lloyd's Register on a ground-breaking 200,000 m³ LNGC design, and on an ambitious collaboration with TotalEnergies, LMG Marin France and Bureau Veritas to develop a liquefied hydrogen carrier. Finally, this issue includes the latest announcements from GTT and its subsidiaries, as well as upcoming events to which you can connect with us in the months ahead.

These projects reflect our commitment to anticipating future needs, driving forward innovation, and embedding sustainability at the core of all we do. Together, let's continue building this promising future.

Thank you for your continued trust and dedication.



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TECH IN FOCUS

THE LAST STEP OF THE BGG TIANJIN NANGANG LNG TERMINAL ADVENTURE

After the commissioning in November 2023 of the first two 220,000 m³ LNG membrane tanks of the Beijing Gas Group Tianjin Nangang LNG Terminal (BGG terminal), the next four corresponding to Phase II of this colossal project were commissioned at the end of June 2024. With the ongoing start-up operation of the last two tanks of the phase III, the BGG terminal construction is coming to an end, four years after the initial stages of the project.

As we reach the end of this adventure, with eight 220,000 m³ LNG membrane tanks successfully in operation, it is a great opportunity for GTT to have an insightful look on the challenges and future opportunities that have paved the way.

Since the last tanks equipped with Technigaz technology in Pyeong Taek in the 90's, the materials and industry have evolved, as has membrane technology. This project, along with the 29,000 m³ membrane tank built in Hejian city, Hebei province, China, and commissioned in October 2022, has been the opportunity for GTT to propose an optimized technology, dedicated to the on-shore tanks, taking advantage of decades of innovation in the LNGC industry.

The GST® technology installed in the BGG terminal membrane tanks is therefore the result of years of experience and innovation, combining highly efficient materials with an optimized design and innovative construction techniques.

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The materials used for the GST technology, have been developed to achieve the optimal balance between thermal efficiency and cost effectiveness. By working closely with a network of approved suppliers for all components, GTT have been able to propose efficient and optimized materials.

One compelling example of a successful design to cost approach is the optimization of the foam density. Thanks to a dedicated creeping analysis and the support of a full test campaign, it has allowed optimising the overall density of the foam, both increasing the thermal efficiency and reducing the cost of the technology.

While GTT has continuously been developing a strong network of approved suppliers to ensure the availability of all components worldwide, this project has been one of the factor that boosted the supply chain in China.

With two different EPCs, five different companies in charge of membrane installation, two different companies in charge of the tests, all involved on different tanks, the project's industrial scheme was an unprecedented challenge for GTT.

Therefore, the assistance provided had to be unique. During the course of the project, GTT has been greatly involved, providing EPC partners full support to ensure the success of the project. From the dedicated assistance provided by GTT specialists to train and qualify new outfitting companies before the start of the construction to the extensive on-site support with a team of up to 20 skilled representatives and assistance during commissioning operations, EPCs and outfitters could rely on GTT to ensure proper installation of the technology.

The great cooperation between all companies has made it possible to overcome these challenges and foster long-lasting partnerships between GTT and its partners, HQC and Chengda.

While the commissioning of the last two tanks is ongoing, GTT is already looking towards the future with new projects being discussed.

The GST® adventure on the onshore market is just at the beginning! ■

PREPARING FOR A MULTI-FUEL FUTURE WITH GTT'S MARK III TECHNOLOGY

The shipping industry, responsible for approximately 3% of global CO₂ emissions, is under increasing pressure to reduce its environmental impact. Global and regional regulations are pushing for lower emissions, but the path forward remains complex and uncertain. While Liquefied Natural Gas (LNG) has established itself over the past decade as a viable marine fuel beyond its traditional use in LNG carriers, alternative fuels like ammonia and methanol are being actively explored. However, these alternatives face significant challenges, including supply constraints, readiness of large engine technology, and infrastructure development.

The Growing Need for Fuel Flexibility

Given these challenges, the ability to accommodate multiple fuel options is becoming increasingly important for ship-owners aiming to future-proof their vessels. With the demand for fuel flexibility on the rise, GTT has been exploring how its Mark III membrane containment system can be adapted to store ammonia and



methanol alongside LNG, offering a practical solution for multi-fuel readiness.

Ammonia and methanol present specific challenges due to their unique physical and chemical properties. Ammonia is toxic and corrosive, requiring stringent safety measures, while methanol has a high liquid density and heavy gas characteristics that demand careful handling. To safely store these fuels, GTT has applied safety measures similar to those used for LNG,

such as double-wall piping and a double segregation philosophy. These adaptations ensure that the containment system meets the necessary safety standards for these alternative fuels.

GTT has achieved Approvals in Principle (AIPs) from Bureau Veritas for ammonia and methanol readiness in LNG-fueled ships. This recognition confirms the technical viability of using the Mark III system for multiple fuels, providing ship-owners with the flexibility to transition to alternative fuels in the future without significant modifications after an initial period of operating with LNG.

PIONEERING PROGRESS - PREPARING FOR A MULTI-FUEL FUTURE WITH GTT'S MARK III TECHNOLOGY

Beyond Fuel Storage: Modifying Fuel Gas Supply Systems and Engines

Fuel storage is just one aspect of multi-fuel readiness. Transitioning to alternative fuels like ammonia and methanol also requires adjustments to fuel gas supply systems and engines. Each fuel - LNG, ammonia, and methanol - has distinct properties that influence the design and operation of these systems. For example, ammonia's toxicity necessitates different safety measures compared to LNG, and methanol's physical properties impact piping class and venting arrangements.

Regulatory frameworks differ between fuels as well. The International Code of Safety for Ships Using Gases or Other Low-flashpoint Fuels (IGF Code) governs LNG use, providing guidelines for safe handling and storage. Interim guidelines are in place for methanol, while regulations for ammonia are still being developed by the International Maritime Organization (IMO) and class societies. These standards cover aspects such as piping configurations, venting

systems, and machinery setups, reflecting the unique safety requirements of each fuel.

GTT has assessed the technical feasibility of ships using multiple fuels or transitioning between them, focusing on practical solutions for both newbuilds and retrofitting existing ships. This included analyzing the necessary modifications to fuel gas supply systems and engines to accommodate the different fuels' properties.

While ammonia and methanol are positioning themselves as future marine fuels alongside LNG, they also face hurdles such as supply chain limitations, the need for further development of large-scale engine technology, and infrastructure challenges.

GTT's approach is to offer solutions that prepare ships for a range of fuel options, thereby reducing the need for extensive retrofits later on. By incorporating multi-fuel readiness into the design of new Mark III vessels, shipowners gain the option to switch to alternative fuels as they become available and economically viable. ■



GTT'S LATEST 200,000 M³ LNGC CONCEPT

3 questions to Panos Mitrou, Global Gas Segment Director, at Lloyd's Register, on GTT's latest 200,000 m³ LNGC design featuring slow-steaming navigation and integrating three-cargo tank.



Can you elaborate on the specific factors Lloyd's Register considered most critical in granting the AIP for the 200,000 m³ LNG carrier (LNGC) concept proposed by GTT, especially compared to traditional 174k four-tank designs?

The original concept of the GTT's 200,000 m³ LNGC is a bold step, featuring three identical cargo tanks instead of the traditional four. This structural change requires ensuring tank integrity under increased sloshing loads. For this AIP, Lloyd's Register carefully assessed the robustness of the cargo tank design against strict class standards and the IGC Code requirements. We conducted a comprehensive evaluation across various GTT containment systems - Mark III Flex, Mark III Flex+, NO96 Super+, and GTT Next1 - and confirmed that the design meets all safety and performance criteria. This assessment underscores the innovation at the heart of GTT's concept, offering a forward-thinking solution that meets the industry's evolving demands for both efficiency and safety in LNG transport.

What are the anticipated environmental and operational benefits that Lloyd's Register sees as most significant in this design?

Following Lloyd's Register Business Advisory verification of GTT's calculations, the 200k concept was evaluated for emissions intensity, Unit Freight Cost (UFC), and potential regulatory benefits versus a standard 174k vessel. Upsizing to a 200k vessel offers environmental and economic advantages: voyage-based emissions intensity can be reduced by ~20%, and UFC by up to 5% by 2035 and 14% by 2050 under

frameworks like EU ETS and FuelEU. These findings illustrate how upsizing not only enhances operational efficiency but also provides a powerful commercial and compliance strategy for the future. By aligning with regulatory trends and reducing costs, this larger vessel concept positions operators to navigate long-term environmental and financial requirements effectively.

How does Lloyd's Register envision this innovation impacting the broader LNG shipping industry, especially regarding future standards for fuel efficiency and emissions reduction in large-capacity carriers?

Size and, more importantly, speed, are key parameters that directly impact emissions intensity but have been overlooked in LNG carrier design due to traditional sector norms. From an emissions perspective, speed is the most significant parameter. In today's energy transition, maintaining speeds of 19.5 knots is no longer viable. This new design demonstrates that by challenging conventional thinking, we can reduce emission intensity by 27% without sacrificing transport capacity. Just as the industry moved from steam to 4-stroke electric propulsion, and then to 2-stroke engines, this concept represents the potential next technological leap for LNGCs. Its enhanced performance and regulatory compliance, mitigates regulatory risk, creating a time window for other advancements, such as alternative fuels and on-board carbon capture systems to reach full maturity. Above all however it addresses investment risk, a key barrier to further growth of the LNG sector. ■

SUSTAINABILITY CORNER

LARGE-SCALE LH₂ CARRIER: ADVANCING HYDROGEN TRANSPORT

TotalEnergies, GTT, LMG Marin France, and Bureau Veritas have collaborated to develop a large-scale vessel designed to transport 150,000 m³ of liquefied hydrogen (LH₂). Equipped with a specialized membrane containment system, it marks an important step forward in positioning hydrogen as key to the energy transition.

A comprehensive study assessed the vessel's design, equipment, containment system, and propulsion. The success is rooted in the partners' extensive experience and technical expertise in energy and cryogenic maritime transportation.

TotalEnergies defined the vessel's specifications, including its operational profile and CO₂ emission targets, ensuring the design meets future decarbonisation needs. Meanwhile, GTT developed the membrane containment system, to handle hydrogen's specific challenges at extremely low temperatures (-253°C), also working on the gas and liquid handling systems to optimize performance and safety.

LMG Marin France designed the vessel, integrating the containment system ensuring that the propulsion system and operational profile were aligned.

This holistic approach enabled the vessel to meet the demands of large-scale hydrogen transport. Bureau Veritas conducted a thorough risk assessment, reviewing the designs in accordance with the latest regulatory requirements and industry standards.

The collaboration has led to two key Approvals in Principle (AIPs) from Bureau Veritas, one for the containment system and the other for the vessel's overall design, confirming the strategic decisions made during the project as well as the vessel's design integrity, and its suitability for the future hydrogen market.

This project demonstrates that large-scale hydrogen transport is feasible and viable. The vessel's design sets a foundation for future alternative fuels transport, advancing global decarbonization goals. ■



LATEST GROUP NEWS

Keep up to date with the latest Group news!



05/09 - GTT to equip 10 LNG-fuelled container ships with GTT's Recycool™ reliquefaction system in collaboration with Nkkiso >>>

09/09 - GTT awarded tank design for eight new LNGCs >>>

19/09 - GTT secures an order for the tank design for the world's six largest ethane carriers >>>

24/09 - GTT receives an order from HD Hyundai Samho Co. for the tank design of four new LNGCs >>>

30/09 - GTT Strategic Ventures invests in Bluefins to support the development of a more sustainable naval propulsion >>>

02/10 - GTT secures the first application of its 1 barg tank design pressure on a series of LNG-powered container vessels >>>

08/10 - GTT receives an order from SHI for the tank design of two new LNGCs >>>

10/10 - GTT receives an order from DSIC for the tank design of two new LNGCs >>>

16/10 - GTT receives an order from HD HSHI for the tank design of two new ULECs >>>

21/10 - GTT signs a service contract for ENI's Coral Sul FLNG in Mozambique >>>

23/10 - GTT receives an order from Hudong-Zhonghua Shipbuilding for the tank design of an LNG bunkering vessel of 18.600 m³ capacity >>>

29/10 - GTT receives an AiP for its 30,000m³ membrane-type LNGC design from ClassNK >>>

30/10 - GTT secures technical services contract with Maran Tankers for eight LNG Dual-Fuel Suezmax vessels >>>

06/11 - GTT receives an order from a Korean shipyard for the tank design of a new FSRU >>>

12/11 - GTT receives an order from China Merchant Heavy Industry-Jiangsu for the tank design of a new LNG Carrier >>>



04/07 - Elogen receives a certification from the Korean Gas Safety Corporation for the stacks used in its electrolyzers >>>



17/09 - Ascenz Marorka to equip Gazocean's entire LNG carrier fleet with its Smart Shipping solution >>>

14/11 - Vessel Performance Solutions to equip 30 vessels of Harren Shipping Services GmbH & Co. with its VESPER performance management platform >>>

MEET GTT

The GTT group will be taking part in these forthcoming events



21 Nov., 2024
Ship Propulsion Summit
Athens, Greece



26 Nov., 2024
Hydrogen Industry
Glasgow, UK



26-27 Nov., 2024
P2X Conference
Frankfurt, Germany



26-28 Nov., 2024
Argus Clean Ammonia
Europe Conference
Rotterdam, Netherlands



5 Dec., 2024
Blue Maritime Summit
Marseille, France



9-12 Dec., 2024
World LNG Summit
Berlin, Germany



11-12 Dec., 2024
OSJ Conference ME
Dubai



28-30 Jan., 2025
Hyvolution Exhibition
Paris, France



3-5 Feb., 2025
OSJ Conference
London, UK



18-19 Feb., 2025
World Maritime Forum
Copenhagen, Denmark

LEARNING & DEVELOPMENT

Stay up-to-date with our industry-focused training sessions

Use of Ammonia, LNG, Methanol and Hydrogen as a Marine Fuel

14-16 January 2025 (online)

GTT Membrane Technologies Course

10-13 December 2024 (Paris GTT HQ)

17-19 December 2024 & 18-20 February 2025 (online)

LNG Cargo Operations - Refresher

10-12 December 2024 & 18-20 February (online)

FSRU Systems and STS Operations course

18-20 February (online)

More information:
www.gtt-training.co.uk

About GTT Inside

Any question?

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