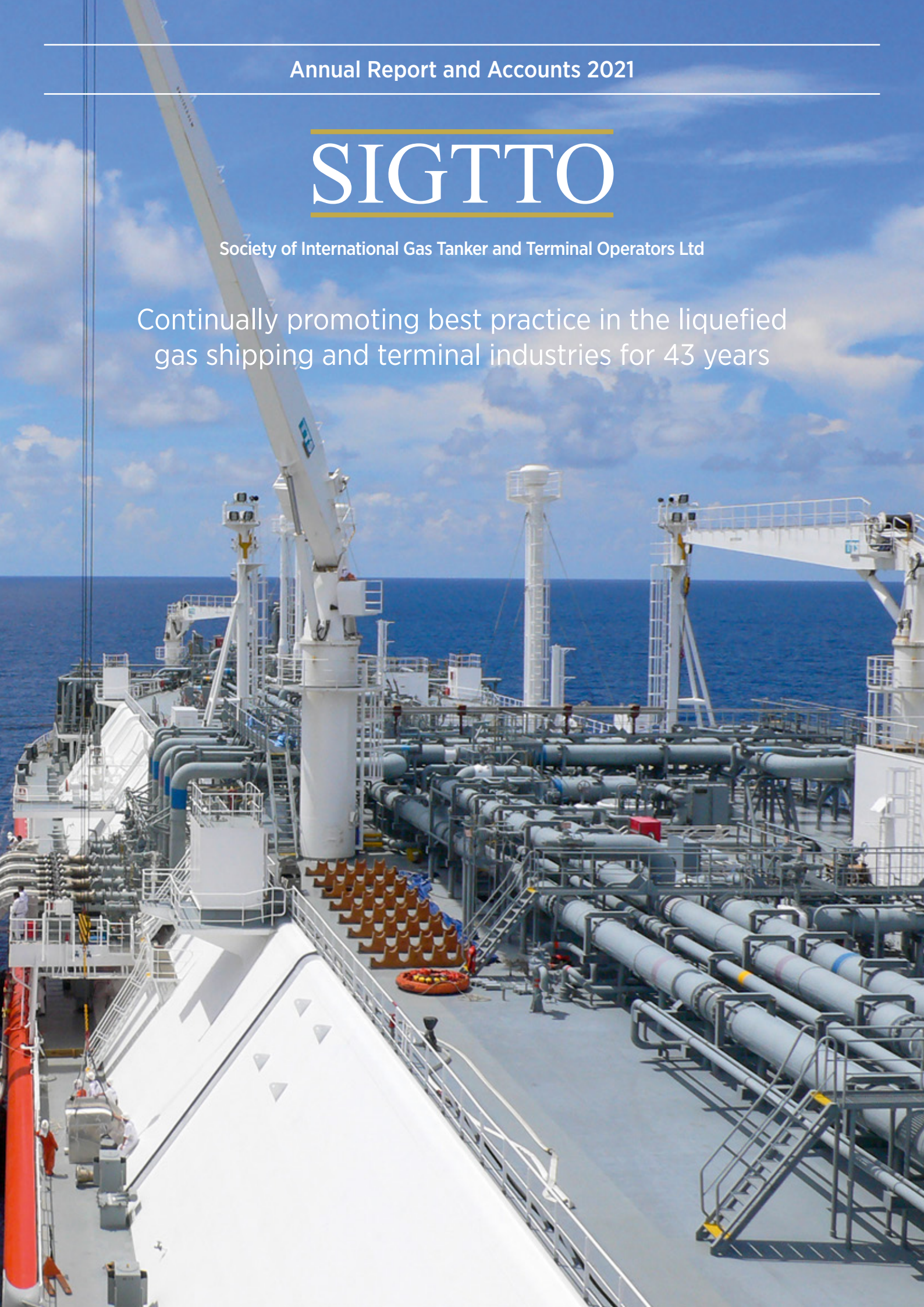

Annual Report and Accounts 2021

SIGTTO

Society of International Gas Tanker and Terminal Operators Ltd

Continually promoting best practice in the liquefied gas shipping and terminal industries for 43 years



SIGTTO Purpose

SIGTTO has been organised to promote the safe and responsible operation of gas tankers, marine terminals and other shipping handling gas as a cargo; to develop advice and guidance for best industrial practice among its members; and to promote criteria for best practice to all who have responsibilities for, or interest in, the safety of gas tankers, other ships carrying gas as a cargo and terminals.



SIGTTO Vision

SIGTTO will continue to be recognised as the gas shipping and terminal industry body - a modern centre of industry expertise - with all appropriate resources available to address industry technical and operational issues; to be the industry advocate for the proactive enhancement of safe and sustainable international gas terminal and shipping operations through the provision of consistent guidelines and measures.

SIGTTO

Annual Report 2021

Contents

- | | | |
|--|--|---|
| <p>5 President's report
Steffen Jacobsen highlights opportunities for new gas carrier types</p> <p>7 General Manager's report
Chris Clucas describes how SIGTTO is meeting the environmental challenge</p> <p>8 SIGTTO members
Full and Associate Members as of 31 December 2021</p> <p>9 SIGTTO members' declared assets
Share of LNG and LPG ship and terminal sectors controlled by SIGTTO members</p> <p>10 SIGTTO membership benefits
Listing of the advantages that Society membership can bring
SIGTTO Associate Member categories
Types of company eligible to join SIGTTO as Associate Members</p> <p>11 SIGTTO – the Society today
A statistical review of SIGTTO's membership and accomplishments</p> <p>12 SIGTTO directors
SIGTTO directors and their companies, as of 31 December 2021</p> | <p>13 SIGTTO Secretariat
The Society's Secretariat office staff</p> <p>14 SIGTTO committees and sub-committees
Progress made by committee and sub-committee working groups in 2021</p> <p>18 LNG carrier fleet in numbers
The global LNG carrier fleet breakdown, courtesy VesselsValue</p> <p>20 The industry year in review
Gas shipping and terminal timeline for 2021 – a year of major developments</p> <p>26 LPG carrier fleet in numbers
The global LPG carrier fleet breakdown, courtesy VesselsValue</p> <p>29 Member survey
Member survey spurs changes to SIGTTO committee structure</p> <p>30 Industry regulations and standards
SIGTTO participation in the evolving regulatory regime governing gas ships</p> | <p>35 Panel Meeting
SIGTTO holds its first face-to-face Panel Meeting in four years</p> <p>37 New publications
Review of latest industry best practice guidelines from SIGTTO</p> <p>39 How We Work
New SIGTTO document to assist industry collaboration efforts</p> <p>40 Publications list
Paid publications available from SIGTTO</p> <p>41 Financials
Statement of Comprehensive Income for the year ended 31 December 2021</p> <p>43 Inside Back Cover
Photo credits</p> |
|--|--|---|



Industry best practice guidance developed by SIGTTO supports the day-to-day activities of crew onboard gas carriers



Clean fuel drive spurs new breeds of gas carrier

The global push to control climate change is set to give rise to carbon dioxide and hydrogen carriers as well as ammonia and hydrogen bunker vessels

The Report of our General Manager Chris Clucas on page 7 highlights the great challenges faced by SIGTTO and its members, both over the past year and going forward, and the steps being taken by the Society to meet these challenges.

For my part I would just like to add how rewarding it has been for the SIGTTO Secretariat and the Society's membership to be able to hold the most recent meetings of our Board, General Purposes Committee (GPC) and Panel on a face-to-face basis. Despite the success we achieved in carrying on with our busy schedule of internal meetings on a virtual basis during the Covid-19 pandemic, there is no substitute for physical, in-person contact. As each and every participant at our recent face-to-face gatherings can testify, communications, the generation of ideas and the development of personal relationships reach new levels, during both formal proceedings and the less time-restrictive social get-togethers.

Another positive development I would like to note is the appointment of Chris Clucas to fill the position of SIGTTO General Manager following the resignation of Andrew Clifton in March 2022 after almost a decade in the role. We are very fortunate that Chris, a very experienced hand in the workings of both the liquefied gas industry and SIGTTO, has offered to cover the position temporarily until a permanent replacement is found. We are most grateful to Andrew for his long and exemplary service on behalf of the Society and to Chris for volunteering to fill Andrew's shoes during this transition period.

One of our principal challenges going forward, as also pointed out by Chris in his General Manager's Report, is the environment, more particularly the need to reduce harmful ship fuel emissions as part of the global drive to control climate change. Although the tightening marine

environment regulatory regime will impact all types of vessel, gas carriers are especially in the spotlight because many of potential clean fuels of the future are gaseous in nature. These fuels are either already established gas carrier cargoes or likely to become ones.

The possible future ship fuels include ammonia and hydrogen. SIGTTO already has a working group able to address the practicalities of establishing the bunker arrangements that would be required for ammonia's use in liquefied form. To date handling experience with liquefied hydrogen (LH₂) in a marine environment is extremely restricted, being limited to the recent completion of a small prototype LH₂ carrier in Japan. However, SIGTTO members have been shipping bulk ammonia cargoes in specially equipped gas tankers on behalf of the fertiliser industry for many decades, and this experience will be invaluable in establishing industry best practice guidelines for handling this product as a marine fuel.

Not surprisingly, in view of the fact that humankind generates greater quantities of carbon dioxide (CO₂) than any other greenhouse gas, the focus on developing carbon capture, utilisation and storage (CCUS) technology has picked up significantly over the past year. The supply chains of many of the CCUS projects under development call for the transport of volumes of CO₂ from the point of generation to remote storage locations such as depleted offshore oil fields. Such projects will require a new type of gas carrier, i.e. scaled-up versions of the handful of small CO₂ tankers currently serving the beverage industry in North West Europe.

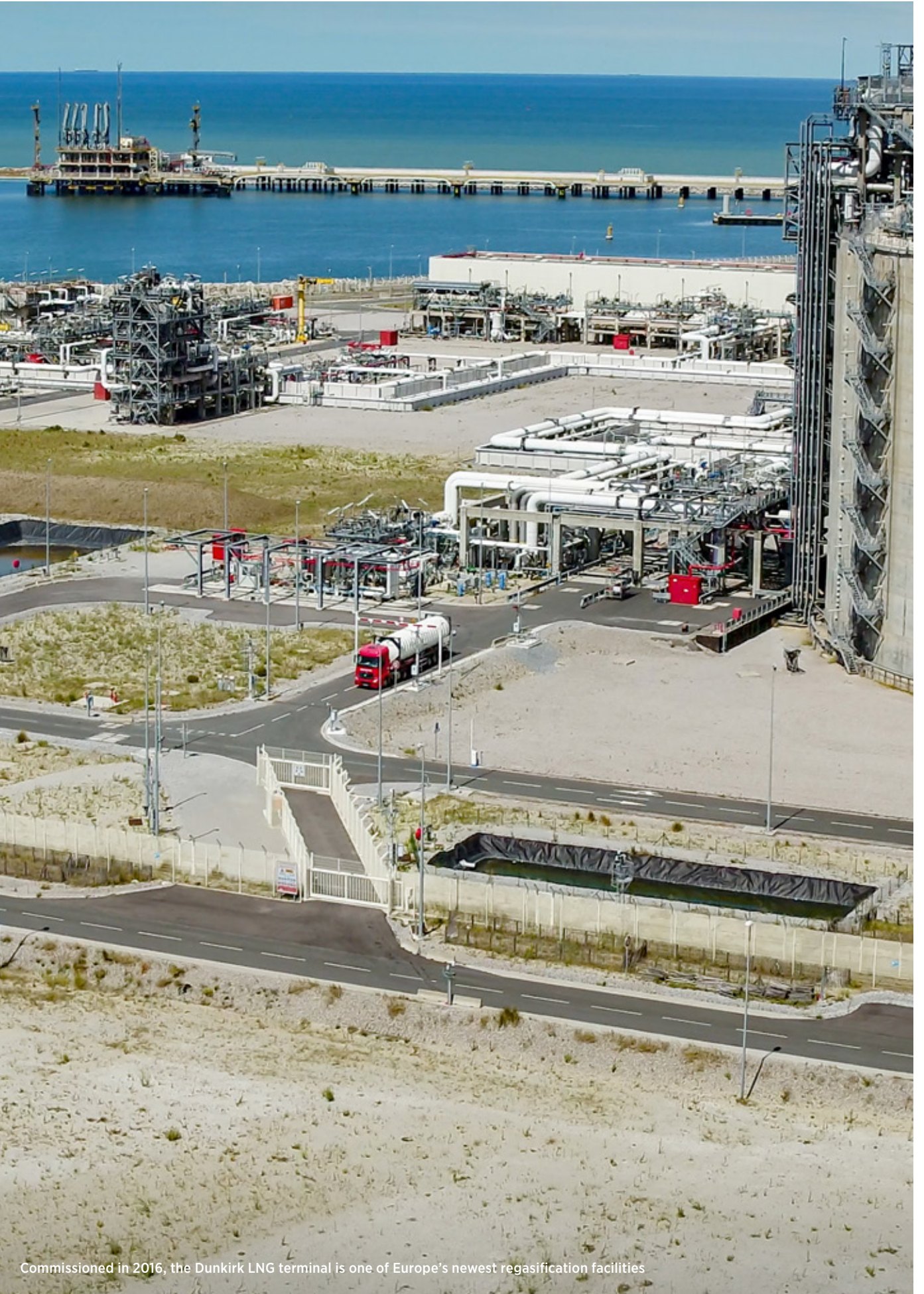
The first few of this new breed of larger CO₂ carriers have recently been ordered and many owners are spending time developing designs and technical solutions. It will be of paramount importance to

adopt standardised specifications for this new type of gas ship at an early stage and, with this in mind, SIGTTO has once again established a dedicated working group to develop the necessary best practice guidance covering CO₂ carriers.

A more immediate environmental concern for SIGTTO members is the work underway at the International Maritime Organization (IMO) to finalise the provisions for applying the Carbon Intensity Index (CII) for new and existing ships. It is likely that many older LNG carriers powered by steam turbines will face significant operational challenges as a result of the requirements that are finally agreed. SIGTTO is closely involved in the discussions on the CII provisions and supports IMO's work in accordance with our Environmental Policy, as agreed by the Board. The IMO decisions are set to impose a significant workload on shipowners and could have a considerable impact on the commercial operation of the older ships. SIGTTO will work to facilitate the sharing of relevant best practices amongst the membership as the new CII regime is implemented.

The environmental challenge is set to ensure a continuation of the rapid pace of change experienced by the liquefied gas industry due to the Covid-19 pandemic and the impact of geopolitics on energy supply and demand. Having taken the necessary in-house organisational steps to accommodate the changes, SIGTTO stands poised to continue the development and sharing of industry best practice guidance for the benefit of its membership.

Steffen Jacobsen
SIGTTO President - July 2022



Commissioned in 2016, the Dunkirk LNG terminal is one of Europe's newest regasification facilities



SIGTTO gears up for environment and expanding industry challenges

The Society's committee structure has been amended to accommodate increasing work on environmental issues while a strengthened Secretariat is ready to deal with industry expansion and diversification

The past year has been one of momentous changes, both within the liquefied gas industry and at SIGTTO itself. The references in last year's General Manager's Report to "depressed oil and gas prices and falling demand" stand in stark contrast to today's record high prices and supply shortages and tell you everything you need to know about the direction the energy industry has taken.

At SIGTTO Captain Andrew Clifton departed in March 2022 to pursue new career opportunities after almost 10 years as the Society's General Manager. The observation that gas shipping is like a village is supported by the fact that Andrew worked with yours truly in the Schulte Group for about nine years from the early 1990s. We missed him when he moved on to pastures new back then, and I am sure the entire SIGTTO family feels just the same now. I'm glad to say that Andrew left the Society in great shape, and well-set for the challenges ahead. The foremost of these is 'the environment' – or, more specifically, the public's increasing expectations over the control of greenhouse gas (GHG) emissions and the resultant tightening regulatory regime that is evolving and set to impact the global liquefied gas industry.

I'm pleased to have been able to step into Andrew's shoes and assist SIGTTO over a transition period going forward. There have been a number of other staff changes at the Society over the past year, not least the appointment of two new Technical Advisers following the retirement of Alex Hammond. The two newcomers - Yunzhe He (Jack) and Adrian Ruiz – both have experience of working for leading classification societies.

Two other new SIGTTO Secretariat recruits are Mariah Abshire and Lindsey Briscoe. Mariah has joined us to assist in the development of our portfolio of publications while Lindsey's appointment is effectively a formalisation of a long-term relationship she has already established

with SIGTTO. She began working on the Society's accounts over a decade ago, first as part of an audit team then on a solo basis. Lindsay has recently concluded a permanent part-time contract with SIGTTO and joins us as Finance Manager.

Although SIGTTO's activities last year were once again dominated by Covid-19 restrictions, we managed to organise our Autumn 2021 Board meeting on a face-to-face basis. Held in Athens and kindly hosted by Naftomar, it was the Society's first in-person gathering in almost two years. Although all SIGTTO Committee and Working Group meetings prior to that were conducted remotely, via video links, we continued to make good progress, as per normal, with our work programme during the course of the global pandemic. Coordinating the work of these SIGTTO bodies, our hard-working Secretariat produced several new publications during the past year, including *Emergency Shutdown Systems (2nd Edition)*, *Recommendations for Cargo Control Room HMI, LNG Shipping Competency Standards (3rd Edition)* and *SIGTTO Information Papers (Consolidated Edition 2022)*.

I'm pleased to report that the 84th General Purposes Committee (GPC) meeting and the 65th SIGTTO Panel Meeting, both held in Athens in March 2022 and hosted by Maran Gas, and the Spring 2022 Board, convened in London in May, were also all staged as in-person gatherings. SIGTTO is confident that the time is not far off when a full schedule of Committee and Working Group meetings and worldwide Regional Panels will once again be possible on a face-to-face basis.

Quite aside from the environmental issue, other events with worldwide impact, such as the Covid-19 pandemic and the circumstances in Ukraine, are having an unprecedented effect on the liquefied gas industry. The LNG and LPG carrier fleets are expanding rapidly; the orderbooks for both now stand at more than 25 per cent of the existing fleets on a capacity

basis. The demand for floating LNG terminals and LNG bunker vessels is greater than ever, the latter an indication of the current and growing popularity of LNG for use as a marine fuel. But LNG is not the only gaseous ship propulsion fuel gaining favour in the drive for reduced GHG emissions. LPG-powered ships are now in service while ammonia and hydrogen are both earmarked as future shipping industry fuels of great potential.

So how is SIGTTO responding to these major industry changes? In Autumn 2021 the Board launched a survey to gauge how our members view the Society and to find out what changes, if any, they would like to see implemented. While the results indicated broad satisfaction with SIGTTO's work, respondents requested that additional steps be taken to address today's challenges, not least the environment.

In response to the survey results the SIGTTO Board at its Spring 2022 meeting agreed to restructure the Society's Environmental Sub-committee (ESC) into a full committee (EC) and to repurpose the Human Element Committee (HEC) as a Focus Group able to serve both the new EC and the well-established General Purposes Committee (GPC).

SIGTTO stands prepared to meet the needs of its members in the face of the evolving challenges facing the liquefied gas shipping and terminal sectors, through both involvement in the rulemaking process and the preparation of new and revised best practice guidance. The maintenance of the industry's exemplary safety record, built up over many decades, will be the central driving force behind this commitment.

Chris Clucas
General Manager - June 2022

SIGTTO members (as at 31 December 2021)

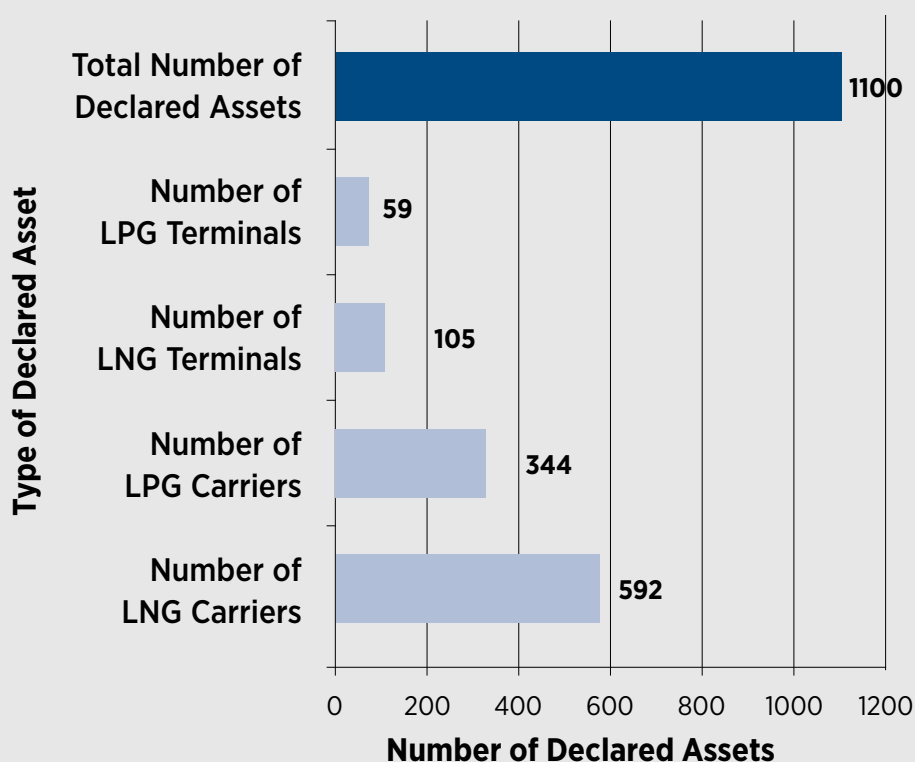
Full Members

Aegis Logistics Ltd	ExxonMobil - SeaRiver Maritime	OLT Offshore LNG Toscana SpA
AES Andres	FLEX LNG	Oman LNG LLC
Alphagas SA	Fluxys LNG	Osaka Gas Co Ltd
Angola LNG Ltd	Freeport LNG Development LP	Pan Ocean Co Ltd
Angola LNG Marketing Ltd	GasLog LNG Services Ltd	Pavilion Energy Trading & Supply Pte Ltd
Anthony Veder Rederijzaken BV	Gate Terminal BV	Pertamina Transportation LNG - JMG
Atlantic LNG Company of Trinidad & Tobago	Gazocean	Petrobras - Petroleo Brasileiro S/A
Avance Gas Holding Ltd	Geogas Maritime SAS	Petronet LNG Ltd
Bernhard Schulte Shipmanagement Ltd	Global Meridian Holdings Ltd	POSCO Energy Co Ltd
B-Gas A/S	GNL Quintero SA	Prime Gas Management Inc
BP Berau Ltd	Golar Management Norway AS	Pronav Ship Management
BP Shipping Ltd	Golden Pass LNG	PT Donggi Senoro LNG
Brunei LNG Sdn Bhd	Høegh LNG AS	PTT LNG Company Ltd
BW Gas AS	Hyproc Shipping Company	Qatar Gas Transport Company Ltd
Byzantine Maritime Gas Pte Ltd	Hyundai LNG Shipping Co Ltd	Qatar Petroleum (Industrial Cities Ports)
Calor Gas Ltd	Iino Kaiun Kaisha Ltd	Qatargas Operating Company Ltd
Cameron LNG	Indianoil LNG Private Ltd	QCLNG Operation Company Pty Ltd
Canaport LNG	INEOS	Santos GLNG
Centrica LNG Company Ltd	Inpex Corporation	Saudi Arabian Oil Co (Saudi Aramco)
Chemgas Shipping BV	International Gas Transportation Co Ltd	SCF Management Services (Dubai) Ltd
Cheniere LNG Inc	Japan Petroleum Exploration Co Ltd	Seapeak
Chevron Shipping Company LLC	JERA Co Inc	Sempra Infrastructure
China LNG Shipping (International) Company Ltd	Kawasaki Kisen Kaisha Ltd	Shell International Trading & Shipping Co Ltd
Chugoku Electric Power Co Inc	Kinder Morgan Inc	Shipping Corporation of India
ConocoPhillips Global Marine	Knutsen OAS Shipping	Shizuoka Gas Co Ltd
CPC Corporation, Taiwan	Koch Shipping Pte Ltd	Singapore LNG Corporation Pte Ltd
DESFA Hellenic Gas Transmission System Operation	Korea Gas Corporation	SK Shipping
Dorian LPG Management Corp	Kuwait Oil Tanker Co SAK	Sonangol Marine Services Inc
Dragon LNG Ltd	Latsco Marine Management Inc	South Hook LNG Terminal Co Ltd
Dubai Supply Authority	Lauritzen Kosan A/S	Stena LNG Services AB
Dunkerque LNG	LNG Hrvatska doo	STS Marine Solutions (UK) Ltd
Dynagas Ltd	LNG Japan Corporation	Synergy Maritime Pvt Ltd
Ege Gaz Anonim Sirketi	LNG Shipping SpA	The Bahrain Petroleum Company BSC (Closed)
Egyptian Operating Company for Natural Gas Liquefaction Projects	Malaysia LNG Sdn Bhd	Thenamaris LNG
Elengy	Maran Gas Maritime Inc	Thome Ship Management Pte Ltd
Empresa Naviera Elcano SA	Marubeni Corporation	TMS Cardiff Gas Ltd
Enagas Transporte SAU	Meiji Shipping Co Ltd	Toho Gas Co Ltd
ENEOS Corporation	Minerva Gas Inc	Tohoku Electric Power Co Inc
Energy Transfer Partners	MISC Bhd	Tokyo Gas Co Ltd
Enterprise Products Partners LP	Mitsubishi Corporation	TotalEnergies SE
Etki Liman Isletmeleri Dogalgaz Ithalat Ve Ticaret AS	Mitsui & Co Plant Systems Ltd	Uniper Global Commodities SE
Evergas A/S	Mitsui OSK Lines Ltd	V. Ships
Excelerate Energy LP	Naftomar Shipping & Trading Co	Wilhelmsen Ship Management Sdn Bhd
Exmar NV	National Gas Shipping Company Ltd	Woodside Energy Ltd
	National Grid Grain LNG	YPF SA
	Nigeria LNG Ltd	
	Northern Marine Management Ltd	
	NYK Line (Nippon Yusen Kaisha)	
	Oiltanking Antwerp Gas Terminal NV	

Associate Members

ABS	GNL Quebec Inc	Polish Oil and Gas Company
Babcock International Group	GTT Training Ltd	Port of Rotterdam Authority
Boluda Towage Spain SL	Guangdong Dapeng LNG Co Ltd	Rimorchiatori Riuniti Spezzini - Imprese Marittime e Saam SA
Bureau Veritas Marine & Offshore	Hazira Port Private Ltd	Saga LNG Shipping Pte Ltd
Capital Gas Carriers Corp	Hong Kong LNG Terminal Ltd	Signet Maritime Corp
Celsius Tech Ltd	Hongkong Salvage & Towage	Single Buoy Moorings Inc
China Classification Society	Indian Register of Shipping	Smit Lamnalco
China Energy Ship Management Co Ltd	Jordan Cove LNG LLC	Svitzer A/S
ClassNK	Korean Register	TotalEnergies EP Mozambique Area 1 Limitada
CNOOC-Fujian LNG Co Ltd	Kotug International	Venture Global LNG Inc
Combined Marine Terminal Operations Worldwide NV	Kuwait Integrated Petroleum Industries Co	Vitol Services Ltd
Commonwealth LNG	Liquid Bulk Ltd	Warsash Maritime Academy (Solent University)
DNV AS	Lloyd's Register	Western Concessions Pvt Ltd
ExxonMobil PNG Ltd	LNG Canada Development Inc	Wison (Nantong) Heavy Industry Co Ltd
Fratelli Neri SpA	Maritime Safety Queensland	Woodfibre LNG Ltd
Gazprom Marketing & Trading Singapore Pte Ltd	Milford Haven Port Authority	
	Moran Towing Corporation	
	NextDecade LLC	

SIGTTO Members' declared assets



BENEFITS OF SIGTTO MEMBERSHIP

New members joining the Society are able to gain immediate access to a vast body of expertise, exclusive information and opportunities to network. They are also able to influence the industry by participating in SIGTTO activities and producing best practices and guidelines.

In addition to the credibility in the industry that membership brings, SIGTTO members derive the following specific benefits:

- Access unique information that is exclusive to members, such as casualty and industry statistics, presentations from past forums and meetings, incident data and lessons learnt.
- Access the Technical Advisers in the London Liaison Office who can give and obtain advice, on behalf of a member, from within the Society.
- Access the very comprehensive technical library maintained in the London Office.
- Submit proposals for industry projects and studies to SIGTTO's General Purposes Committee (GPC) and Environmental Committee (EC).
- Network regularly with the membership which represents more than 90 per cent of the LNG shipping and terminal industry and over 50 per cent of the LPG industry.
- Participate with other members in SIGTTO regional forums that are held regularly throughout the year on subjects of topical and mutual interest.
- Receive copies of all SIGTTO publications, free of charge.
- Receive regular updates on new and pending technical and operational developments, including regulatory initiatives from the International Maritime Organization (IMO) and regional agencies.
- Access the LNG webinfo portal, which is restricted to SIGTTO and GIIGNL members only, for updated LNG information on ship/terminal compatibility.
- Through SIGTTO's observer status at IMO, participate in IMO meetings, including working groups, and submit technical analysis on matters being discussed. SIGTTO directly represents member interests to individual governments and regulatory authorities.

Associate Member company eligibility

In addition to the organisations that have an equity interest in, own or operate a gas tanker or terminal as Full Members, SIGTTO also welcomes companies from a range of disciplines participating in the gas sector as Associate Members. Such companies include the following:

- Organisations that have entered into a contract to build a gas tanker or a terminal
- Classification societies
- Harbour/port authorities
- Tug vessel providers for liquefied gas terminals
- Training providers for liquefied gas vessel sea staff and/or terminal personnel

Associate Member stories

Launched in 2020 on the SIGTTO website, the Full and Associate Member stories profile companies and showcase the benefits they derive from membership in the Society. The following illustrative lines are drawn from two Associate Member stories:

"GTT Training's membership of the Society has provided us with direct contact with a wide range of ship and terminal operators in one forum. This dialogue, in turn, has helped us improve our understanding of the needs of those on both the ship and the shoreside and to fine-tune our products accordingly." – *GTT Training (joined SIGTTO in 2015)*

"CCS is very pleased to be associated with SIGTTO starting this year. In partnership with SIGTTO, we believe we will have more opportunities to exchange technical knowledge and experience with a wider community for liquefied gas shipping and terminal industry and further, collectively contribute to the global fight against greenhouse gas emissions." – *China Classification Society (joined SIGTTO: in 2021)*

<https://sigtto.org/membership/member-stories/>

Publications directly selling across 69 countries, 6 continents



43

Years since established
39 years since admitted to IMO



213

No. of members
138 Full Members, 46 Associate,
29 Non-contributory Members
25+% have been onboard over 20 years



50

Countries across the world
Asia Pacific 34%, Mediterranean 13%,
Middle East 6%, Pan American 18%,
Scandinavian 7%, Western European 22%



90+%

Of LNG market
No. of Declared LNG Terminals: 105
No. of Declared LNG Carriers: 592
*Data in 2021



50+%

Of LPG market
No. of Declared LPG Terminals: 59
No. of Declared LPG Carriers: 344
*Data in 2021



16

Working groups and projects
7 GPC/ 2 ESC/ 3 HEC WGs + 4 projects in
progress
4 GPC WGs planned



10,000+

Publication copies sold
In the last 6 years

SIGTTO Board of Directors (as of 31 December 2021)



The Autumn 2021 meeting in Athens in November was the first time the SIGTTO Board of Directors had met face-to-face in two years

Mr Steffen Jacobsen
Mr Tetsuya Watabe
Mr Lloyd Bland
Mr David Furnival
Mr Rahul Kulkarni
Mr Riju Cherian
Mr Emilio Tsocalis
Mr Øivin Iversen
Mr Paul Oliver
Mr Raja Sager Muniandy

Evergas [President]
 JERA [Vice President East]
 Chevron Shpg [Vice President West]
 Bernard Schulte Shipmanagement
 BP Shipping
 BW Gas
 ExxonMobil/SeaRiver Maritime
 Höegh LNG
 International Gas Transportation Co
 MISC

Mr Kenta Matsuzaka
Mr George Paul Perantzakis
Mr Akira Kono
Mr Abdullah Al-Sulaiti
Mr Chris McDade
Mr Carl Henricksen
Mr Atsunori Takeuchi
Mr Luc Gillet
Mr Peter Pearman
Mr Edwin Mortimer

Mitsui OSK Lines
 Naftomar
 NYK Line
 Qatar Gas Transport
 Seapeak Maritime (Canada)
 Shell
 Tokyo Gas
 Total SA
 Conyers Dill & Pearman
 Conyers Dill & Pearman [Secretary]



Once all the greetings and catching-up conversations were out of the way, it was time for the Autumn Board to get down to work

SIGTTO Secretariat Staff



Chris Clucas
General Manager



Cherian Oommen
Senior Technical Adviser



Rob Farmer
Principal Technical Adviser



Adrian Ruiz
Technical Adviser



Yunzhe (Jack) He
Technical Adviser



Ian Harrison
IMO Representative



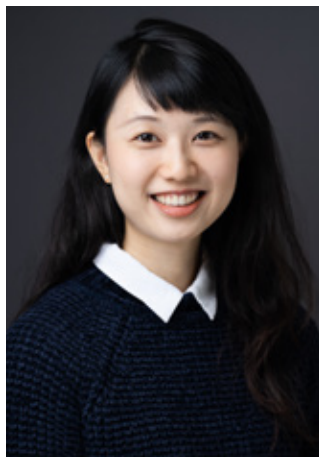
Laura Else
Technical Publishing Manager



Mariah Abshire
Technical Publishing Assistant



Susan Humphrey
Membership Manager



Bella Mao
Marketing Executive



Erin Rydings
Receptionist/Admin Support



Lindsey Briscoe
Finance Manager

SIGTTO maintains high best practice guidance output

Incorporating revised versions of two earlier SIGTTO publications, the new gas terminal design and operations document incorporates a risk-based methodology for the first time



At the start of 2022 SIGTTO working groups had over 20 different projects underway, a continuation of the record-high workload undertaken by the Society in recent years. The overall work programme was supported by the Society's agreed Strategic Plan, robust internal processes and a parent committee structure that comprised the General Purposes Committee (GPC), the Human Element Committee (HEC) and the Environmental Sub-committee (ESC), the latter established under the auspices of GPC.

In more recent months the SIGTTO Board of Directors has agreed to amend this committee structure to reflect the latest developments in the liquefied gas shipping and terminal sectors. The new structure is described on page 29. The following paragraphs describe the progress achieved by the working groups in 2021 and early 2022 under the then-existing GPC, HEC and ESC committee structure.

General Purposes Committee (GPC)

SIGTTO's GPC held two virtual meetings in 2021 – its 82nd Session in April and 83rd in October – while its 84th Session, which took place in March 2022 in Athens, was GPC's first face-to-face gathering in 30 months. The GPC members were unanimous in their praise of the benefits afforded by a return to in-person meetings. Although SIGTTO committees and their working groups continued to make good progress with their projects while holding virtual meetings during the Covid-19 pandemic lockdowns, there is no substitute for flexibility afforded by face-to-face gatherings when discussing nuanced topics with numerous parties involved.

Aside from the work of its Environmental Sub-committee (ESC), the projects that GPC had in focus over the past year are terminal design and operation, the use of LNG, LPG and ammonia as fuels, reliquefaction systems, gas

carrier salvage, valve selection and testing, LNG carrier gas trials and jetty maintenance and inspection.

Chaired by Guy Nicholls of Cheniere, the Design and Operation of Liquefied Gas Terminals Working Group is combining two existing SIGTTO documents, *Site Selection and Design for LNG Ports and Jetties (1997)* and *LNG Operations in Port Areas – Essential Best Practices for the Industry (2003)*. The single revised document will consider technical advances made and lessons learnt from incidents since the original documents were published and will introduce a risk-based approach. The working group has met six times so far and continues to develop the draft document.

SIGTTO's Working Group on the Use of LNG, LPG and Ammonia as Fuels continues to develop an initial draft document on environmental and operational issues associated with gas carrier propulsion systems. The document deals with the International

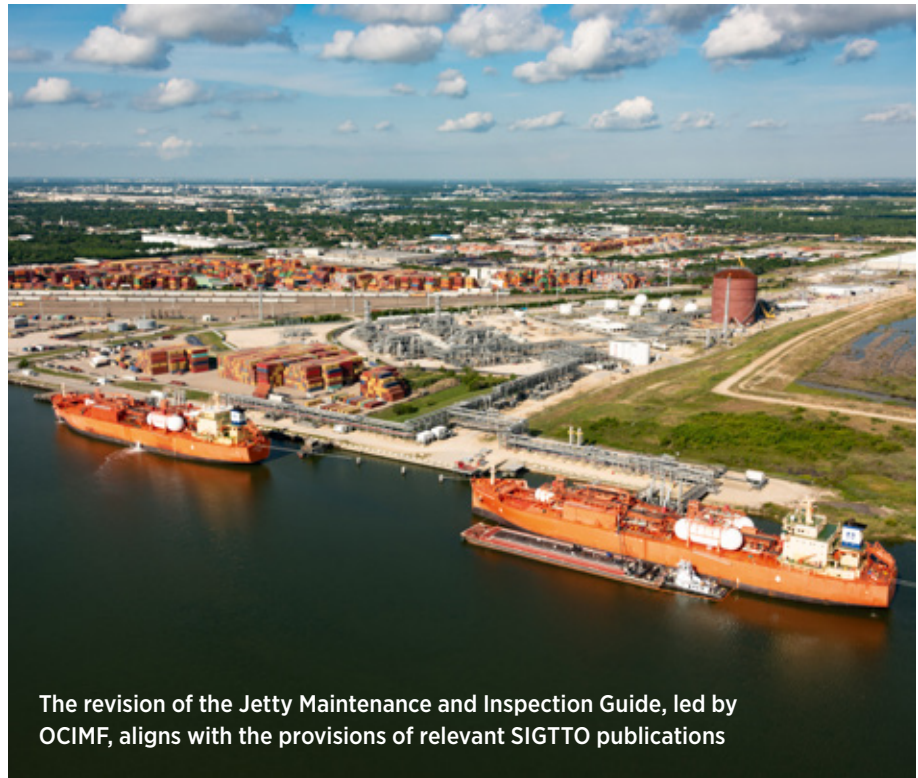
Gas Carrier (IGC) Code, the Energy Efficiency Design Index (EEDI), the Energy Efficiency Existing Ship Index (EEXI) and lessons learnt from incidents. All topics included in this draft will be used to align future revisions to the appropriate IGC Code chapters. The working group last met in May 2022 and is working to compile a first draft.

The Gas Carrier Reliquefaction Systems Working Group is producing a document on the safety, environmental and operational issues associated with gas carrier reliquefaction systems. Like the Working Group on the Use of LNG, LPG and Ammonia as Fuels, it will cover the IGC Code, EEDI, EEXI and incident lessons. All topics included in this draft will be used to align future revisions to the appropriate IGC Code chapters. The working group last met in May 2022 and is working to compile a first draft.

Chaired by Ian Wolfarth of Chevron, the Gas Carrier Salvage Working Group has utilised the initial content that has been submitted to produce the first draft of a document. The publication will focus on gas carrier emergency preparedness while considering potential salvage situations and how to prevent them.

Chaired by John Taylor of Shell, the Selection and Testing of Valves for LNG/LPG Applications Working Group is combining two existing SIGTTO documents, i.e. *The Selection and Testing of Valves for LNG Applications (2008)* and *The Selection and Testing of Valves for LPG Applications (2012)*, into a single revised publication. The working group has met four times so far, most recently in July 2022, and is compiling the first draft of the document.

The Guide for Planning Gas Trials for LNG Vessels Working Group is chaired by Rose Brooks of BP and is working to revise the existing SIGTTO publication *Guide for Planning Gas Trials for LNG Vessels (2008)*. The updated version will take into account recent technology advances, including Type A and large Type C cargo containment system developments. The reduction of greenhouse gas (GHG) emissions from gas trials is also being considered. The working group will submit a



The revision of the Jetty Maintenance and Inspection Guide, led by OCIMF, aligns with the provisions of relevant SIGTTO publications

concept draft of the revised document for comment at the 85th session of the GPC (GPC 85) in October 2022.

The CO₂ Operations Working Group held its kickoff meeting in June 2022. Group members comprise liquefied gas ship and terminal operators, ship designers and classification societies. The group has been tasked with the development of guidance to assist with safe operations involving the transport of carbon dioxide (CO₂) by ship.

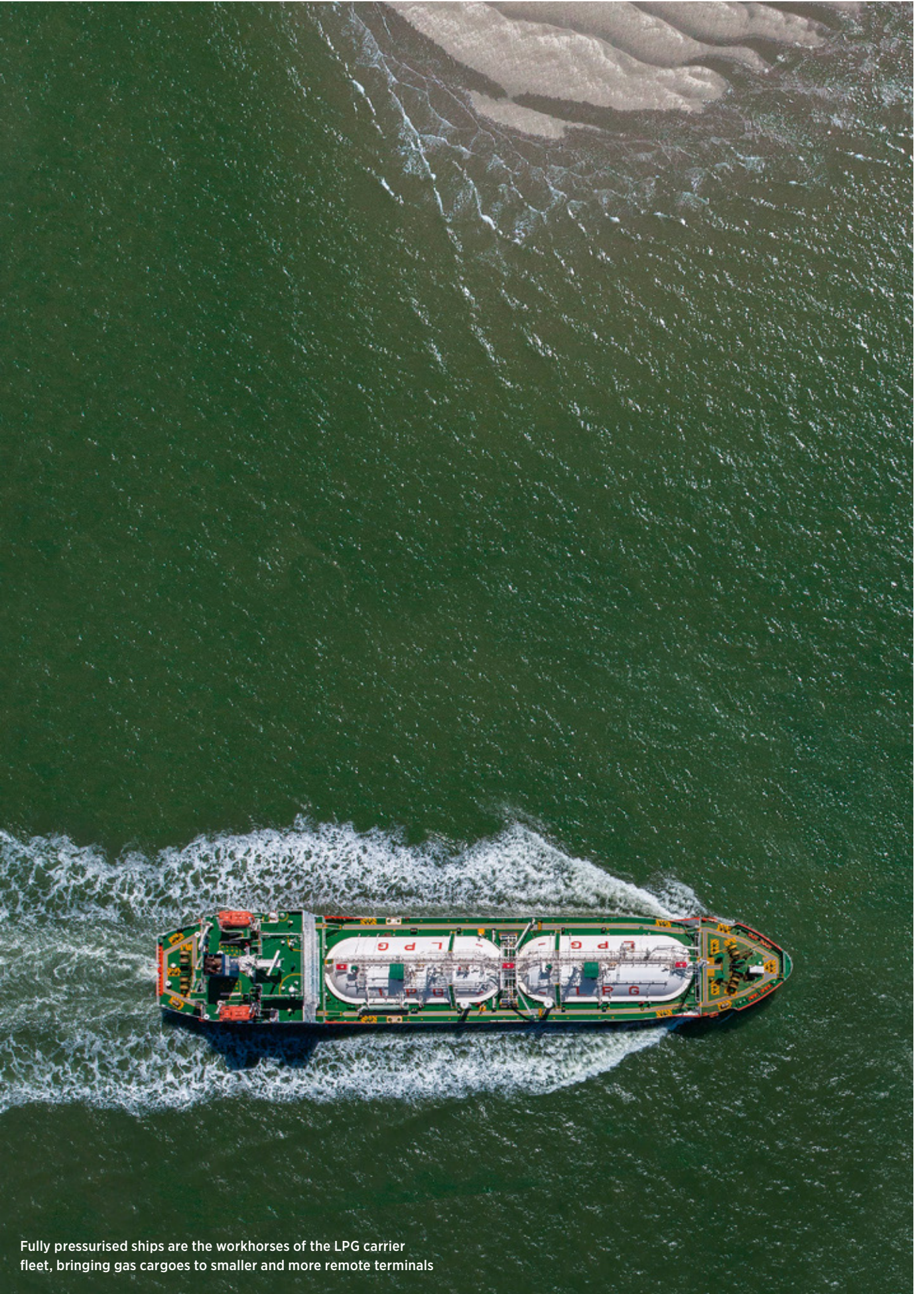
The Jetty Maintenance and Inspection Guide Working Group has been established by the Oil Companies International Marine Forum (OCIMF) to lead the revision of *Jetty Maintenance and Inspection Guide (2008)*, a document that it produced jointly with SIGTTO. SIGTTO Principal Technical Adviser Rob Farmer is acting as liaison with this group and is assisting in aligning it with SIGTTO publications. The working group has held six meetings so far, most recently in February 2022. SIGTTO's GPC will review and comment on the revised document prior to approval.

Environmental Sub-committee (ESC)

Chaired by John Boreman of BP, SIGTTO's ESC is comprised of GPC

members representing BP, Cheniere, Chevron, Enagas, ExxonMobil, Maran Gas, Shell and TotalEnergies. The Subcommittee has held six meetings to date, most recently in March 2022 when progress updates were provided on the four ESC-initiated working groups on carbon dioxide (CO₂) and methane emissions. Current work items at the International Maritime Organization (IMO) were also reviewed and discussed, including outcomes of the 77th Session of IMO's Marine Environment Protection Committee (MEPC 77) which took place in November 2021.

Chaired by John Taylor of Shell, Gas Carrier CO₂ Emissions Working Group has sought to identify all distinct processes that generate CO₂ emissions on board gas carriers and outline guidance to assist standardisation of reporting methodology. The group received approval of the final draft of the document it has produced at GPC 84 in March 2022 and the publication will be available in summer 2022. The work carried out by this working group will be built upon by a separate SIGTTO group, the Reduction of Gas Carrier CO₂ Emissions Working Group. The working group is embarked on the provision of guidance and best practices to assist with the reduction of CO₂ emissions from gas carriers. >



Fully pressurised ships are the workhorses of the LPG carrier fleet, bringing gas cargoes to smaller and more remote terminals

Chaired by Leonidas Koulouridis of Shell, the Reduction of Gas Carrier CO₂ Emissions Working Group has held two meetings so far, most recently in May 2022. The working group is embarked on the provision of guidance and best practices to assist with the reduction of CO₂ emissions from gas carriers.

The LNGC Fugitive Methane Emissions Working Group is chaired by Ajay Edakkara of Shell. It has sought to identify all distinct equipment and systems that could generate fugitive methane (CH₄) emissions on board LNG carriers; consider best practice measurement and monitoring functions; and outline guidance to assist with the standardisation of reporting methodology. The group received approval of the final draft of the document it has produced at GPC 84 in March 2022 and the publication will be available in summer 2022. The work carried out by this working group will be built upon by a separate SIGTTO group, the Reduction of LNGC Methane Emissions Working Group.

Also chaired by Ajay Edakkara of Shell, the Reduction of LNGC Methane Emissions Working Group has held two meetings so far, most recently in May 2022. This working group's scope has been expanded to encompass the provision of guidance and best practices to assist with the reduction of all methane emissions from LNG carriers.

Human Element Committee (HEC)

HEC's LPG Shipping Suggested Competency Standards Working Group has completed the revision and updating of *LPG Shipping Suggested Competency Standards* (2008), an earlier SIGTTO publication. The group was chaired by Steve Allibone of MOL and its revision focuses on how working practices and competencies have been affected by changes in the industry, new technologies and improvements in safety, as well as lessons learnt from past incidents. A major addition to this revision is coverage of the use of LPG as a fuel. The final draft of the revised document was approved at 12th meeting of the Human Element Committee (HEC 12) in January 2022 and at the Spring



The new gas carrier trials document takes into account the issue of greenhouse gas emissions during the procedure

2022 meeting of the SIGTTO Board of Directors in May. The new publication will be available to purchase in summer 2022.

Chaired by Jo McDade of Chevron, the Shore Staff Competency Management System Standards Working Group has continued to gather and refine information associated with suggested best practices. Group members have sought to identify and define components that may be used to develop a high-hazard competence management framework for shore staff

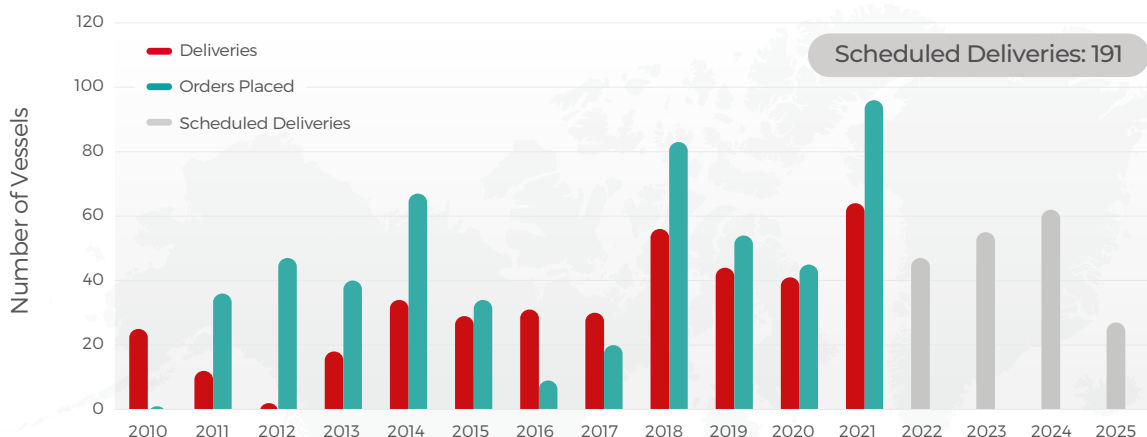
that adds to a company's human factor toolkit. This publication will align with concepts provided in SIGTTO's upcoming Human Element Guide publication.

Chaired by Steve Allibone of MOL, the Cargo Resource Management Working Group has been charged with developing a document on a model gas cargo resource management training course. A concept draft of the group's document received approval at HEC 12 in January 2022 and a final draft will be considered at HEC 13 in July 2022.

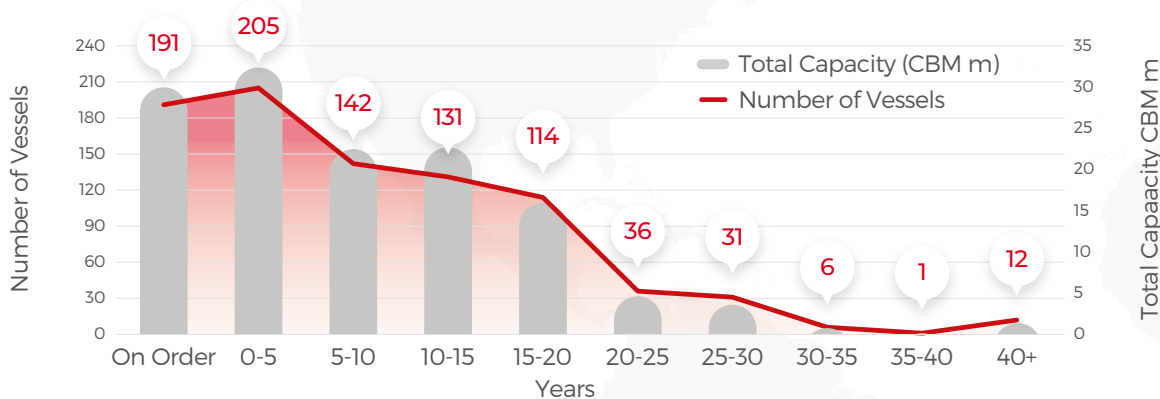
LNG Carrier fleet breakdown

GLOBAL LNG CARRIER FLEET 2021

LIVE LNG FLEET DELIVERIES AND ORDERS PLACED



LNG FLEET AGE PROFILE



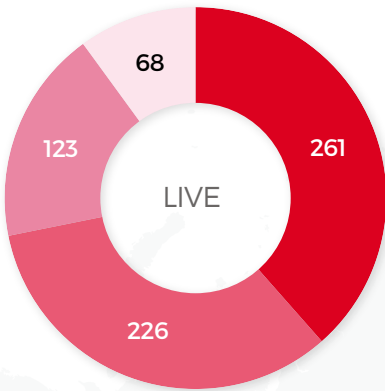
TOP LIVE & ON ORDER LNG OWNER NATIONS BY TOTAL CAPACITY CBM m

1. Greece 122 Vessels	20.76 CBM m	6. Norway 67 Vessels	10.06 CBM m
2. Japan 138 Vessels	20.56 CBM m	7. Bermuda 45 Vessels	7.17 CBM m
3. Qatar 77 Vessels	14.98 CBM m	8. Russia 33 Vessels	5.42 CBM m
4. South Korea 77 Vessels	11.01 CBM m	9. Malaysia 30 Vessels	4.10 CBM m
5. China 70 Vessels	10.53 CBM m	10. USA 27 Vessels	4.01 CBM m

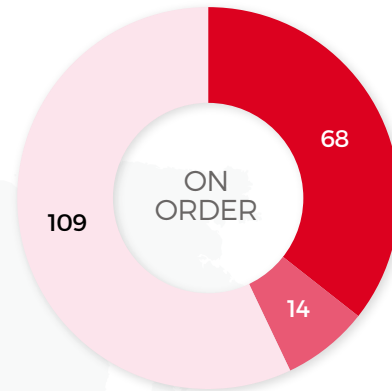
Source: VesselsValue as of 31st December 2021
Does not include floating production vessels.



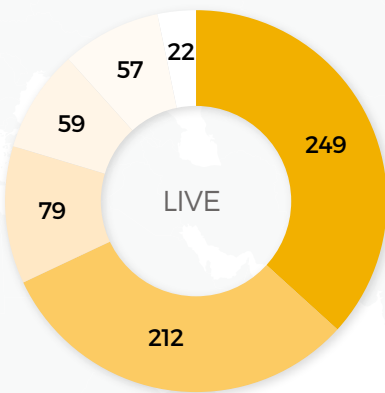
LNG CARRIER FLEET BY CONTAINMENT SYSTEM



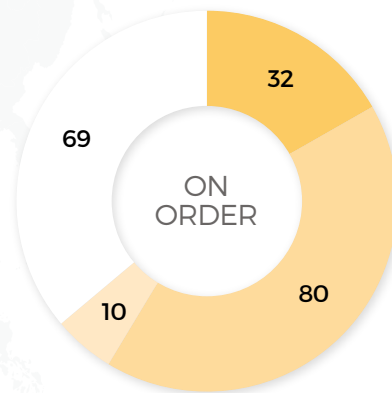
261	GTT Mark III	68
226	GTT 96 Membrane	14
123	Spherical	0
68	Others	109



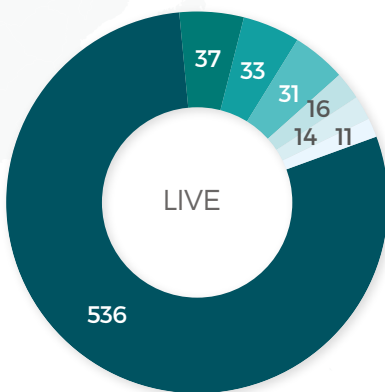
LNG CARRIER FLEET BY PROPULSION SYSTEM



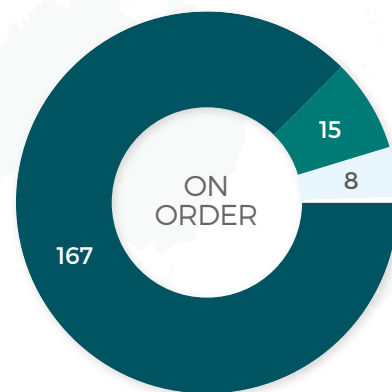
249	Turbine	0
212	DFDE (Gas & FO)	32
79	X-DF	80
59	Low Speed Electronically Controlled	0
57	MEGI (Gas & FO)	10
22	Others	69



LNG CARRIER FLEET BY VESSEL TYPE



536	Large LNG	167
37	Small Scale LNG	15
33	FSRU	0
31	QFLEX	0
16	RLNG	0
14	QMAX	0
11	Midsize LNG	8
0	CNG	1



Gas shipping and terminal timeline 2021

A roundup of key gas shipping and terminal developments in 2021 highlights many aspects of an industry that was beginning to recover following a year of little or no growth due to the Covid-19 pandemic. These developments include the spread of an increasingly diverse global infrastructure; the application of new technologies; the emergence of new players and cargoes; and the introduction of new vessel types.

January

- The Croatia LNG terminal received its first cargo. The import facility, located on Krk island in the northern Adriatic Sea, makes use of a converted floating storage and regasification unit (FSRU) which was formerly the 140,000 m³ LNGC *Golar Viking* and renamed *FSRU LNG Croatia*.
- Early in the month two 172,400 m³ icebreaking Arc7 LNGCs serving the Yamal LNG project in the Russian High Arctic - *Christophe de Margerie* travelling eastbound to Asia with a cargo loaded at the Sabetta terminal and *Nikolay Zubov* in ballast sailing westbound from Dalian in China toward Sabetta to load - crossed paths in the eastern Siberian Sea. Both vessels were unaccompanied by specialist icebreaker escorts, marking the latest in the season transits of the Northern Sea Route by unassisted commercial ships.
- Two notable LNG bunker vessels (LNGBVs) were delivered - the 4,000 m³ *Q-LNG 4000* and the 7,500 m³ *FueLNG Bellina*. For operation in US waters, *Q-LNG 4000* is the first LNGBV built to the articulated tug and barge (ATB) design while *FueLNG Bellina* is Singapore's inaugural LNGBV.

February

- Qatar Petroleum (QP) took the final investment decision (FID) to press ahead with the US\$28.75 billion North Field East (NFE) project that will boost the country's annual LNG export potential from 77 to 110 million tonnes per annum (mta). Four new mega trains, of 8 mta capacity each, will be built.
- *PFLNG Dua* produced its first LNG, on the Rotan field, 140 km offshore Kota Kinabalu in the Malaysian state of Sabah. *PFLNG Dua* is the second of two Petronas floating LNG production (FLNG) vessels active in Malaysian waters. *PFLNG Dua* is capable of reaching gas fields in water depths up to 1,500 metres and can produce 1.5 mta of LNG.
- Eni lifted a cargo at Damietta, the first LNG to be produced at this 5.7 mta Egyptian terminal since November 2012.
- China reported that the country's fleet of 500,000 LNG-fuelled trucks and buses consumed 13 million tonnes (mt) of LNG in 2020.
- Bharat Petroleum inaugurated a 1 mta LPG import terminal at Haldia in northeastern India's West Bengal state.



FueLNG Cellina is Singapore's first LNG bunker vessel

March

- The third 5 mta train at Cheniere's Corpus Christi LNG export terminal in Texas was commissioned. The new train boosted overall US LNG export capacity to 80.1 mta, up from 63.4 mta in April 2020.
- Knutsen's 1,100 m³ LNGC *Pioneer Knutsen* delivered an inaugural cargo to the 2,000 m³ mini LNG terminal at Mowi Scotland's fishfeed mill at Kyleakin.
- Elengy celebrated the discharge of the 10,000th LNG cargo at its French terminals since the first shipment reached its now-defunct Le Havre facility onboard the 25,500 m³ *Jules Verne* in 1965. The deliveries have amounted to 326 mt of LNG over the 57 years, equivalent to one year of Europe's current gas consumption.

Fos Tonkin is the oldest of France's four terminals and has hosted the most ship visits by a wide margin



- New Fortress Energy (NFE) reached a FID on its first Fast LNG plant. The concept, which has been developed to enable the speedy, low-cost development of small offshore gas fields, features an offshore rig-mounted 1.4 mta liquefaction plant and an adjacent LNGC utilised as a floating storage unit (FSU).
- The large container ship *Ever Given* grounded in the Suez Canal, blocking all traffic for six days. During 2020 close to 260 LNG cargoes were sent from Qatar to Europe via the Suez Canal, an average of five per week.
- Lauritzen Kosan and Epic Gas finalised their earlier agreement to combine their respective gas carrier fleets. The new BW Epic Kosan operation makes use of 34 Lauritzen Kosan LPG and chemical gas carriers and 42 pressurised LPG ships contributed by Epic Gas.

April

- The establishment of Korea as a LNGC repair centre was formalised when Korea Gas Corp (Kogas) signed deals with the Samkang S&C and Sungdong Shipbuilding yards. Kogas had traditionally opted to have the LNGCs it charters surveyed and repaired at specialist yards in Singapore and Malaysia but in 2020, with Covid limiting international travel, Kogas had seven vessels repaired at domestic facilities. Some 12 LNGCs were scheduled for drydockings at Samkang and Sungdong in 2021.
- GTT unveiled its NO96 Super+ membrane cargo containment system. The design utilises reinforced polyurethane foam (R-PUF) panels rather than plywood boxes to reduce heat ingress into the cargo tank. The new system, which has received an approval in principle (AiP) from BV, guarantees a cargo boil-off gas rate of 0.08 per cent per day for a conventional size LNGC.
- Excelerate Energy completed its 2000th LNG ship-to-ship (STS) operation, the cargo being transferred to the company's 138,000 m³ FSRU *Excellence* positioned off Moheshkhali in Bangladesh. Over 236 million m³ of LNG were transferred in these 2,000 operations. Excelerate handled the industry's first commercial STS transfer of LNG in 2007, at Scapa Flow.

May

- Econnect Energy successfully tested its IQuay patented jettyless transfer system in Norway with the discharge of LNG from the 15,600 m³ *Coral Energy* to the Herøya Industrial Park via an offshore platform and floating cryogenic hoses. The IQuay technology has been developed for deployment in remote areas where installing marine jetties may be cost-prohibitive and impactful to the local environment.
- The Oman-based OQ Group commissioned its new 300,000 tonnes per annum (tpa) LPG terminal in the southern Omani port of Salalah. Over 90 per cent of the LPG produced at the site is for export and the first overseas shipment, for India, was loaded onboard the 37,400 m³ *Searambler* in June.
- BW LPG carried out the first ship-to-ship (STS) transfer of LPG bunker fuel when the 5,000 m³ *Epic St Martin*, one of the ships in the group's BW Epic Kosan fleet, transferred sufficient fuel to fill the two 820 m³ deck-mounted bunker tanks on the 84,000 m³ VLGC *BW Balder*. The operation was carried out in the waters of South East Asia.

Gas shipping and terminal timeline 2021

June

- Novatek commissioned the fourth and final train at the Yamal LNG export terminal in the Russian High Arctic. The unit, with a small capacity of 0.95 mta, was built as a prototype to test the Arctic Cascade liquefaction technology developed and patented by Novatek.
- Excelerate Energy deployed the 150,900 m³ FSRU *Exemplar* in the Argentinian port of Bahia Blanca to support the South American nation's peak energy demand during the Southern Hemisphere's 2021 winter season. The vessel was chartered by IEASA and YPF, the country's two leading energy companies. The charter marked a return to the port for Excelerate, the company having supplied a FSRU for positioning at a purpose-built jetty in 2008 to enable Argentina to commence LNG imports. Winter season LNG imports via an FSRU continued at Bahia Blanca until 2018 but then were halted as other sources of gas became available.
- The first Turkish-flag FSRU, the 170,000 m³ *Ertuğrul Gazi*, went into service at the Dörtyol import terminal on the country's eastern Mediterranean coast with the reception of a 132,000 m³ cargo delivered by the LNGC *Berge Arzew*. The FSRU is owned by the Turkish oil and gas pipeline operator BOTAS.
- Exmar took delivery of the 88,000 m³ *Flanders Innovation*, the first very large gas carrier (VLGC) newbuilding to be provided with a dual-fuel engine and the ability to burn LPG.



July

- The European Commission published its “Fit for 55” package, marking the start of the drive to cut greenhouse gas (GHG) emissions from marine fuels now while maintaining a focus on air quality improvements. The initiative recognises that the use of operationally proven and commercially available LNG and bioLNG provides a first step on the journey to shipping decarbonisation.
- Hyundai Samho Heavy Industries delivered the 90,000 m³ very large gas carrier (VLGC) *Bellavista Explorer* as the world's largest LPG carrier currently in service. The dual-fuel vessel is able to run on LPG as well as oil fuel.
- Kuwait received the first LNG cargo at its new Al-Zour LNG shore import terminal. The shipment, of 213,000 m³ from Qatar, was delivered by the Nakilat Q-flex LNGC *Al Kharsaah*. Prior to the start-up of Al-Zour, Kuwait began receiving LNG in 2009 via an FSRU positioned at a jetty at Mina Al Ahmadi. The new Al-Zour terminal boasts eight storage tanks of 225,000 m³ each, two marine jetties and the capacity to process 22 mta of LNG.
- Commercial operations commenced at the small New Fortress Energy LNG receiving terminal at the port of Pichilingue in Mexico's Baja California Sur. The terminal features the proprietary ISOFlex system, which allows larger LNG carriers to transload LNG into multiple ISO tank containers on offshore support vessels simultaneously with a specialised manifold. NFE licenses the ISOFlex technology from Argent Marine Management.



- Fujian Gulei Petrochemical completed the construction of its LPG import terminal at the port of Zhangzhou in southeastern China's Fujian province. The facility features two refrigerated 120,000m³ storage tanks – one for propane and one for butane – and a marine jetty able to accommodate VLGCs.

August

- Sinopec of China commissioned two new 160,000 m³ storage tanks at its Qingdao LNG import terminal in Shandong province, effectively boosting throughput capacity from 6 to 7 mta. The next expansion phase at the site, now underway, will enable Qingdao to handle 14 mta of LNG by the end of 2023. Elsewhere in China, CNPC inaugurated four new 160,000 m³ tanks at its 6.5 mta Tangshan LNG import terminal in the port of Caofeidian in Hebei province, doubling storage capacity at the facility.
- Navigator Gas and Ultragas finalised their merger, creating a combined fleet of 56 ships that is the largest in the petrochemical gas shipping market on a capacity basis.

September

- The small, coastal LNG distribution terminal in Ravenna owned by Depositi Italiani GNL received its inaugural cargo, delivered by the 30,000 m³ *Ravenna Knutsen*. The facility, which is the first of its kind in Italy, boasts a 20,000 m³ storage tank and a processing capacity of 0.75 mta. The cargoes it receives will be used to fuel LNG-powered ships and road vehicles.

October

- Qatar Petroleum (QP) launched the massive shipbuilding programme that will underpin its US\$28.75 billion North

Field East (NFE) project by ordering the first four ships of the required fleet. Contracted at the Hudong Zhonghua yard in China, the 174,000 m³ quartet will be powered by two-stroke, dual-fuel engines. The NFE project will boost Qatar's LNG export capacity by 43 per cent, from 77 to 110 mta. QP plans to follow NFE with a further expansion project, North Field South (NFS), which will add another 16 mta to the country's production capacity by 2027. To meet the shipping needs of NFE and NFS, QP has reserved newbuilding berth slots for 16 LNGCs at Hudong Zhonghua and "more than 100 LNGCs" at Korea's three major shipyards. During the month Qatar Petroleum changed its name to QatarEnergy to reflect a broadening market strategy which will encompass energy efficiency and environment-friendly technology.

- Shell, in tandem with Equinor and TotalEnergies, its partners in Europe's Northern Lights project, ordered two LNG-powered, wind-assisted carbon dioxide (CO₂) carriers at Dalian Shipbuilding in China. The 7,500 m³ vessels, which will be equipped with Type C pressure vessel cargo tanks, are the first of a kind and the inaugural CO₂ carriers contracted for use in carbon capture and storage (CCS) schemes.
- Clarkson Research Services reported that the cargo-carrying capacity of the global LNGC fleet topped 100m m³ for the first time, thanks to the completion of 8m m³ of newbuildings in the first nine months of the year. Furthermore, the combination of the 665 ships in the current fleet and a massive orderbook, equivalent to 25 per cent of the existing fleet in capacity terms, means there could be more LNGCs sailing the oceans than very large crude carriers (VLCCs) by as soon as 2025.



Northern Lights is poised to introduce a new type of gas tanker – the CO₂ carrier

Gas shipping and terminal timeline 2021



The FSRU BW Tatiana takes onboard its first ship-to-ship transfer cargo in El Salvador

November

- Petronet LNG reported that it will build a third marine jetty at its Dahej LNG import terminal in India's Gujarat state, and that it will boost the facility's LNG-handling capacity from 17.5 to 20 mta. The third jetty will be 2.5 km long and built to accommodate very large ethane carriers (VLECs) and VLGCs up to 100,000 m³ in size. Shoreside infrastructure for handling ethane and propane will also be constructed.
- The 137,000 m³ FSRU *BW Tatiana* was moored at its new purpose-built berth in Acajutla harbour to enable El Salvador to import LNG for the first time. The vessel, the converted former LNGC *Gallina*, will serve the Energía del Pacífico LNG-to-power project.
- Woodside announced its decision to proceed with construction of Train 2, a 4.9 mta unit, at the Pluto LNG facility near Karratha in Western Australia. A 2026 completion date is targeted.

December

- The first cargo produced by the new 5 mta Train 6 at Cheniere Energy's Sabine Pass LNG export terminal in southwestern Louisiana was loaded for shipment.
- Sinopec commissioned Jetty No 2 at its Tianjin facility, making it the only LNG import terminal in China with two jetties. The berth, which makes possible the simultaneous discharge of two LNGCs, is part of the current second expansion phase at Tianjin which will boost the facility's capacity from 6 to 10.8 mta by the end of 2023. The expansion project also involves the construction of five 220,000 m³ storage tanks.
- The Hyosung Group completed work on an underground LPG storage cavern, the largest in South East Asia, adjacent to its propane dehydrogenation (PDH) plant in Vietnam's Mekong Delta province of Ba Ria-Vung Tau, not far from Ho Chi Minh City. In addition to the cavern, which is able to hold 240,000 tonnes of LPG, the shoreside facility has 10 spherical LPG storage tanks, each with a 4,000-tonne capacity.

Stena Clear Sky in the Panama Canal – helping in the carriage of the rising US exports of LNG



Summary

The global LNG market bounced back robustly in 2021, after a slowdown and only marginal growth in 2020 due to the outbreak of the Covid-19 pandemic. Seaborne movements of LNG reached 372.3 million tonnes (mt) in 2021, a 4.5 per cent increase on the 2020 level of 356.1 mt. According to statistics compiled by GIIGNL, LNG sold in the spot and short-term markets decreased by 6.2 mt in 2021, dropping 4 per cent, to 136.3 mt and accounting for 36.6 per cent of the LNG market in 2021.

Australia, with shipments of 78.5 mt, topped the LNG exporters list for the second year running in 2021. Qatar, with loadings of 77.0 mt, remained a close second. The US was once again in third place, but its 67.0 mt of exports was 49.8 per cent ahead of its 2020 shipments. With still more new liquefaction trains coming onstream in the US Gulf in late 2021/early 2022, the US is expected to emerge as the world's leading LNG exporter in 2022.

Liquefaction plant and feedgas problems in Peru, Nigeria, Trinidad, Angola and Norway meant double-digit drops in export shipments from these countries in 2021 but Egypt, with its two export terminals once again fully operational, recorded a 390 per cent jump in exports compared to 2020, to 6.6 mt.

Of the world's 44 LNG import countries in 2021, China recorded the biggest annual increase in volume. It purchased 79.3 mt, 10.4 mt more than the 2020 total. The performance pushed China to the top of the LNG importers league table, dislodging Japan from a position it had held for five decades. Japan's LNG imports, at 74.4 mt, were more or less static last year while Korea, the third largest purchaser of LNG, welcomed the discharge of 46.9 mt at its terminals, a 15 per cent year-on-year jump.

Another notable performance amongst LNG importers in 2021 was that of Brazil. The country suffered its worst drought in a century last year, curtailing the generation of hydropower, the primary source of Brazil's electricity, to slow to a trickle. LNG imports were stepped up to cover for the lost hydropower and the country's purchases, of 7.0 mt, were 193 per cent up on the 2020 figure.

GIIGNL reports that a total of 68 LNGCs were delivered in 2021, up from 47 in 2020. The global fleet of LNGCs stood at 700 vessels at the end of 2021, including 48 FSRUs and 64 vessels of less than

50,000 m³. The sub-50,000 m³ fleet comprised 31 LNG bunker vessels and 33 LNGCs. A record 111 LNGCs were ordered in 2021, including 86 large carriers, pushing the total LNGC orderbook as of 31 December 2020 to 196 ships. The newbuilds represented 28 per cent of the existing LNGC fleet in capacity terms.

In addition to the 31 LNGBVs in service at the end of 2021, another 22 such vessels were on order, ten of which are due for delivery in 2022. Figures compiled by DNV show that 240 dual-fuel ships that are not LNG carriers but will be powered with LNG were ordered in 2021. That number exceeded the total of LNG-fuelled vessels contracted in the previous four years combined and is likely to require some 3 million tonnes per annum (mta) of LNG as bunker fuel.

According to the DNV statistics there were 251 LNG-fuelled vessels in service at the end of 2021 and 403 more on order. The level of LNG-fuelled ship contracting continued briskly during the first half of 2022 and it is estimated that the demand for LNG as bunker fuel will hit 9-10 mta by the end of 2025.

In its review of the global seaborne LPG trade in 2021 Barry Rogliano Salles (BRS) points out that the US consolidated its position as the top LPG exporter with shipments of slightly over 50 mt, 11.5 per cent ahead of the 2020 level. The US thus accounted for 41 per cent of the 122 mt of LPG transported by sea worldwide in 2021. Middle East LPG exports, at 34.7 mt, were marginally down year-on-year.

East Asia remained the world's major LPG importer last year, with 54.8 mt discharged at the region's terminals. China accounted for 44 per cent of this volume, its imports of 23.9 mt being 14.5 per cent up on the 2020 total. Propane accounted for two-thirds of China's purchases, for use as a feedstock at the country's growing number of propane dehydrogenation plants.

India remained the world's second largest LPG importer in 2020, its purchases of 18.6 mt being 7.4 per cent up on the 2020 level. LPG shipments to Europe, at 22 mt, and to South East Asia, at 11.6 mt, were comparable to the 2020 volumes.

Some 15.2 mt of petrochemical gases was moved by sea in 2021, with ethane representing a comparably new and important cargo. The US exported 6 mt of ethane in 2021, 64 per cent of which was delivered to India and China, primarily in very large ethane carriers (VLECs).

The very large gas carrier (VLGC) fleet numbered 321 vessels at the end of 2021, compared to 303 12 months earlier. Some 52 VLGCs were ordered in 2021, bringing to 70 the total number of such ships on order, equivalent to 22 per cent of the existing fleet in cargo-carrying capacity terms. All the VLGCs ordered in 2021 were specified as dual-fuel ships, with the ability to burn LPG.

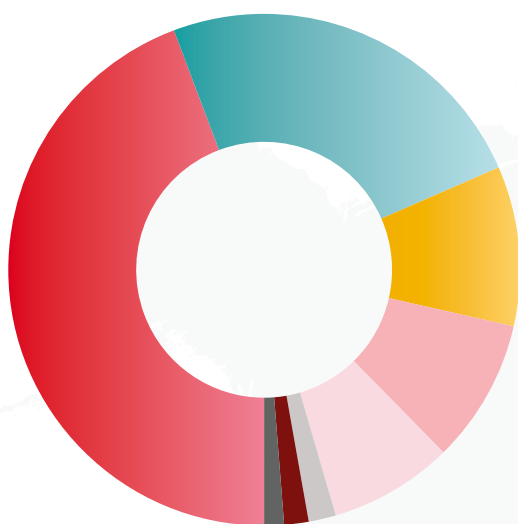
BW Epic Kosan reported that, exclusive of Chinese-flag ships, there were 342 fully pressurised LPGCs of over 3,000 m³ in service at the end of 2021, with 18 such vessels on order. Navigator, another operator active in the smaller ship sectors, stated that there were 117 fully refrigerated medium gas carriers (MGCs) of 25-40,000 m³ in service, 15 of which were ethylene-capable, while another 28 MGCs were on order at end-2021. Also, there were 118 handysize gas carriers of 15-25,000 m³ in service, 35 of which were ethylene-capable, at the turn of the year.

Sources: *International Group of LNG Importers (GIIGNL); Society of International Gas Tanker and Terminal Operators (SIGTTO); BW LPG; BRS Group; BWEK; Navigator Gas*

LPG carrier fleet by type, age, flag state and owner nation

GLOBAL LPG CARRIER FLEET 2021

LPG FLEET BY NUMBER OF VESSELS

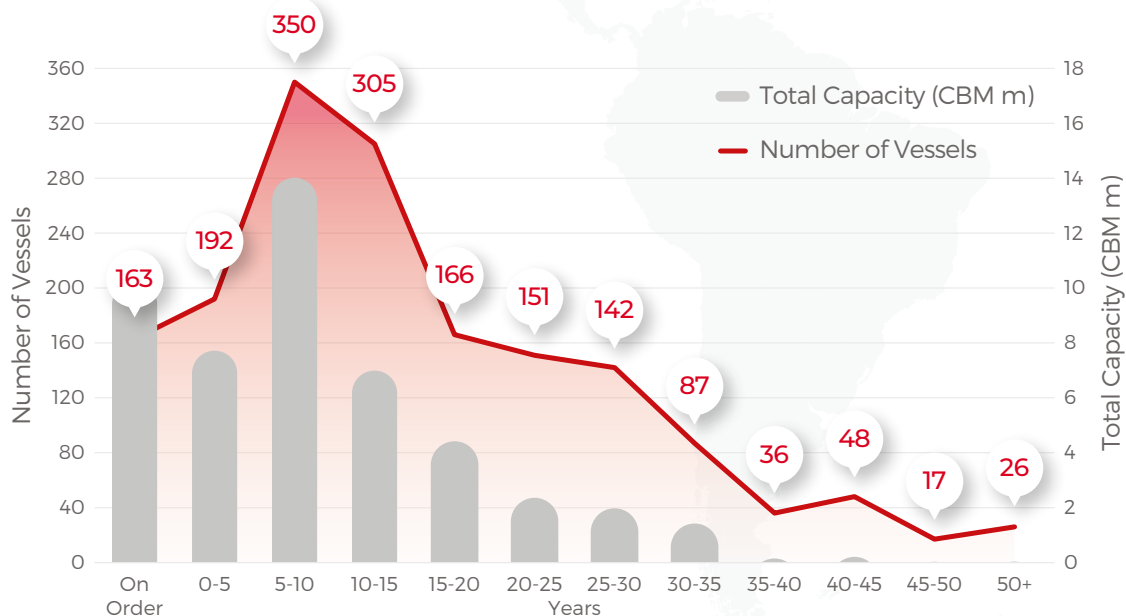


LPG Type	Number of Vessels	Total Capacity (CBM M)
Fully Pressurised	745	2.59
VLGC	407	33.94
LEG	170	1.98
SP FR LPG	153	1.76
MGC	132	4.95
HGC	29	0.65
VLEC	26	2.45
LGC	21	1.25

Total of **1,683** vessels

163 of which are currently on order

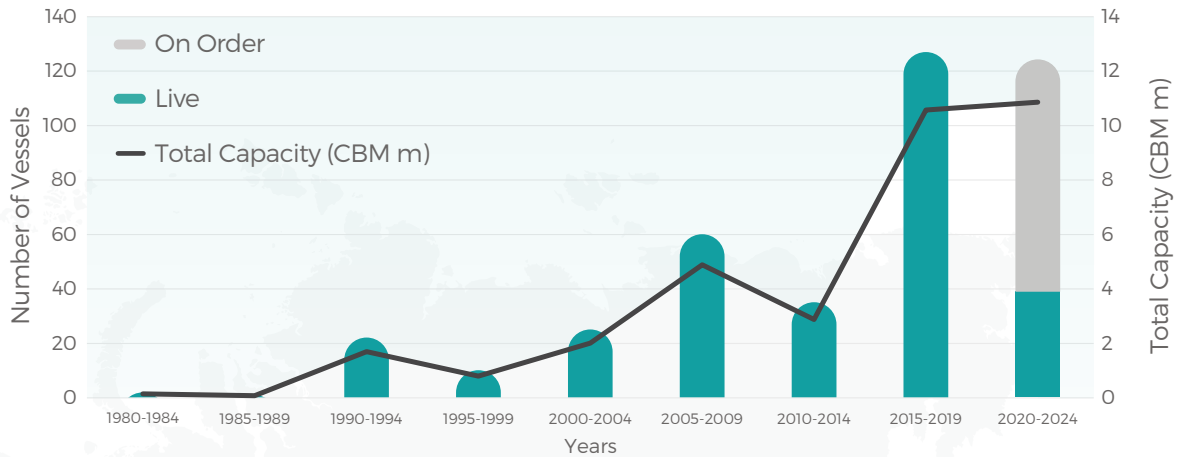
LPG FLEET AGE PROFILE



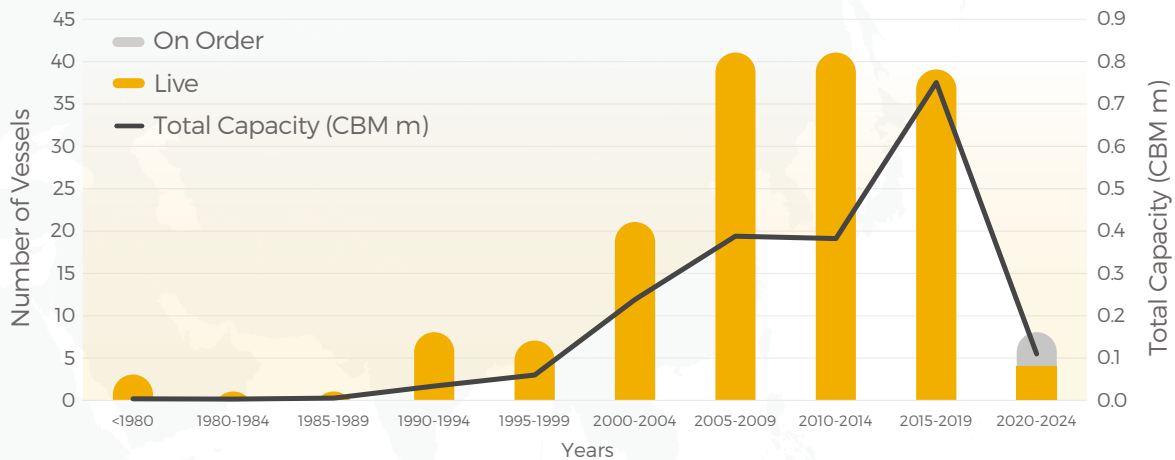
Source: VesselsValue as of 31st December 2021
Does not include floating production vessels.



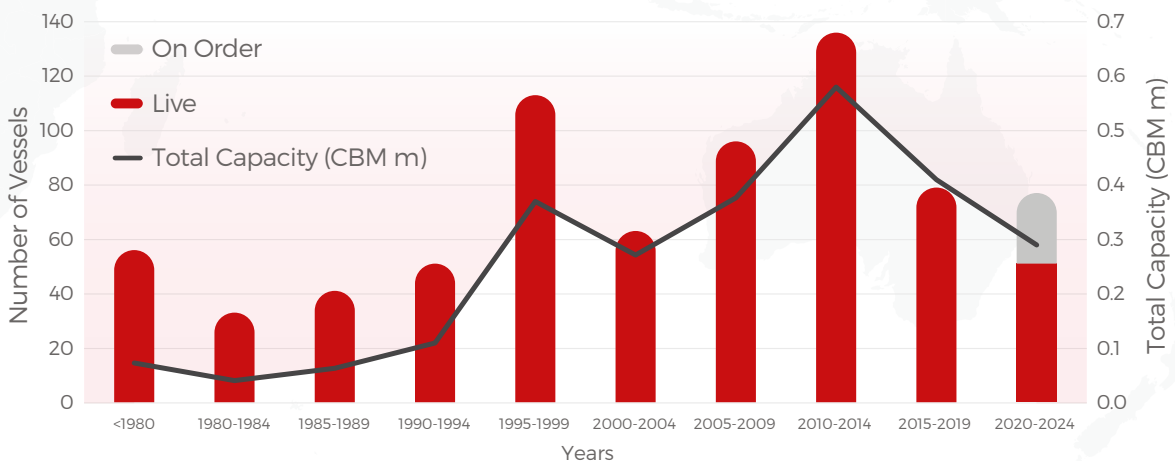
VLGC DELIVERY SCHEDULE



LEG DELIVERY SCHEDULE



FULLY PRESSURISED DELIVERY SCHEDULE





The global fleet of LNG bunker vessels is growing steadily

Member survey directs restructure

A strongly supported survey of SIGTTO members in late 2021 has prompted a new committee structure and other key administrative changes

In Autumn 2021 the SIGTTO Board of Directors launched a survey amongst the Society's members to gauge how they view the Society and to find out what changes, if any, they would like to see implemented. The initiative was particularly timely in view of the important developments currently impacting the liquefied gas shipping and terminal sectors.

While the results indicated broad satisfaction with SIGTTO's work, respondents requested that additional steps be taken to address today's challenges, not least the environment and, in particular, the drive to reduce emissions of harmful atmospheric pollutants from ships.

Over one-third of SIGTTO's members responded to the survey. Reflecting their status as the core elements of the SIGTTO membership portfolio, gas carrier and terminal operators accounted for 80 per cent of the survey responses. Classification societies, too, were well represented as a group. Some 88 per cent of the respondents stated that they were either satisfied or very satisfied by the level of service provided by SIGTTO and 90 per cent were happy to report that they enjoyed positive interactions with the Secretariat staff.

The respondents also indicated a willingness to commit to the Society's activities. Some 73 per cent of those members completing the survey who are not currently involved with the development of the Society's industry best practice guidance said that they would like to participate in project working groups. In the same vein several respondents stated that in certain cases a continuation of remote, hybrid meetings, of the type held during the Covid pandemic lockdowns, would help reduce the cost burdens for participants from companies wishing to participate but with limited resources.

The majority of those taking part in the survey replied that they would like to receive more updates on environmental

issues, particularly with regard to the work being carried out by the Marine Environment Protection Committee (MEPC) of the International Maritime Organization (IMO). There was broad agreement amongst the respondents that the current SIGTTO position of supporting the work programme being developed by MEPC to reduce ship emissions of greenhouse gases (GHGs) is appropriate, as are the long-term climate goals set out in the *Initial IMO Strategy for GHG Emissions Reductions from International Shipping*.

As part of the 'green' commitment, a number of the survey participants believed that there is merit in the establishment of SIGTTO focus groups on new types of gas carrier, such as carbon dioxide (CO₂) and hydrogen ships, as well as further dedicated working groups on other liquefied gases besides LNG that are set to play a growing role as gas carrier propulsion fuels. The latter gases include LPG, ethane, ammonia and hydrogen and may in time spur the development of new types of liquefied gas bunker vessels and floating terminals. A further idea was also tabled, i.e. that the membership might well derive considerable benefit by SIGTTO-organised seminars on various of these topics.

Some members would like to see the Secretariat provide the membership

with more information/guidance, beyond the current regular publications, especially with regard to incident investigation reports and safety alerts, backed by relevant analysis.

In response to the survey results the SIGTTO Board at its Spring 2022 meeting agreed to upgrade the Society's Environmental Sub-committee (ESC) into a full committee (EC) and to repurpose the Human Element Committee (HEC) as a Focus Group able to serve both the new EC and the well-established General Purposes Committee (GPC). The Board approved the guidance developed by the ESC to date on carbon dioxide (CO₂) emissions from all gas carriers and methane (CH₄) emissions from LNG carriers and this will be issued shortly as new SIGTTO publications.

The Board also decided that in future the terms of reference for new working groups can be agreed by the chair of the relevant parent committee and the General Manager. In addition all future publications will utilise the 'bow tie' risk assessment methodology in line with the approach that now prevails across industry generally. Finally, the Board adopted a streamlined approval-for-publication process, following on from the Society's recently compiled *How We Work* information document (see page 39).



A number of designs for large liquefied hydrogen carriers are already on the drawing board

Focus on ship emission reductions intensifies



In November 2021, at its MEPC 77 meeting, IMO approved guidance on the application of innovative energy efficiency technologies for existing ships

At any one time a number of rulemaking initiatives are underway at the International Maritime Organization (IMO) which impact gas carrier operators engaged in international trade. SIGTTO has had 'observer status' as a non-governmental organisation (NGO) at IMO, the UN agency responsible for global maritime safety and marine environment protection affairs, since 1983.

The Society plays a key role in the rulemaking processes of IMO, contributing information necessary for the drafting and implementation of sound and effective regulations; representing member interests on issues of gas ship safety and reliability; and disseminating the results of the progress being made at the various regulatory meetings amongst the membership.

The following paragraphs detail decisions impacting the design, construction and operation of gas carriers taken by IMO's two central bodies – the Maritime Safety Committee (MSC) and Marine Environment Protection Committee (MEPC) – during 2021 and into early 2022.

Traditionally, SIGTTO has had most involvement with the deliberations of MSC, in line with the Society's central purpose of promoting the safe and

responsible operation of gas tankers, marine terminals and other shipping handling gas as cargo. In recent years, however, environmental issues have come to the fore at IMO, particularly the need to reduce emissions of greenhouse gases (GHGs) from ships as part of the global drive to bring climate change under control. As a result, SIGTTO is now devoting equal attention to the work of MEPC.

Marine Environment Protection Committee (MEPC)

IMO's Marine Environment Protection Committee met for its 77th Session (MEPC 77) in November 2021 and its 78th Session (MEPC 78) in June 2022. The primary focus at the meetings was on the IMO's GHG strategy and mid-term GHG reduction measures.

MEPC 77
GHG strategy and reduction measures
MEPC 77 considered a proposal for a resolution revising the GHG target of zero by 2050. While the proposal did not find consensus, the Committee did agree to initiate the strategy review anticipated by the original strategy resolution. The Committee also discussed ongoing work on the Lifecycle Assessment of Alternative Fuels and mid- and long-term measures for the reduction of

greenhouse gas. It was agreed to continue the work intersessionally with two further working groups, one focusing on lifecycle assessment (ISWG-GHG 11) and another focusing on mid- to long-term measures (ISWG-GHG 12).

Energy Efficiency Design Index (EEDI)

Also approved at MEPC 77 in November 2021 was MEPC.1/Circular 896 2021 *Guidance on Treatment of Innovative Energy Efficiency Technologies for Calculation and Verification of the Attained EEDI and EEXI*. EEXI is an acronym for Energy Efficiency Existing Ship Index. The circular provides updated guidance on the application of innovative energy efficiency technologies, including air lubrication systems; wind-assisted propulsion systems; waste heat recovery systems for the generation of electricity; and photovoltaic power generation systems. This new circular replaces MEPC.1/Circular 815.

Arctic black carbon emissions

Noting the IMO's ongoing work to establish appropriate control measures to reduce the impact on the Arctic of black carbon emissions from international shipping, MEPC 77 adopted Resolution MEPC.342(77) which recognises that black carbon is a short-lived contributor to climate warming, and that a switch to distillate fuel reduces an engine's black carbon emissions. The Resolution urges IMO member states and ship operators to voluntarily use distillate or other cleaner alternative fuels, such as LNG and LPG, or methods of propulsion that are safe for ships and could contribute to the reduction of black carbon emissions from ships when operating in or near the Arctic.

MEPC 78

The main topics for discussion at MEPC 78 in June 2022 were the reports of the two intersessional working groups and the report of the correspondence group on Carbon Intensity Indicator (CII) guidelines.

Revised GHG Strategy

A lengthy high-level discussion on the revision of the IMO GHG Strategy was carried out at MEPC 78. Many views on

the level of ambition were expressed, including “zero by 2050”, although some environmental non-governmental organisations (NGOs) suggested an earlier target of 2040. Most views centred around zero (or net zero) by 2050, more stringent targets for 2030 and an addition milestone in 2040, along with the suggestion of five-yearly checkpoints. Although positions were being laid down, the aim at this meeting was to define a way forward for the review of the IMO GHG Strategy. It was decided to continue this work at the next intersessional working group (ISWG-GHG 13) in December 2022.

ISWG-GHG 11 Report

The eleventh intersessional working group on greenhouse gas reduction met in March 2022, with its principal tasks being to develop draft lifecycle GHG and carbon intensity guidelines for maritime fuels (draft LCA guidelines) and revise the Ship Fuel Oil Consumption Data Collection System (DCS). A review of the impact assessment procedures was also conducted.

MEPC 78 noted the discussion on LCA guidelines and agreed to establish a correspondence group (CG) on marine fuel lifecycle GHG analysis to take the work forward. Recognising the complexity of the task, the deadline for reporting was moved to MEPC 80, scheduled for July 2023, with an interim report to be submitted to MEPC 79 in December 2022.

The Committee noted the discussion on the revision of the Ship Fuel Oil Consumption DCS and approved the draft amendments to Appendix IX of MARPOL Annex VI to include more information on the ship’s carbon intensity performance in the DCS, including:

- attained EEXI
- applicable CII (AER/cgDIST)
- required CII
- attained CII before any correction
- attained CII
- operational CII rating (A/B/C/D/E).

ISWG-GHG 12 Report

The twelfth intersessional working group on greenhouse gas reduction met in May



A further raft of guidelines to back up the tightening ship emissions regulatory regime was adopted by IMO at its MEPC 78 meeting in June 2022

2022 with its principal tasks being to consider (a) issues arising from the final report of the Correspondence Group (CG) on Carbon Intensity Reduction and (b) concrete proposals for mid- and long-term measures. How to manage the workload generated from GHG issues was also discussed.

In considering the CG report, the ISWG had agreed many of the guidelines necessary for the implementation of the CII. CII corrections was an area of considerable debate and many, including those proposed for gas carriers, were rejected. The main reason cited was a lack of data. However, MEPC invited interested parties to collect relevant data in the early years of implementation of the CII rating system and to report relevant information back to the Committee ahead of the review of the CII regulations and guidelines to be completed at the latest by 1 January 2026.

In considering the Ship Energy Efficiency Management Plan (SEEMP) Guidelines the ISWG-GHG 12 included additional text in the Guidelines specifically relating to LNG carriers. This text related to speed optimisation (para 5.2.6 of the Guidelines) and, in paras 7.1.4 and 7.1.5, using the Custody Transfer Monitoring System (CTMS) when calculating fuel consumption, including discounting the nitrogen mass content.

The ISWG considered amendments to the EEXI guidelines to incorporate

an in-service measurement method to determine a reference speed. This was agreed and the EEXI guidelines have been updated accordingly. It is worth noting that the International Association of Classification Societies (IACS) submitted not only its draft guidelines on the implementation of EEXI to IMO as Information Paper 27 (INF.27) but also a paper (INF.16) on the development of guidelines for the use of computational fluid dynamics (CFD) for the purposes of deriving the reference speed (V_{ref}). As information papers, they were not discussed and simply noted in the MEPC 78 report.

When considering port state control (PSC) guidelines, the ISWG debated whether it should be regarded as a detainable deficiency if the implementation plan and/or the plan of corrective actions for a ship rated as D for three consecutive years or rated as E are not implemented by the ship as planned at the time of an inspection. MEPC 78 agreed to the proposal that this matter should be referred to III 8 for further consideration and to identify whether any further guidance needs to be developed on this issue and to advise MEPC 79 accordingly.

MEPC 78 noted the discussions on proposals for mid-term measures and associated impact assessments in the context of Phase I of the three-phase Work Plan for the development of mid- and long-term GHG reduction measures as well as the proposal to >



The partnership of Evergas and INEOS launched the transatlantic trade of US ethane to Europe



Given that the scope of the review of possible IGC revisions is unlimited, numerous submissions on new and amended Code provisions are anticipated in the months ahead

establish an International Maritime Research Board. The Committee also recognised that the ISWG-GHG 12 group agreed to advance to the further development of a "basket of candidate mid-term measures" under Phase II.

MEPC 78 adopted the following guidelines in June 2022:

Ship Energy Efficiency Management Plan (SEEMP)

- 2022 Guidelines for the development of a SEEMP
- Guidelines for the verification and company audits by the Administration of Part III of the SEEMP

Data Collection System (DCS)

- 2022 Guidelines for Administration verification of ship fuel oil consumption data and operational carbon intensity
- 2022 Guidelines for the development and management of the IMO Ship Fuel Oil Consumption Database

- MEPC Circular on the Guidance for submission of data to the IMO data collection system of fuel oil consumption of ships from a state not party to MARPOL Annex VI

Energy Efficiency Existing Ship Index (EEXI)

- 2022 Guidelines on the method of calculation of the attained EEXI
- 2022 Guidelines on survey and certification of the attained EEXI
- Guidance on methods, procedures and verification of in-service performance measurements

Carbon Intensity Indicators (CII)

- 2022 Guidelines on Operational CIIs and the Calculation Methods (CII Guidelines, G1)
- 2022 Guidelines on the Reference Lines for use with Operational CIIs (CII Reference Lines Guidelines, G2)
- 2022 Guidelines on the Operational Carbon Intensity Rating of Ships (CII Rating Guidelines, G4)
- 2022 Interim Guidelines on Correction Factors and Voyage Adjustments for CII Calculations (CII Guidelines, G5)

Next MEPC steps on GHG reductions

Work at IMO on GHG reductions will now be focused on two levels, i.e. the revision of the IMO GHG Strategy, with a view to completion by MEPC 80 in July 2023, and (b) the revision of the mid-term measures, as a basket of measures in the context of Phase II of the Work Plan.

These topics will next be discussed at the ISWG-GHG 13 intersessional meeting scheduled to be held just before MEPC 79 in December 2022. This arrangement will allow the topics to be progressed at MEPC 79. In addition, as noted above, IMO's Marine Environment Protection Committee has agreed to a correspondence group on the LCA Guidelines which will report to MEPC 80 in July 2023. It is anticipated that there will be two further intersessional working groups between MEPC 79 and MEPC 80.

Maritime Safety Committee (MSC)

Discussions on gas carrier design, construction and equipment matters at the 104th Session of IMO's Maritime Safety Committee (MSC 104) in October 2021, were limited to the adoption of a small amendment to the International Gas Carrier (IGC) Code on watertight doors (paragraph 2.7.1.1).

However, gas carriers are coming much more into focus for MSC and its sub-committees in 2022. For a start, the revision of *Guidelines for the approval of fixed dry chemical powder fire-extinguishing systems for the protection of ships carrying liquefied gases in bulk (MSC.1/Circ.1315)* was approved at the 8th Session of the Sub-committee on Ship Systems and Equipment (SSE 8) in March 2022.

Proposed by SIGTTO, the Marshall Islands and the International Association of Classification Societies (IACS), the Review of the IGC Code was adopted as a new work programme item at MSC 103 in May 2021. The possibility of revising and updating the Code will first be considered at the 8th Session of the Sub-committee on Carriage of Cargoes and Containers (CCC 8) in September 2022. Deliberations are scheduled to take two sessions, i.e. CCC 8 and CCC 9, but may be extended. It is anticipated there will be a correspondence group between sessions to progress the work.

The aim of the IGC Code review is to clarify areas of ambiguity while maintaining the levels of safety and integrity inherent in the IGC Code. Areas that are the subject of Unified Interpretations (UIs) and issues that have been raised at IMO but not resolved will no doubt be considered. In addition, given that the scope of the review is unlimited, SIGTTO anticipates numerous other submissions on possible Code revisions in the months ahead.

Another new agenda item, *Revision of the Revised recommendations for entering enclosed spaces aboard ships (Resolution A.1050(27))*, will also be considered at CCC 8 in September 2022.



Terminal staff, working to common purpose with gas carrier crews at the critical ship/shore interface

Up close and personal at SIGTTO's 65th Panel



Back at the liquefied gas 'coalface' – person-to-person in Athens for the 65th Panel Meeting in March 2022

SIGTTO held its 65th Panel Meeting in Athens on 30-31 March 2022. Hosted by Maran Gas Maritime (MGM) and chaired by MGM's Eleni Lazaratou, it was the Society's first face-to-face Panel in four years, the last such event – the 64th – having taken place in London in April 2018.

There was no Panel Meeting in 2019 because SIGTTO staged a special celebratory event to mark its 40th anniversary that year. The 65th Panel had originally been scheduled for spring 2020 but the outbreak of the Covid-19 pandemic forced a delay of the gathering for two years.

The Society did organise two Virtual Panels in 2021 – one in April and the other in October – and a large number of participants signed up to gain online access to a range of presentations on key topical issues at these events. However, as delegates to the 65th Panel reported, there are additional benefits offered by face-to-face conference gatherings that are not possible with video links. These include opportunities to renew and make new acquaintances; the opening of new question-and-answer pathways during spontaneous post-presentation discussions; and the generation of enhanced levels of ideas, questions and solutions made possible when groups of people get together.

A total of 24 speakers made

presentations at the 65th Panel Meeting and 185 registrants from 83 companies signed up for the event.

The current drive to reduce ship greenhouse gas emissions, spearheaded by IMO's developing regulatory regime, was a strong theme at the conference, with seven papers devoted to the subject. These included two papers on the compliance challenges facing LNG carriers – one by Spyros Gertsos of MGM and the other by Carlos Guerrero and Vassilios Dimoulas of BV – and a look at the issue of carbon intensity indicators for LNGCs past 2030 by George Dimopoulos and Martin Cartwright of DNV. On the same theme Niels Clausen of MAN Energy Solutions looked at the efforts being made by his company to decarbonise propulsion systems. The topic was explored further in an illuminating question-and-answer panel discussion chaired by Chris Clucas.

With the recent order for the first carbon dioxide (CO₂) carrier to serve a carbon capture and storage (CCS) project, there was considerable interest in a presentation by Tore Ulleland as he explored what is essentially a reversal of the traditional oil and gas industry material flow, i.e. the transport of a product (CO₂) for disposal in depleted offshore oil and gas fields.

The 'ship/shore interface' has taken

on a new dimension in recent years as more and more specialist vessels are employed as floating liquefied gas terminals in nearshore and offshore waters. To elucidate, Andrew Brown of Smit Lamnalco was on hand to provide Panel Meeting delegates with a marine services perspective on side-by-side operations offshore. He was followed to the podium by Mark McBride of HR Wallingford, who examined ship manoeuvring criteria for floating LNG terminals, and Patrick Everts of KOTUG, who, speaking as an operator of terminal support vessels, set out how to use data, training and innovative solutions to improve safety and efficiency.

Kjetil Sjølie Strand of LNT Marine was present in Athens to update delegates on the status of, and experience gained with, the new LNT A-Box IMO Type A liquefied gas containment system. The concept was developed, as the LNG shipping market increasingly diversifies, to meet the needs of the mid-scale LNG sector. It is a sector which does not want to be compromised by the low volume utilisation and heavy weight of the Type C tanks used for small LNGCs or the high costs attendant on scaling down the spherical and membrane tanks employed on large LNG carriers. Another selling point of the relatively simple LNT A-Box approach is that it enables as many yards as possible to build the LNG carriers at a reasonable cost.



The spherical tank floating storage and regasification unit (FSRU) Golar Freeze receives a cargo for processing from LNG delivery tanker Golar Seal in Jamaica

New titles enhance industry best practice portfolio

The latest batch of SIGTTO publications includes the Society's first documents with a specific focus on environmental issues

For SIGTTO the proactive development of industry best practices and guidelines is one of the five central pillars in its drive to promote safe, environmentally responsible and reliable gas shipping and terminal operations. Work on this portfolio of guidance began with the establishment of the Society 43 years ago and the library has constantly been updated and augmented, as required, ever since.

A listing of SIGTTO's paid publications is given on page 40. The various sets of SIGTTO guidelines and recommendations available for purchase are augmented by more than 60 free publications, newsletters, annual reports and articles produced by the Society. Details of these are given on the Society's website: www.sigtto.org.

The following paragraphs describe the Society's notable publishing achievements since SIGTTO's previous Annual Report, the 2020 edition, appeared 12 months ago. The tally comprises three documents that have now been published and three that have been completed and approved and will appear during the 2022 summer months.

SIGTTO Information Papers, Consolidated Edition 2022 (January 2022)

Compiled for the guidance of industry members, *SIGTTO Information Papers, Consolidated Edition 2022* contains all the Information Papers that are in force for 2022. The new edition, which replaces the *SIGTTO Consolidated Information Papers (2019)*, includes the following new publications from the Society:

- *ESD Systems – Recommendations for Emergency Shutdown and Related Safety Systems, Second Edition*
- *Guidance on Gas Carrier and Terminal Gangway Interface*
- *Recommendations for Management of Cargo Alarm Systems*



The revised edition of the *LPG Shipping Suggested Competency Standards* publication covers the use of LPG as marine fuel for the first time

- *Recommendations for Designing Cargo Control Rooms*
- *Recommendations for Cargo Control Room HMI.*

ESD Systems (July 2021)

Approved by the SIGTTO Board in May 2021 and published in July, *ESD Systems* updates and replaces the previous edition, *ESD Arrangements and Linked Ship/Shore Systems for Liquefied Gas Carriers (2009)*. This new edition, with an updated title, was produced by a working group chaired by Ajay Edakkara of Shell, and the revision work took into account advancements in safety philosophy, technological improvements and lessons learnt from incidents.

This publication provides useful guidance for organisations involved in the design, integration and use of emergency shutdown (ESD) systems and related safety systems on gas carriers and terminals. It first explains the key philosophies that guide the design of safety systems, with reference to the requirements of the International Code of the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk (IGC Code) and relevant International Electrotechnical Commission (IEC) and International Organization for Standardization (ISO) documents.

The revised ESD document then provides recommendations for ESD and related safety systems, including overflow control, ship/shore link and emergency release systems. Guidance for testing these systems is provided and the 'bowtie' risk assessment method is used to help explain the IGC Code requirements.

In addition to discussing the requirements of the IGC Code, this document recommends additional measures for linked ESD systems for LPG. An overview of the types of ship/shore link systems that are typically used in the industry is provided in the annexes, including guidance for cyber security issues associated with linked ESD systems.

Recommendations for Cargo Control Room HMI (July 2021)

Approved by the SIGTTO Board in May 2021 and published in July, this is the third and final publication prepared by the Society's Cargo Control Room (CCR) Ergonomics Working Group. Chaired by Ray Gillett of GTT Training, this working group produced *Recommendations for Management of Cargo Alarm Systems*, published in 2019, followed by >



The detection and reporting document is the first of a new SIGTTO series of publications aimed at reducing fugitive methane emissions

Recommendations for Designing Cargo Control Rooms, published in 2020.

Building on the previous two publications in the series, *Recommendations for Cargo Control Room HMI* recommends a human-machine interface (HMI) design process that is centred around the needs of the operator, allowing effective monitoring and control of the system. It is recommended that shipowners work with system designers, classification societies and shipyards to create an HMI that clearly presents the appropriate information and control functions.

The guidance in this document is based on established standards, such as *ISO 11064 – Ergonomic design of control centres*, which covers the principles and processes to follow when designing the HMI of a control station.

Specific guidance and examples are provided to explain the HMI design process, including examples of key questions to consider when specifying the requirements of the HMI. An example of a task-based display for a loading operation is provided to show how user feedback is used to improve the presentation of information to the operator.

LPG Shipping Suggested Competency Standards, Second Edition

Approved by the SIGTTO Board of Directors in May 2022, this new

publication updates and replaces the previous edition *LPG Shipping Suggested Competency Standards* (2008) and will be available to purchase in summer 2022. This publication is written for organisations involved in training officers, including cargo engineers, for LPG cargo-handling operations. These standards are useful for all types of LPG carriers, regardless of size, and are relevant for all types of LPG cargo-handling operations, including traditional at-berth cargo loading and discharge procedures and ship-to-ship cargo transfers.

This new second edition reflects changes in technology and lessons learnt from incidents since the previous edition was published. The use of LPG as a fuel is a significant addition now covered by this edition.

Measurement and Reporting of CO₂ Emissions from Gas Carriers

This publication provides guidance to assist the gas shipping industry in its efforts to reduce carbon dioxide (CO₂) emissions. It is the first output of the SIGTTO Environmental Sub-committee (ESC), and has been compiled as part of the Society's efforts to support the industry in reducing the environmental impact of liquefied gas shipping.

CO₂ is the most voluminous of the greenhouse gases (GHGs), and this publication is the first in a SIGTTO

series addressing various aspects of CO₂ emissions. The document provides guidance on the standardised measurement and reporting of CO₂ emissions. It first identifies typical sources of CO₂ emissions from gas carriers and describes the methodologies for measuring CO₂ emissions. The reporting standards set by the International Maritime Organization (IMO) and European Union (EU) for CO₂ emissions are then explained, covering both technical and operational efficiency.

This publication has been approved by the Board and will be available to download for free from the SIGTTO website in summer 2022.

Detection and Reporting of Fugitive Methane Emissions from LNG Carriers

This publication provides guidance to assist the gas shipping industry in its efforts to reduce methane emissions from LNG carriers. Like CO₂, methane is a GHG and this document has been prepared to support the liquefied gas shipping industry's efforts to reduce its environmental impact.

This is the first publication in a SIGTTO series that will address the issue of methane emissions. The main purpose of this inaugural publication, which provides guidance on the detection and reporting of fugitive methane emissions, is to recommend the establishment of a structured system for identifying, detecting, measuring and quantifying fugitive emissions of methane from LNG carriers.

The publication represents an important primary step in understanding the mechanisms of methane emissions. It is hoped that the document will support the development of a more comprehensive leak detection and repair (LDAR) system capable of reducing emissions through maintenance and design improvements.

This publication has been approved by the Board and will be available to download for free from the SIGTTO website in summer 2022.

New SIGTTO tool for enhanced collaboration



The Society's new *How We Work* document has been produced to provide clarity on what we do and how we do it

As part

of SIGTTO's drive for continuous improvement, the Society's Secretariat recently prepared an information document entitled *How We Work*. The purpose of the guide, which was approved by the SIGTTO Board of Directors in November 2021, is to improve cooperation between the Secretariat, the Society's members and the wider industry. By providing clarity on what we do, and how we do it, we aim to encourage more effective collaboration in ensuring safe, reliable and environment-friendly operations amongst all the participants involved in the liquefied gas carrier and terminal sectors.

As highlighted in the new document, an important result of current industry developments is an expanding brief for SIGTTO. The Society's basic remit is gas carriers, other ships carrying gas as cargo and associated terminals, including floating terminals. This includes all gas carriers covered by the International Code of the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk (IGC Code) and all the cargo types covered in Chapter 19 of the IGC Code.

This realm encompasses the increasing variety of floating terminals and the growing fleet of LNG bunker vessels and the terminals that serve them now becoming available. New cargoes, too, fall within SIGTTO's scope. Hydrogen and carbon dioxide (CO₂), for example, are poised to become key gas carrier cargoes of the future.

Another part of the broadening SIGTTO remit is the use of gas as a propulsion system fuel on gas carriers. LNG, already a popular marine fuel, is being joined by other liquefied gases as part of the

shipping industry's drive to reduce emissions of harmful atmospheric pollutants. LPG-powered LPG carriers and ethane-powered ethane carriers are already in service and the first ammonia carriers to be fuelled by ammonia are imminent. Hydrogen fuel cells, too, would also become a SIGTTO work agenda item if specified in a future gas carrier propulsion system.

As the *How We Work* publication states, SIGTTO also works with industry partners on topics not specific to gas carriers alone, such as harbour design, maritime security, mooring, emergency support vessels, lifeboats and marine loading arms.

SIGTTO's Board of Directors is responsible for the Society's governance, finances, policies and strategy, and is able to call on input from the various committees plus the Secretariat to implement its decisions. Subject to Board approval, these committees are able to establish individual working groups to tackle specific topical projects. The Board has recently agreed some modifications to the Society's committee structure and ways of working, and these are described on page 29.

The General Purposes Committee (GPC) has traditionally been SIGTTO's principal technical decision-making body and its working groups have been the primary generator of industry best practice guidelines and SIGTTO submissions to the International Maritime Organization (IMO) over the four decades since the Society was established. The Human Element Committee (HEC) and Environmental Sub-committee (ESC) are comparatively new SIGTTO bodies but they have quickly established themselves with the successful completion of some challenging projects.

As *How We Work* explains, the framing and resolving of issues represent critical starting points for SIGTTO initiatives. The decisions taken by the Board and the committees are facilitated by the preparatory work carried out by the SIGTTO Secretariat. In this way

information gathered from the industry enables the Secretariat to frame an issue, backed by relevant supporting documentation, for consideration. More specifically, the Secretariat will provide issue analyses and written summaries, along with options for possible solutions, at least one month before the Board or committee meeting in question.

Another type of information collected by the Secretariat is that related to incidents, including near misses. Utilising lessons learnt from incidents to improve industry best practice guidance and regulations is an effective way to ensure continuous improvements in safety.

SIGTTO has held non-governmental organisation (NGO) status at IMO since 1983 and, in view of the Society's primary focus on safety issues, has worked most closely with the Maritime Safety Committee, one of IMO's two principal technical bodies, over the years.

However, with an effective regulatory regime covering key maritime safety matters now in place, in more recent years IMO has been focusing increasing attention on environmental protection measures, not least as part of the drive to reduce emissions of greenhouse gases from ships. SIGTTO, through ESC and the Secretariat, has been participating increasingly in the work of the Marine Environment Protection Committee (MEPC), the second of IMO's two technical bodies, of late. Besides the emission reduction tools being developed at IMO for shipping in general, there are some issues specific to gas carriers requiring the development of targeted SIGTTO input.

The *How We Work* guide is also available on the Society's website and will be updated regularly. For example, the next revision will reflect SIGTTO's new committee structure described on page 29. SIGTTO members are encouraged to familiarise themselves with the new guide and to provide the Secretariat with any feedback they feel to be relevant.

SIGTTO paid publications



SIGTTO Information Papers,
Consolidated Ed 2022 (2022; £195.00)

Floating LNG Installations
(2021; £225)

LNG Shipping Suggested Competency
Standards 3rd Ed (2021; £175)

Recommendations for Relief Valves
on Gas Carriers, 3rd Ed (2020; £175.00)

Recommendations for Liquefied Gas
Carrier Manifolds (2018; £175.00)

Ship/Shore Interface for LPG/
Chemical Gas Carriers and
Terminals (2018; £175.00)

Guidelines for the Alleviation of
Excessive Surge Pressures on
ESD for Liquefied Gas Transfer
Systems (2018; £175.00)

LNG Emergency Release Systems
- Recommendations, Guidelines
and Best Practices (2017; £125.00)

Liquefied Gas Handling Principles
on Ships and in Terminals,
4th Ed (LGHP4) (2016; £275.00)

Support Craft at Liquefied Gas
Facilities: Principles of Emergency
Response and Protection -
Offshore (2016; £125.00)

Support Craft at Liquefied Gas
Facilities: Principles of Emergency
Response and Protection -
Onshore (2015; £125.00)

Ship-to-Ship Transfer Guide
for Petroleum, Chemicals and
Liquefied Gases (2013; £275.00)

Liquefied Gas Carriers: Your Personal
Safety Guide (2012; £25.00)

Application of Amendments to Gas
Carrier Codes Concerning Type C
Tank Loading Limits (2012; £25.00)

Liquefied Petroleum Gas Sampling
Procedures (2010; £25.00)

LNG Steamship Suggested
Competency Standards for
Engineers (2010; £125.00)

LPG Shipping Suggested Competency
Standards (2008; £125.00)

Jetty Maintenance and Inspection
Guide (2008; £175.00)

Hydrates in LPG Cargoes
(2008; £75.00)

Liquefied Gas Fire Hazard
Management (2004; £175.00)

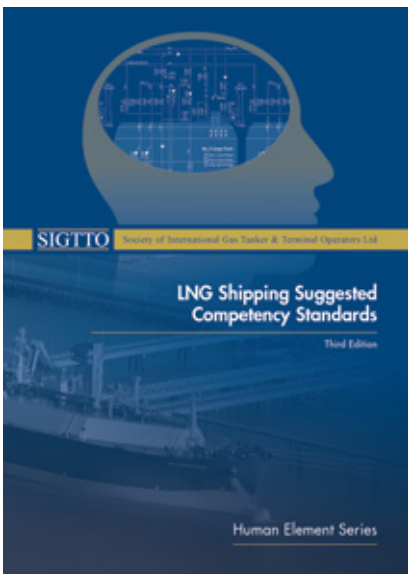
LNG Operations in Port
Areas (2003; £75.00)

Guide to Contingency Planning for
Marine Terminals Handling Liquefied
Gases in Bulk, 2nd Ed (2001; £40.00)

Guidelines on the Ship-Board
Odourisation of LPG (2000; £40.00)

Site Selection & Design for LNG
Ports & Jetties (Information
Paper No 14) (1997; £40.00)

Details of more than 60 free SIGTTO
publications, newsletters, annual
reports and articles are given on the
Society's website: www.sigtto.org



SIGTTO

Society of International Gas Tanker and Terminal Operators Limited

Statement of Comprehensive Income For the year ended 31 December 2021

	<u>2021</u> £	<u>2020</u> £
Revenue		
Members' annual dues	1,273,734	1,286,056
Royalties	210,137	288,201
Interest receivable	1,045	1,047
	<u>1,484,916</u>	<u>1,575,304</u>
Expenditure		
Employee benefit expense	892,385	776,788
Office supplies, web and library costs	79,040	65,714
Members' meetings	19,339	7,139
Rents, rates and services	109,291	119,454
Professional fees	124,053	197,562
Project costs	14,015	1,201
Communications	8,254	8,390
Depreciation	62,332	83,823
Amortisation of right-of-use	150,808	150,808
Miscellaneous expenses	10,879	4,830
Finance expense	51,989	58,838
	<u>1,522,385</u>	<u>1,474,547</u>
(Deficit)/surplus for the year	<u>(37,469)</u>	<u>100,757</u>

The society has no items of other comprehensive income.

SIGTTO

Society of International Gas Tanker and Terminal Operators Limited

Statement of Financial Position at 31 December 2021

	<u>2021</u> £	<u>2020</u> £
Non-current Assets		
Property, plant and equipment	77,739	109,023
Right-of-use assets	904,848	1,055,656
	<u>982,587</u>	<u>1,164,679</u>
Current Assets		
Trade and other receivables	314,092	527,021
Cash and cash equivalents	2,728,880	2,666,948
	<u>3,042,972</u>	<u>3,193,969</u>
Total Assets	<u>4,025,559</u>	<u>4,358,648</u>
Current Liabilities		
Trade and other payables	438,574	584,864
Lease liabilities	107,440	100,267
	<u>546,914</u>	<u>685,131</u>
Non-current Liabilities		
Lease liabilities	910,956	1,069,148
Total Liabilities	<u>1,456,970</u>	<u>1,754,279</u>
Capital and Reserves		
Called up share capital	25,935	24,246
Retained earnings	2,542,654	2,580,123
Total Equity	<u>2,568,589</u>	<u>2,604,369</u>
Total Liabilities and Equity	<u>4,025,559</u>	<u>4,358,648</u>



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SIGTTO

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