
Annual Report and Accounts 2020

SIGTTO

Society of International Gas Tanker and Terminal Operators Ltd

Continually promoting best practice in the liquefied gas shipping and terminal industries for 42 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 2020

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Making shipboard preparations to ensure compatibility with terminal arrangements for an upcoming cargo transfer operation



Tackling the challenges of going green

The Covid pandemic was not the only global challenge facing the shipping industry in 2020. Gas carriers, like all maritime sectors, were faced with the rise in prominence of the green agenda

Climate change consolidated its position as a real and imminent societal danger last year. Growing concern amongst the general public about global warming, informed by environmental scientists and pressure groups and reflected in strengthening media coverage, investor pressures on company managers and government decarbonisation measures, is making the control of atmospheric pollutants a, if not the, key issue for the 21st century.

Ship emissions have come squarely onto the climate change radar in recent years. According to the third IMO study on greenhouse gases (GHGs), maritime transport emits around 940 million tonnes of carbon dioxide (CO₂) annually and is responsible for about 2.5 per cent of global GHG emissions. In 2018 IMO, in line with the internationally agreed temperature goals under the Paris Agreement, stipulated that shipping must reduce its total annual GHG emissions by at least 50 per cent by 2050 compared to 2008 levels, and that it needed to pursue efforts to phase them out as soon as possible in this century. It was pointed out that, if nothing was done, shipping GHG emissions could increase by anything from 50 to 250 per cent by 2050.

This is an extremely ambitious goal for shipowners and calls for the use of new fuels and the implementation of new and complex propulsion system and fuel efficiency technologies, most of which are as yet undeveloped. Because some of these green technologies will require at least a decade of development work before they become available globally on a commercial scale, shipowners in need of new tonnage today are faced with the particular challenge of deciding on what type of ship should they be ordering over the next few years. What type of propulsion system and hull optimisation arrangement currently available will future-proof their investment?

Shipowners operating LNG carriers or considering the use of LNG as a ship fuel also have methane – the principal

constituent of natural gas – to consider. Although natural gas is the cleanest burning of the fossil fuels, methane is a potent GHG, its adverse effects being some 25 times stronger than CO₂ on a per volume basis. Some gas-burning engines are susceptible to methane slip, whereby not all the gas is fully combusted in the engine and small amounts of methane are exhausted to the atmosphere.

As a first step in improving ship energy efficiency IMO has introduced a flexible set of rules and standards. The short-term measures under this new regime, which is based on the concept of continuous improvement, are centred around the Energy Efficiency Design Index (EEDI) for new ships and the Ship Energy Efficiency Management Plan (SEEMP). The package of short-term measures was completed in November 2020 when IMO introduced an Energy Efficiency Design Index for existing ships (EEXI).

Following approval by IMO's Marine Environment Protection Committee in June 2021, EEXI will enter into force in November 2022. EEXI will have a significant impact across the maritime industry, not least on the gas carrier fleets controlled by SIGTTO members. Our Secretariat has been kept busy over the past year answering questions from the Society's membership on the potential impact of this new element of the energy efficiency regime. To help the membership better understand what the Society can and cannot do to influence the rulemaking process on energy efficiency and other gas ship-related matters, SIGTTO is preparing a new document entitled *How We Work*.

Gas ship operators have been introducing their own series of measures in recent years in the drive for improved energy efficiency. New LNG carriers, for example, are commonly fitted with reliquefaction plants which enable any cargo boil-off gas not required as propulsion or auxiliary fuel to be directed back to cargo tank as LNG. Also, engine manufacturers continue

to develop their products with the aim of minimising methane slip. Elsewhere, most owners of very large gas carriers (VLGCs) requiring new tonnage over the past year have specified vessels with dual-fuel engines that enable LPG to be burned and oil bunker purchases to be minimised.

Ammonia and hydrogen are amongst the leading alternatives touted as pollution-free shipping fuels of the future. However, much work still needs to be done, not least in the development of processes that produce the required volumes of such liquefied gases in the mandated environment-friendly manner. Thereafter, SIGTTO will be closely involved with the development of new regulations governing the transport of significant volumes of liquefied hydrogen by sea in gas carriers in a safe manner (the transport of ammonia in gas ships is already a well-established activity).

While the potential of hydrogen as fuel in the maritime and other sectors is set to create the need for a new type of gas carrier, another environmental consideration is similarly creating opportunities for gas ship naval architects. Carbon capture and storage (CCS) projects, to be situated adjacent to heavily polluting shore plant, will require CO₂ carriers of up to 15,000 m³, about 10 times the size of the handful of CO₂ carriers currently carrying such cargoes around Europe on behalf of the beverages industry.

SIGTTO thus remains at the forefront of the climate change debate's impact on the shipping industry, supporting the adoption of new energy-efficient technologies and clean fuel from its vanguard liquefied gas position.

Steffen Jacobsen
SIGTTO President - June 2021



Now in its 52nd year of operation, the Negishi terminal in Tokyo Bay is the world's longest serving LNG import terminal



Maintaining progress with Covid contingency measures

The new approach to maintaining SIGTTO's ambitious work programme in the face of the Covid-19 pandemic was implemented smoothly

The first and principal challenge for SIGTTO and its Secretariat in 2020, as it was for practically every other business worldwide, was how to function effectively in the face of the unprecedented Covid-19 pandemic.

Like members of other maritime non-governmental organisations (NGOs) and other London-based businesses, the SIGTTO Secretariat commenced working remotely in mid-March 2020 when it became apparent that the new Covid virus was going to have a serious and deep-rooted impact on everyone's life. SIGTTO was able to continue with its busy programme of technical projects through remote working group meetings. However, bringing groups of people together remotely to develop industry best practice guidelines was something we had never had to do before and the changeover to the new approach necessitated a significant adjustment to our internal processes. For a start, more pre-work and preparation was required from our technical staff and we quickly learned that virtual meetings cannot be as long as face-to-face meetings without losing the audience's attention and reducing their value.

Nevertheless, the membership adapted smoothly to the new regime and good progress was made with our work projects. The Society's latest publications, both of which were approved at the 2020 Autumn Board and Annual General Meetings, are *Guidance on Gas Carrier and Terminal Gangway Interface* and *Floating LNG Installations*. The two meetings also approved terms of references for six new projects, boosting the number of SIGTTO projects currently underway to 26, the most in our history.

Full credit to my very hard-working Secretariat team who have been instrumental in maintaining impressive productivity levels despite the conditions pertaining over the past 15 months. Also, special mention must go to the Society's various committees for their sterling

work. These include the General Purposes Committee (GPC), which is chaired by Mark Hodgson of Shell, the Human Element Committee (HEC), chaired by Steve Allibone of MOL, and our new Environmental Subcommittee (ESC). John Boreman of BP has recently been appointed ESC chair.

Throughout the Covid period SIGTTO has remained fully open for business and accessible through our normal phone lines and emails for any technical, membership and other enquiries. Although the Society has perhaps not been as adversely impacted by the virus as much as other organisations, we nevertheless have missed the wide range of face-to-face meetings, both for technical working groups and regular members meetings, that are part of our normal annual calendar. For example, on an annual basis we would normally hold 11 or 12 Regional Forums around the world as well as other gatherings, such as Panel Meetings, for the full membership.

To mitigate the lack of face-to-face meetings for membership engagement, the Society staged a series of webinars in 2020 and also organised a Virtual Panel Meeting in more recent months. These online sessions have proved to be extremely popular, and the online platform technology that we've employed has allowed SIGTTO members to join and interact with other members from their own offices and homes.

To its great credit, the LNG shipping industry has maintained continuity of operations throughout and SIGTTO is not aware of a single vessel or terminal which has ceased operations due to Covid-19.

For me, seafarers have been the unsung heroes, keeping the supermarket shelves stocked and the lights burning. However, because of Covid-19 containment measures restricting travel and crew changes, most seafarers have been kept onboard well past their scheduled end of contract date. At the time of writing, crew changes are still presenting challenges to shipowners and operators in many parts of the world.

Depressed oil and gas prices, falling energy demand and full inventories, as well as the repercussions of these conditions on future investment, are all causes of concern for the gas shipping and terminal industry. However, LNG and LPG trade volumes held steady in 2020. The demand for gas has remained strong and a return to a healthy growth rates in the seaborne movements of LNG, LPG and chemical gases is expected in 2021.

The gas shipping industry itself has also adopted new ways of doing business during this era of Covid-19 restrictions. Companies have embraced remote vetting and inspections; secured extensions to certificate and survey dates from class societies and flag administrations; and undertaken remote drydockings without the need for anyone from the operator's office being in attendance. However, besides the crew change problems already mentioned, the inability of service engineers to travel to vessels and terminals has also proved to be a challenge for shipping companies in our sector.

If Covid has taught us anything over the past 18 months, it is to appreciate many of the things we used to take for granted and to value life and the important things in it. My thoughts are with those families and friends who have lost loved ones due to the pandemic. SIGTTO hopes that we can all draw a line under this issue very soon and that life returns to normal.

As SIGTTO General Manager, I look forward immensely to 2021, meeting and working with the membership, hopefully on a face-to-face basis once again before too long. Quite aside from the pandemic, this is a very exciting and challenging time to be in this role.

Andrew Clifton
General Manager - June 2021

SIGTTO members (as at 31 December 2020)

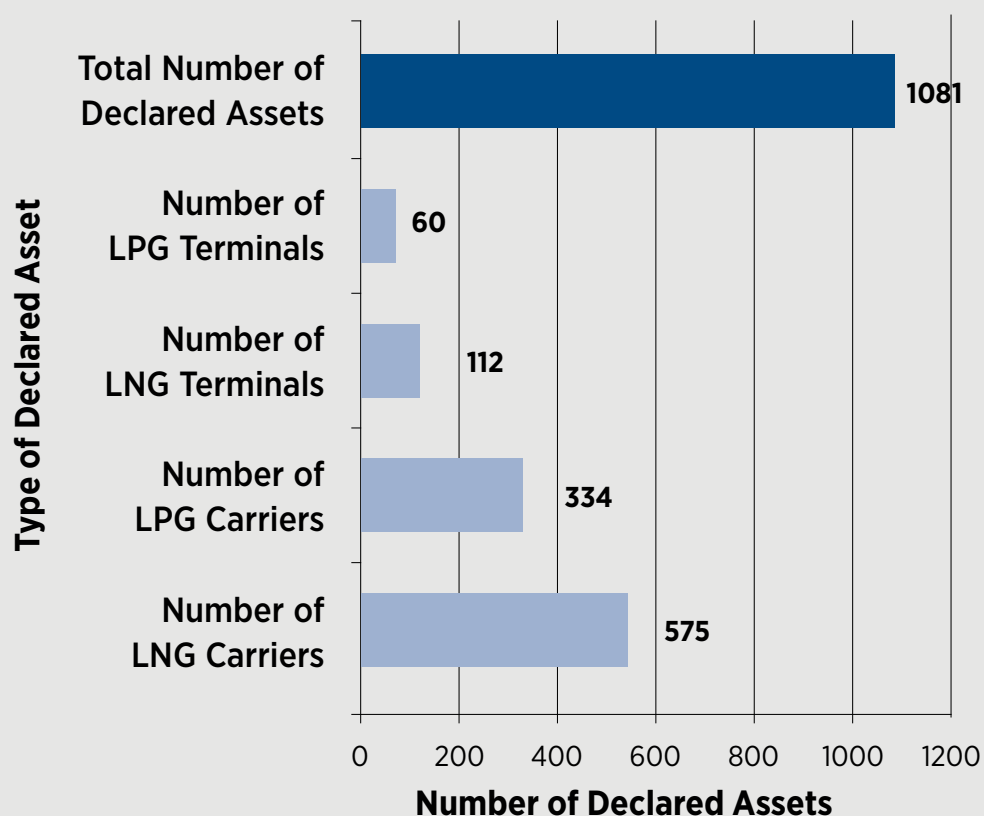
Full Members

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

Associate Members

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

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 Human Element Committee (HEC).
- 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 discussion forums, regional forums and panel meetings 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/>



42

Years since established
38 years since admitted to IMO



213

No. of members
137 Full Members, 47 Associate,
29 Non-contributory Members



50

Countries across the world
Asia Pacific 35%, Mediterranean 12%,
Middle East 7%, Pan American 18%,
Scandinavian 6%, Western European 22%



90+%

Of LNG market (Capacity)
No. of Declared LNG Terminals: 112
No. of Declared LNG Carriers: 575



50+%

Of LPG market (Capacity)
No. of Declared LPG Terminals: 60
No. of Declared LPG Carriers: 334



25+%

Members have been
onboard over 20 years



18

Working groups
GPC 12, GPC Sub 2, HEC: 4
26 projects in progress

SIGTTO Board of Directors (as of 31 December 2020)

The spring 2019 meeting of SIGTTO's Board of Directors was held in San Ramon, California



Mr Steffen Jacobsen
Mr Masayuki Ishida
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
 Høegh LNG
 International Gas Transportation Co
 MISC

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

Mitsui OSK Lines
 Naftomar
 NYK Line
 Qatar Gas Transport
 Shell
 Teekay Shipping
 Total SA
 Tokyo Gas
 Conyers Dill & Pearman
 Conyers Dill & Pearman [Secretary]



SIGTTO's first face-to-face meeting in a year

Travel and lockdown restrictions imposed as a result of the Covid virus prevented North West Shelf Shipping Service Co (NWSSSC) from hosting its usual annual Australian SIGTTO Regional Forum in 2020. However, with restrictions easing across the country early in 2021, it was decided to hold a "local" meeting in Perth, with participants mostly from the gas industry in Western Australia, at the earliest opportunity. Termed the SIGTTO Regional Forum Lite, the gathering took place on 4 March 2021. Paul Oliver and Tony Spence, General Manager and Marine & Technical Manager, respectively, of NWSSSC updated delegates on general SIGTTO activity and that of its General Purposes Committee (GPC) in particular. This was followed by a technical presentation given by Rajeev Punnen from Shell Australia entitled "The Application of the Line of Defense Model to Marine Assurance" and another by Zubin Bhada of Nautilus Innovation on "The Decommissioning and Recycling of Ships". General discussions on Covid impacts on the industry, crew changes and remote assurance inspections rounded out the day's work at the SIGTTO Regional Forum Lite and at the closing networking drinks event everyone reported how pleasurable it was to once again connect with colleagues on a face-to-face basis.

SIGTTO Secretariat Staff



Andrew Clifton
General Manager



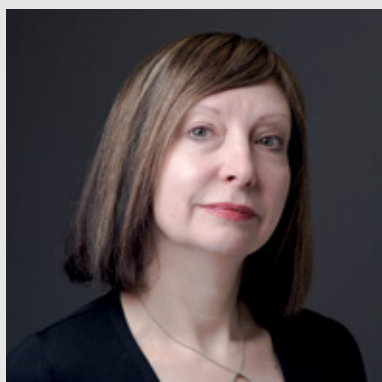
Cherian Oommen
Senior Technical Adviser



Rob Farmer
Technical Adviser



Ian Harrison
IMO Representative



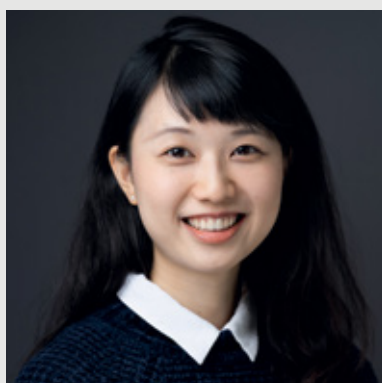
Susan Humphrey
Membership Manager



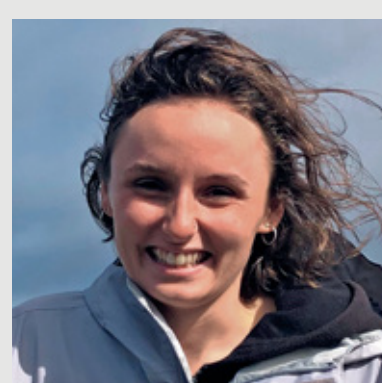
Laura Else
Technical Publishing Manager



Erin Rydings
Receptionist/Admin Assistant



Bella Mao
Marketing Executive



Mariah Abshire
Technical Publishing Assistant

SIGTTO committee work programme reaches record level



The revision of SIGTTO's LPG crew competency standards now nearing completion covers ethane carriers for the first time

SIGTTO has two principal committees – the General Purposes Committee (GPC) and the Human Element Committee (HEC) - to manage and carry out its work programme.

GPC, the Society's technical body, has traditionally been responsible for developing and coordinating all the internal projects generated by SIGTTO. However, in 2016 the Society's Board of Directors agreed that, in view of the critical importance of the human factor and training in gas carrier and terminal operations, the subject should have its own dedicated focus group, and HEC was duly established. HEC's remit includes, but is not limited to, competency and training, design and ergonomics and the human element side of incident investigation.

More recently, Floating Systems and Environmental Sub-committees have been established under the aegis of GPC. Creation of the former body is a reflection of the growing

importance of floating gas terminals and ship-to-ship transfers of liquefied gases in the industry's day-to-day operations while the second body enables a dedicated focus on the key issues that have emerged in the maritime sector's new drive to minimise environmental emissions.

Completion of new project work identified by GPC and HEC is carried out by working groups comprising relevant experts from amongst SIGTTO's membership. The technical publications which are the end-result of these projects are effectively the best practice procedures, recommendations and standards that guide the gas shipping and terminal industry's operations and underpin its exemplary safety record. Board approval in autumn 2020 of the terms of references for six new initiatives boosted the number of SIGTTO projects currently underway to 26, the most in the Society's history.

General Purposes Committee (GPC)

GPC, like HEC, would normally meet twice a year. However, the onset of the Covid pandemic early in 2020 disrupted plans and GPC was able to meet only once during the year. The gathering was held virtually, utilising the Teams online link technology, in October. Despite this curtailment of the parent body's schedule, the GPC sub-committees and working groups made good progress with their projects in 2020.

Mark Hodgson of Shell chairs SIGTTO's General Purposes Committee. With the backing of the SIGTTO Board and the support of the SIGTTO Secretariat, GPC has recently developed an active and comprehensive present and future agenda to deal with the current fast-moving pace of developments in the industry. The newly configured points and systems of this agenda seek to go beyond straightforward guideline development in order to support the

SIGTTO Strategy and deal with topical issues in as holistic a manner as possible.

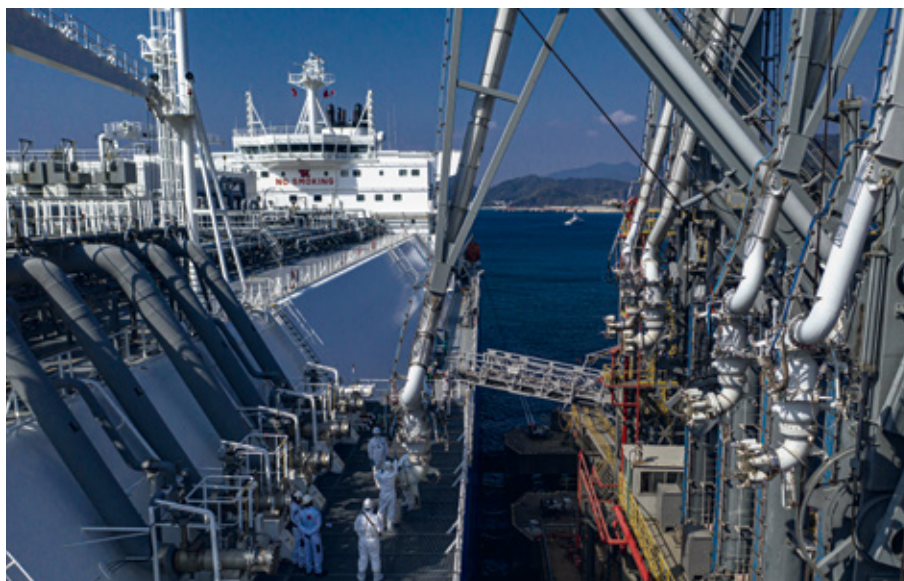
These initiatives include ensuring balanced representation, not least by encouraging increased participation in GPC working groups by SIGTTO member companies that are not GPC members; the establishment of key performance indicators to gauge the extent to which the issues identified in the SIGTTO Strategic Plan are being dealt with; and the utilisation of risk-based assessment in addressing the development and review of industry best practice guidance.

The topics that GPC has had in focus over the past year are propulsion systems, reliquefaction systems, gangways, emergency shutdown systems, gas carrier salvage, terminal design and operation and valve testing. Working groups, comprising relevant industry experts from amongst the membership, have been established to examine each issue.

The Propulsion System and Reliquefaction System Working Groups are both now chaired by Philip Ryan of BP. During 2020 the two working groups worked on draft documents covering environmental and operational issues associated with gas carrier propulsion and reliquefaction systems, respectively. The provisions of both documents take into account the impacts of the revised International Gas Carrier (IGC) Code, the Energy Efficiency Design Index (EEDI), the Energy Efficiency Existing Ship Index (EEXI) and lessons learnt from incidents.

Chaired by Rick Boudiette, SIGTTO's Gangways Working Group has completed its task. The document it produced, *Guidance on Gas Carrier and Terminal Gangway Interface*, was approved by the SIGTTO Board in November 2020 and has been made available to download from the Society's website. The guidance provides ship and terminal designers and operators with recommendations on gangway design, operations and compatibility determination.

The Emergency Shutdown (ESD) Systems Working Group is revising SIGTTO's existing *ESD Arrangements and Linked Ship/Shore Systems for Liquefied Gas Carriers (2009)* publication. Chaired



The current fast-moving pace of developments in the liquefied gas industry is reflected in the record number of 26 SIGTTO technical projects now underway

by Ajay Edakkara of Shell, the group held its last face-to-face meeting in January 2020 and completed its work through virtual meetings throughout the rest of the year. The finalised second edition, with an updated title of *ESD Systems: Recommendations for Emergency Shutdown and Related Safety Systems*, was approved by the SIGTTO Board in spring 2021.

SIGTTO's Gas Carrier Salvage Working Group is chaired by Ian Wolfarth of Chevron. Having had its terms of reference agreed in autumn 2019, the group spent the early part of 2020 gathering information related to potential salvage situations on gas carriers, with a primary focus on incident prevention and preparedness. Group members are now preparing a draft guidance document based on these findings.

The Design and Operation of Liquefied Gas Terminals Working Group, chaired by Guy Nicholls of Cheniere, 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 use a risk-based approach and consider technical advances made and lessons learnt from incidents since the original documents were published. The group held the first of an ongoing series of meetings in June 2020 and work on the compilation of the draft document continues.

Another body launched in 2020, concerned with combining two earlier SIGTTO documents and making good progress is the Selection and Testing of Valves for LNG/LPG Applications Working Group. Chaired by John Taylor of Shell, the group is revising *The Selection and Testing of Valves for LNG Applications (2008)* and *The Selection and Testing of Valves for LPG Applications (2012)* and consolidating the output into a single publication.

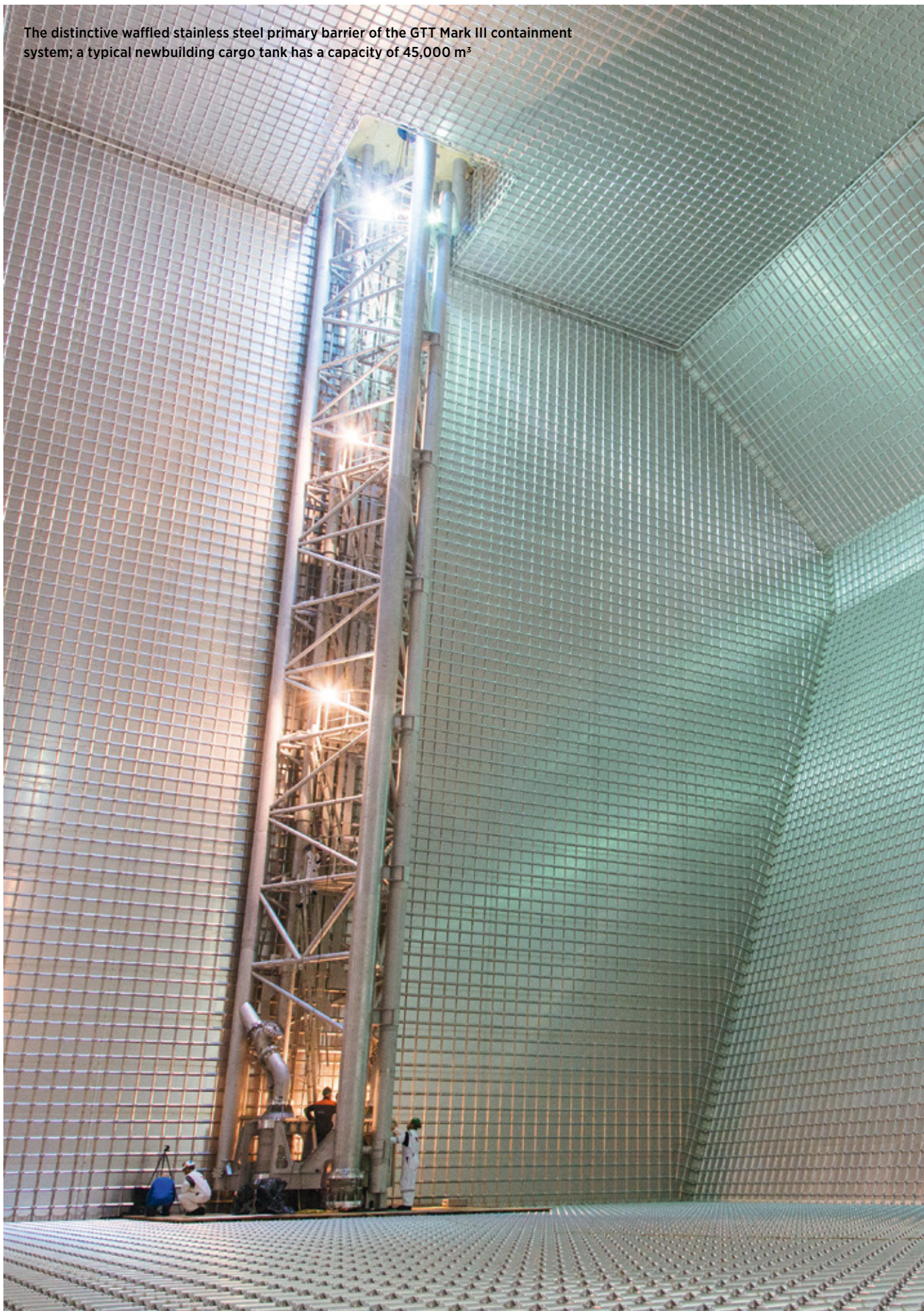
In addition to the progress and accomplishments of the working groups outlined above, terms of reference for two further GPC working groups were agreed in October 2020. The Guide for Planning Gas Trials for LNG Vessels Working Group, chaired by Rose Brooks of BP, is tasked with revising the existing SIGTTO publication *Guide for Planning Gas Trials for LNG Vessels (2008)*. The second new body, the Gas Concentrations in the Insulation Spaces of Membrane Gas Carriers Working Group, is also undertaking update work. It will revise *Gas Concentrations in the Insulation Spaces of Membrane LNG Carriers (2007)*.

Floating Systems Sub-committee (FSSC)

The final draft of the Floating LNG Installations document, prepared by GPC's Floating Systems Sub-committee, was approved by SIGTTO's Board in November 2020. The publication, which >

Committees and Subcommittees

The distinctive waffled stainless steel primary barrier of the GTT Mark III containment system; a typical newbuilding cargo tank has a capacity of 45,000 m³



is now available for purchase, is the result of an effort to identify and address possible gaps in available SIGTTO guidance covering nearshore and offshore floating assets.

The Sub-committee, chaired by Edward Scott, had established three working groups, to focus on the topics of site assessment, design criteria and operational guidance, respectively. The guidelines produced by these groups were then consolidated to produce the Floating LNG Installations publication which is effectively a new industry best practice document on floating LNG systems.

The efforts of the Floating Systems Sub-committee to date have contributed to an HEC working group's development of suggested competency standards for floating storage and regasification units (FSRUs). This has been included as an additional annex in the recently published third edition of *LNG Shipping Suggested Competency Standards*.

Environmental Sub-committee (ESC)

Chaired by John Boreman of BP, SIGTTO's new Environmental Sub-committee is comprised of GPC members representing BP, Cheniere, Chevron, Enagas, ExxonMobil, Maran Gas, Shell and Total. A revision of the GPC Constitution, which incorporates the remit of the Environmental Sub-committee, was approved in October 2020.

Also approved were terms of reference for the Sub-committee's first four working groups. They are the Gas Carrier CO₂ Emissions, the Reduction of Gas Carrier CO₂ Emissions, the LNGC Fugitive Methane Emissions and the Reduction of LNGC Fugitive Methane Emissions Working Groups.

The CO₂ emissions group will work to identify all distinct processes that generate CO₂ emissions on board gas carriers, outline guidance to assist standardisation of reporting methodology and also assist in the efforts of its sister CO₂ emissions reduction body.

The LNGC Fugitive Methane Emissions



The Design and Operation of Liquefied Gas Terminals Working Group is engaged in combining and updating two established SIGTTO documents

Working Group is charged with identifying all distinct equipment and systems that could generate fugitive methane (CH₄) emissions on board LNGCs; considering best practice measurement and monitoring functions; and outlining guidance to assist standardisation of reporting methodology. It will similarly collaborate closely with its sister methane emissions reduction group.

Human Element Committee (HEC)

SIGTTO's HEC, chaired by Steve Allibone of MOL, was able to meet twice, as per normal, during 2020. The first gathering, pre-Covid, took place in London while the second was a virtual meeting held in July 2020. Topics on the HEC's 2020 agenda included cargo control room ergonomics, shore staff competencies, LPG shipping suggested competency standards and cargo resource management training. Two publications recently completed by HEC working groups and now available, i.e. the third edition of the *LNG Shipping Suggested Competency Standards and Recommendations for Designing Cargo Control Rooms*, are described in the New Publications section on page 37.

Chaired by Ray Gillett of GTT Training, the Cargo Control Room (CCR) Ergonomics Working Group also finalised the third document in the CCR series, *Recommendations for Cargo Control Room HMI*, in 2020. Recommending the use of established human factor principles and processes in the design of the CCR human/machine interface

(HMI), the document lays down the basis for maximising the safe, reliable, efficient and comfortable use of CCR displays and controls. The document received SIGTTO Board approval in spring 2021.

Having been engaged in gathering and refining information associated with suggested best practices in the early part of 2020, the Shore Staff Competency Management System Standards Working Group then moved on to drafting work on the relevant guidelines. Chaired by Jo McDade of Chevron, the group is charged with identifying and developing a competence management system for shore staff that adds to a company's human factor toolkit. A draft framing document has been compiled and was submitted for consideration in summer 2021.

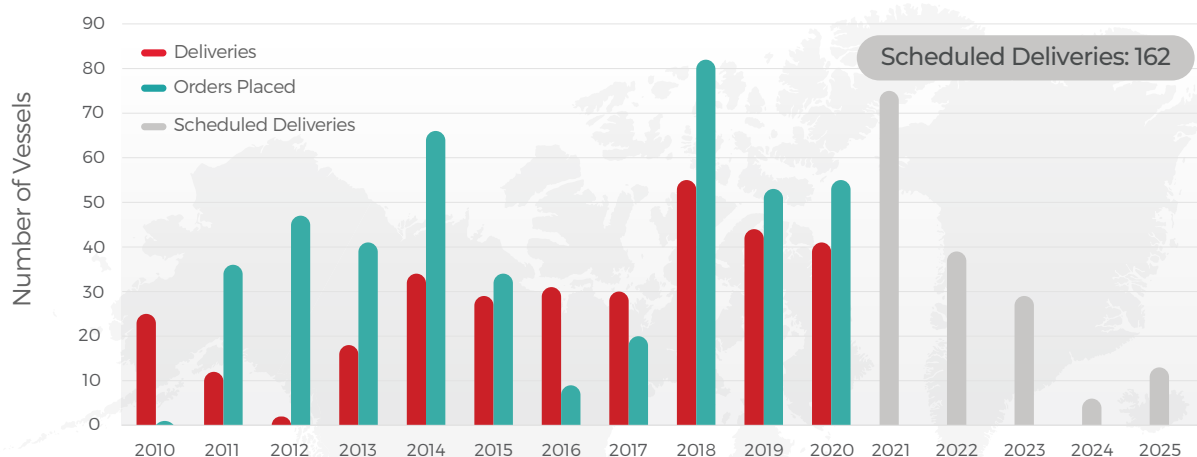
The LPG Shipping Suggested Competency Standards Working Group is engaged in the revision of SIGTTO's *LPG Shipping Suggested Competency Standards (2008)* publication. The group, which is chaired by Steve Allibone, will include provisions on the carriage of ethane and the use of LPG cargo as a propulsion fuel for the first time in the updated edition. A target of early 2022 has been set for completion of the draft document.

Another HEC body chaired by Steve Allibone is the newly established Cargo Resource Management Working Group. Its terms of reference call for the development of a document on a model gas cargo resource management training course.

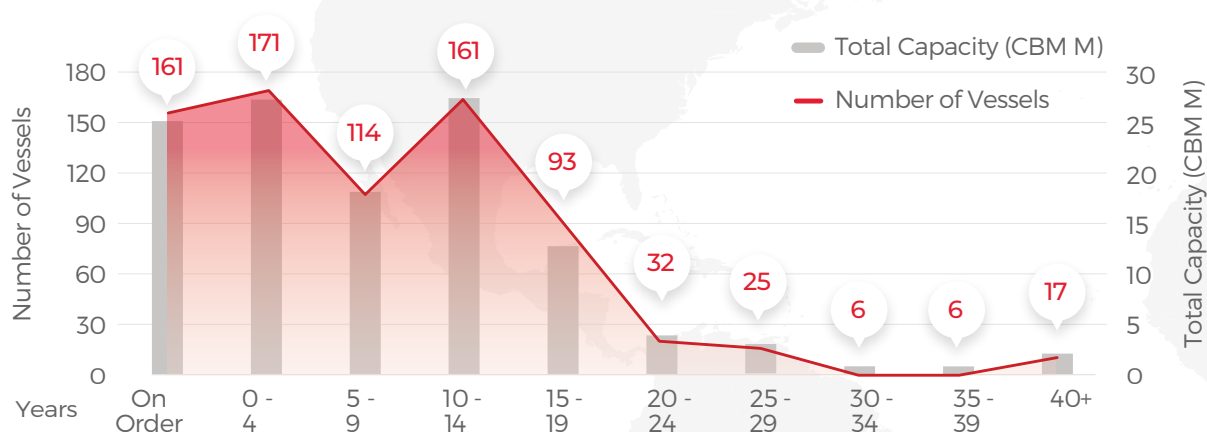
LNG Carrier fleet breakdown

GLOBAL LNG CARRIER FLEET 2020

LIVE LNG FLEET DELIVERIES AND ORDERS PLACED



LNG FLEET AGE PROFILE



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

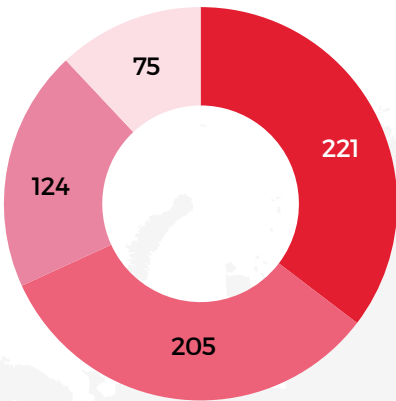
1. Greece 116 Vessels	19.52 CBM M	6. Norway 51 Vessels	8.04 CBM M
2. Japan 134 Vessels	19.40 CBM M	7. Russia 37 Vessels	6.11 CBM M
3. Qatar 69 Vessels	14.01 CBM M	8. United Kingdom 42 Vessels	5.40 CBM M
4. China 68 Vessels	10.19 CBM M	9. Malaysia 31 Vessels	4.23 CBM M
5. South Korea 61 Vessels	8.79 CBM M	10. Bermuda 27 Vessels	4.17 CBM M

Source: VesselsValue as of 31st December 2020
Does not include floating production vessels.



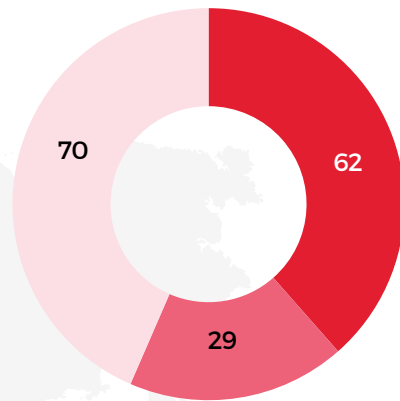
LNG CARRIER FLEET BY CONTAINMENT SYSTEM

LIVE



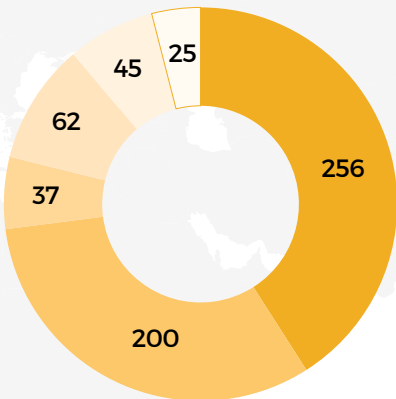
221	GTT Mark III	62
205	GTT 96 Membrane	29
124	Spherical	0
75	Others	70

ON ORDER



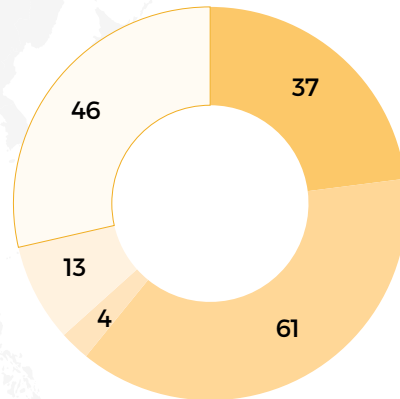
LNG CARRIER FLEET BY PROPULSION SYSTEM

LIVE



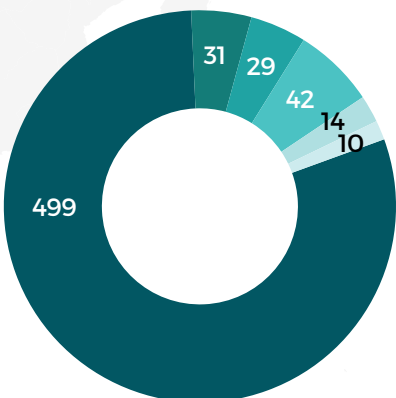
256	Turbine	0
200	DFDE (Gas and FO)	37
37	X-DF	61
62	Low Speed Diesel	4
45	MEGI (Gas and FO)	13
25	Others	46

ON ORDER



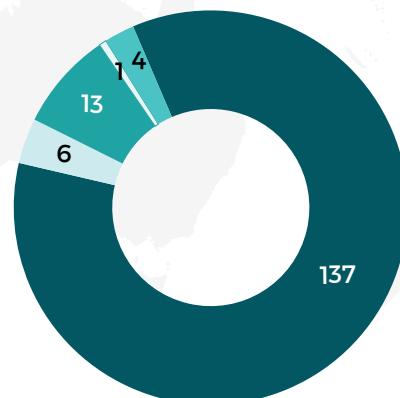
LNG CARRIER FLEET BY VESSEL TYPE

LIVE



499	Large LNG	137
31	QFLEX	0
29	Small Scale LNG	13
42	FSRU	4
14	QMAX	0
10	Midsize LNG	6
0	CNG	1

ON ORDER



Gas shipping and terminal timeline 2020

A roundup of key gas shipping and terminal developments in 2020 highlights many aspects of an industry that remained dynamic despite the adverse effects of the Covid-19 pandemic on the global economy. These 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

- Under amendments to Annex VI of IMO's Marine Pollution (MARPOL) Convention the maximum allowable sulphur content in marine fuels was reduced from 3.5 per cent to 0.5 per cent as of 1 January.
- Bidinvest Tank Terminals (BTT) opened its LPG import terminal in South Africa's Richards Bay on behalf of Petredec. The facility, which features four 10,700 m³ fully pressurised, mounded, horizontal, cylindrical LPG storage tanks, will enable South Africa to double its LPG usage, to 400,000 tonnes per annum (tpa). The tanks are the world's largest of this type.

Pakistan also opened a new LPG import terminal, at the port of Gwadar. The inaugural shipment to the Al Qasim Gas facility, loaded at Sohar in Oman, was discharged by the fully pressurised, 7,500 m³ Stealth Gas LPGC *Gas Esco*.
- The Mundra receiving terminal in Gujarat state, India's sixth LNG import terminal, received its inaugural cargo. Developed by Adani Group and Gujarat State Petroleum Corp, Mundra has a capacity of 5 million tonnes per annum (mta) of LNG and two 160,000 m³ storage tanks.
- Freeport LNG's Train 2 started commercial operations on 17 January. The facility's third and final train entered into service in May 2020, along with a second ship berth and a third 165,000 m³ full containment storage tank. All three Freeport trains are 5 mta units.
- Saibu Gas shipped fifteen 40-foot ISO tank containers of LNG from its Hibiki LNG receiving terminal in the Japanese city of Kita-kyushu to Shanghai in China. The 270-tonne consignment, which was bought by JUSDA Energy Technology (Shanghai), was the largest ever LNG export shipment from Japan.
- The Enterprise Product Partners (EPP) ethane loading terminal at Morgan's Point on the Houston Ship Channel commissioned an ethylene export facility at the site. Developed as a 50/50 EPP/Navigator Gas joint venture and dubbed the world's largest ethylene export project, the ethylene complex loaded its inaugural cargo onboard the 21,000 m³ *Navigator Europa* for shipment to Asia. The capacity of the 600,000 tonnes per annum (tpa) ethylene terminal was increased to 1 mta in December 2020 with the completion of a 60,000 m³ fully refrigerated ethylene tank at Morgan's Point.



With the new ethylene storage tank now complete, Morgan's Point is able to export up to 1 mta of this petrochemical gas

February

- Golar's 170,000 m³ FSRU *Golar Nanook* loaded a commissioning cargo for the new power plant operated by Centrais Eletricas de Sergipe (CELSE) in the Brazilian port of Sergipe. Golar's FLNG vessel *Hilli Episeyo* in Cameroon supplied *Golar Nanook* with the inaugural cargo for the 1.55 GW Sergipe plant. Sergipe is Brazil's first LNG-to-power project and the largest such facility in Latin America.
- The first signs that the newly emerging Covid-19 virus was impacting Chinese LNG buying became apparent during the month. Most notably, China National Offshore Oil Corp (CNOOC) declared force majeure on several LNG import contracts due to disruptions caused by the outbreak of the virus. By March the global demand for LNG and crude oil was falling dramatically and the prices for both nosedived. LNG trade levels had been buoyant in the early months of 2020, up until the effects of Covid began to be felt. By May 2020, although Qatar had announced there was "no way" it was going to cut LNG production as a result of the pandemic, US terminals were cancelling some of their planned export cargo loadings due to slackening demand.
- PFLNG Dua, the second Petronas floating LNG production (FLNG) vessel, departed the Samsung yard in Korea on its maiden voyage. The vessel, which has the capacity to produce 1.5 mta of LNG, was set for positioning on the Rotan gas field off the coast of Sabah in Malaysia.

March

- Cameron LNG's 4 mta Train 2 in southwestern Louisiana commenced commercial operations on 3 March. The third and final Cameron train, the 4 mta Train 3, began producing LNG in May 2020.



All three trains at the Cameron LNG bidirectional terminal in Louisiana are now up and running

April

- Gasum purchased two small-scale Scandinavian LNG receiving terminals, two bunkering vessels and 48 gas filling stations in Sweden and Norway from Linde AG and Nauticor Marine Bunkering. The terminals in question were the 20,000 m³ distribution installation in Nynäshamn, Sweden and a small 1,200 m³ facility in Ålesund, Norway. The LNGBVs were the 180 m³ *Seagas*, based in Stockholm, and Nauticor's 7,500 m³ *Kairos*, designed for a wide range of Baltic and North Sea LNG fuelling operations.
- China's Hudong Zhonghua yard delivered the 18,600 m³ *Gas Agility*, the world's largest LNG bunker vessel (LNGBV), to MOL. For charter to Total, the vessel will bunker a fleet of nine LNG-powered, 22,000 TEU ultra-large container ships (ULCSs) operated by CMA CGM on the long-haul route between Asia and Europe. Like the bunker tanks on the ULCSs, *Gas Agility* is equipped with a cargo tank built to the GTT Mark III Flex membrane containment system design.



Gas Agility and CMA CGM Jacques Saade participating in the world's largest LNG bunkering operation, a transfer of 17,300 m³ of product, in Rotterdam in November 2020

May

- Yamal LNG shipped its earliest ever (by a month) summer season LNG export shipment eastwards along the Northern Sea Route (NSR) to Asia. Dispatched on 18 May on the 172,600 m³ *Christophe de Margerie*, the shipment was destined for PetroChina's Tangshan import terminal in northern China achieved its target transit time of 24 days. *Christophe de Margerie* was accompanied on the voyage by a tanker and two Russian nuclear icebreakers operating in escort mode.
- Petronas supplied Myanmar's first-ever LNG cargo, delivered to Yangon by the 28,000 m³ *CNTIC VPower Global*. The project operator, CNTIC VPower, is a joint venture comprising the VPower Group of Hong Kong and China National Technical Import and Export Corp (CNTIC). The company is developing a series of gas-fired power stations in Myanmar and had signed an LNG sale and purchase agreement (SPA) with Petronas and taken *CNTIC VPower Global* on charter earlier in 2020.

Gas shipping and terminal timeline 2020

June

- Novatek awarded a US\$748 million contract to Daewoo covering the construction of two 361,600 m³ floating LNG barges. The floating storage units (FSUs) will have GTT NO 96 containment systems and be placed in Murmansk and Kamchatka, respectively, for use as LNG storage and transshipment facilities. They will enable Novatek's icebreaking LNGCs to offload their Yamal and Arctic LNG 2 project cargoes close to the east and west entry points to Russia's Northern Sea Route for subsequent transshipment to conventional LNGCs and onward delivery to the final customer. The barges are due for delivery by the end of 2022.
- Qatar Petroleum (QP) provisionally booked building berth space at Hyundai, Samsung and Daewoo that would enable the construction of as many as 100 LNGCs valued at US\$20 billion through 2027. The deal follows a similar arrangement concluded in April 2020 with China's Hudong yard covering the construction of eight option eight LNGCs, an order valued at US\$3 billion if all 16 vessels are built. QP is planning to boost the capacity of its Ras Laffan export complex from 77 to 126 mta by 2027 through its North Field Expansion (NFE) project and the construction of six new 8 mta liquefaction trains. The 100 new vessels will not only expand the fleet but also replace some of the older LNGCs currently carrying Qatari export cargoes. Dual-fuel ships of approximately 174,000 m³ with two-stroke engines are envisaged.



- Excelerate Energy took delivery from Daewoo Shipbuilding & Marine Engineering (DSME) of the 173,400 m³ *Excelerate Sequoia*, its 10th FSRU and a vessel bareboat chartered from Maran Gas for a period of five years. *Excelerate Sequoia* is set to replace Excelerate Energy's 150,900 m³ FSRU *Exquisite* in regasification service at the Engro Elengy Terminal Ltd (EETL) terminal at Port Qasim near Karachi in Pakistan. When *Excelerate Sequoia* is positioned at the Port Qasim jetty, it will boost the EETL terminal's throughput capacity from 4.8 to 5.9 mta.
- WinGD unveiled the X-DF2.0, the latest version of its two-stroke, dual-fuel engine technology. The company stated that the use of its new Intelligent Control by Exhaust Recycling (iCER) system in tandem with the X-DF2.0 engine results in a reduction in methane slip emissions of up to 50 per cent when using LNG and a 3 per cent reduction in fuel consumption in the gas mode and 5 per cent in the diesel fuel mode. The iCER exhaust recirculation system, developed in conjunction with Alfa Laval, captures the methane in the exhaust gas and gives it a second chance to burn.

July

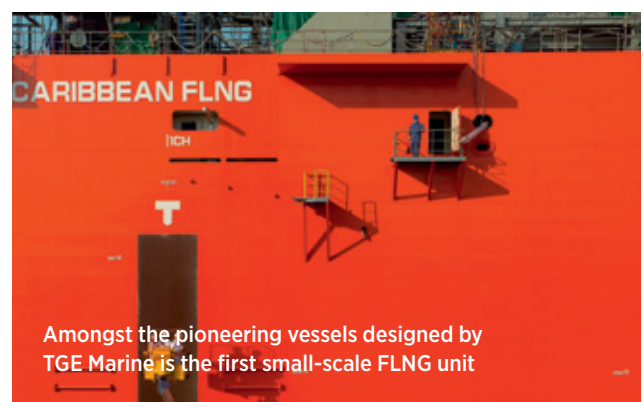
- Dominion Energy sold its gas transmission and storage interests, including the Cove Point LNG import/export terminal, to Warren Buffett's Berkshire Hathaway Energy for US\$9.7 billion.

August

- Elba Liquefaction Co (ELC) brought online the last of its ten 0.25 mta LNG production units at the Elba Island LNG terminal in Georgia. The small-scale units are built to a design known as the Movable Modular Liquefaction System (MMLS). The terminal is owned jointly by Kinder Morgan and EIG Global Energy Partners, and Shell has signed up for its entire output.
- Daewoo developed a new LNG reliquefaction system which it calls the Nitrogen Refrigerant System. The units will be employed on the two 361,600 m³ FSUs that DSME is building for Novatek (see June). The vessels, which will function as transshipment terminals, are expected to generate significant quantities of cargo boil-off gas (BOG) during operations.

September

- TGE Marine Gas Engineering celebrated its 40th anniversary. More than 220 gas tankers have been built to TGE Marine designs and the company has supplied over 35 fuel gas systems. Amongst the portfolio of TGE Marine-designed vessels are the largest LNG carrier based on IMO Type C tanks; the first small-scale FLNG unit (with a storage capacity of 16,100 m³); the first LNG bunker vessel newbuilding; and the first combined LNG/LEG carrier (a ship of 7,500 m³).



- Karpowership of Turkey brought the world's first floating LNG-to-power project into operation. Its 125 MW *PowerShip Zeynep Sultan* vessel started generating electricity utilising natural gas at Amurang off the northern coast of the Indonesian island of Sulawesi on 20 September. The project makes use of the 14,000 m³, 2017-built LNGC *Hua Xiang 8* as a regasification vessel connected to *PowerShip Zeynep Sultan* by means of floating hoses.

October

- The 7,500 m³ LNG bunker vessel (LNGBV) *Avenir Advantage* was delivered by Keppel's Nantong yard to Future Horizon. A joint venture comprising Avenir LNG and MISC of Malaysia, First Horizon is the first dedicated LNGBV operator in South East Asia. *Avenir Advantage* is the first of six LNGBVs under construction for Avenir.
- Qatar Petroleum booked up to 7.2 mta of capacity at the Grain LNG import terminal in Kent. The 25-year deal, agreed with the UK's National Grid, the terminal's operator, is set to commence in 2025. The arrangement is part of Qatar Petroleum's drive to secure positions at European import terminals to tie in with its NFE expansion project which will boost LNG production capacity at Ras Laffan by up to 64 per cent by 2027.
- The newly delivered 3,500 m³ LNG bunker vessel *Kaguya* carried out Japan's first ship-to-ship (STS) LNG bunkering operation. Japan's first LNGBV, *Kaguya* fuelled NYK's dual-fuel car carrier *Sakura Leader* at the Shin Kurushima yard of Toyohashi Shipbuilding Co. *Kaguya* will be based at JERA's Kawagoe LNG terminal and will serve dual-fuel vessels in the Chubu region.



The *Kaguya* carries out the first LNG ship-to-ship refuelling operation in Japan

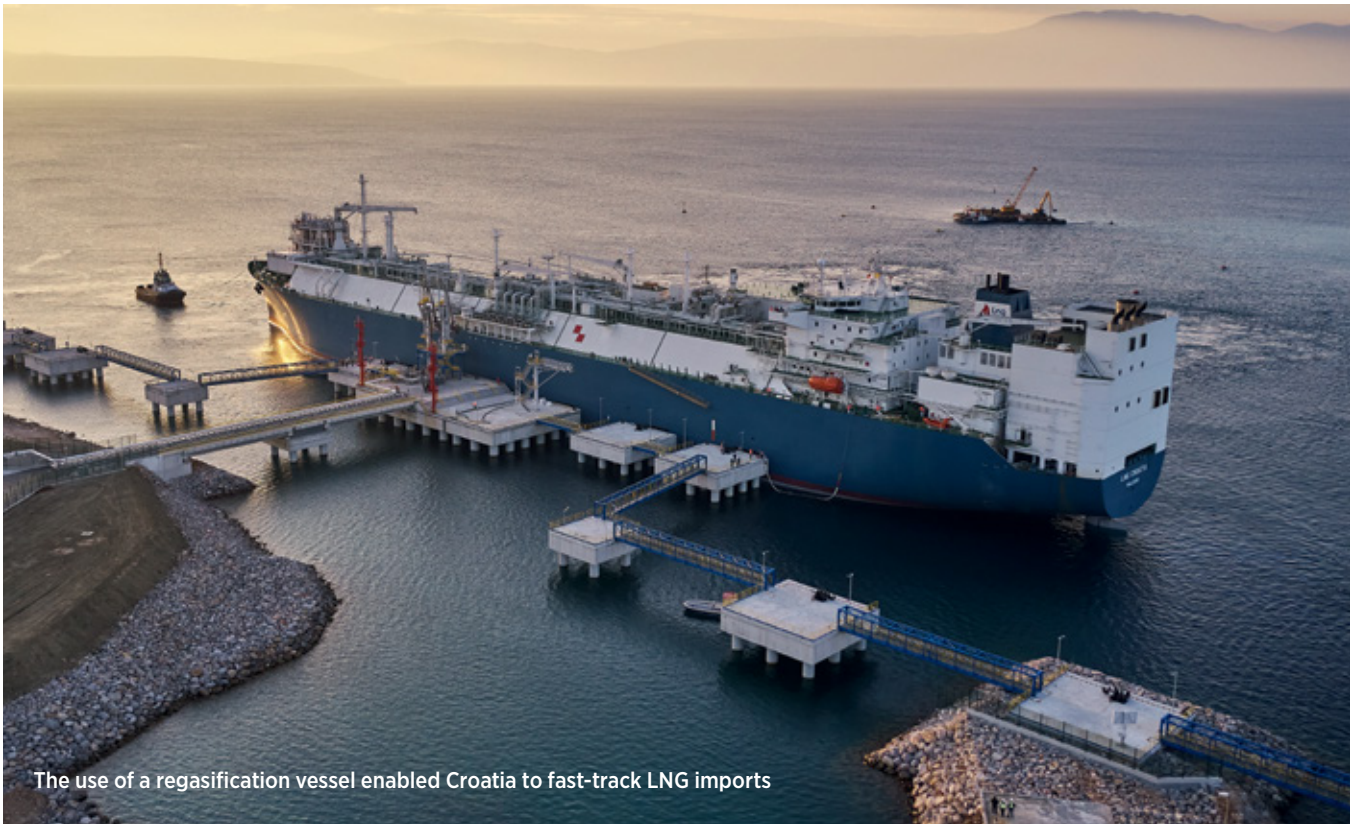
November

- Sempra reached a final investment decision (FID) to proceed with a project to provide its Energia Costa Azul (ECA) import terminal at Ensenalda in Mexico with a capability to export up to 3.25 mta of LNG. Japan's Mitsui & Co and Total of France have signed up for a total of 2.5 mta of this output for 20 years. Feedgas from the US will be piped to the terminal for liquefaction at its new single train. The US\$2 billion ECA LNG Phase 1 scheme was the only LNG export project to reach a final investment decision in 2020, and startup was targeted for late 2024.
- Samsung Heavy industries delivered the 98,000 m³ *Seri Everest*, the first in a series of 12 very large ethane carriers (VLECs) for MISC and a 15-year charter to Zhejiang Satellite Petrochemical (STL). Built to an LNG cargo-ready notation, *Seri Everest* is the world's largest VLEC and MISC's first VLEC. The vessel will be utilised in the transport of US ethane to STL's ethylene cracker in China's Jiangsu province.
- Pavilion Energy and QP Trading, the newly created LNG trading arm of Qatar Petroleum, signed the world's first carbon-tracked LNG SPA. Qatar Petroleum will supply up to 1.8 mta of LNG to Singapore for 10 years starting from 2023. Each LNG cargo delivered under this supply agreement, QP Trading's first, will be accompanied by a statement of its greenhouse gas (GHG) emissions measured from well to discharge port.



Seri Everest departed Nederland, Texas with the largest-ever cargo of ethane in January 2021

Gas shipping and terminal timeline 2020



The use of a regasification vessel enabled Croatia to fast-track LNG imports

December

- The FSRU *LNG Croatia* arrived at its new berth on Krk Island off the coast of Croatia with a commissioning cargo loaded at the Sagunto terminal in Spain near Valencia. China's Huarun Dadong yard had completed the conversion of the former 2005-built, 140,000 m³ LNGC *Golar Viking* into the FSRU *LNG Croatia* three months earlier. *LNG Croatia* will handle LNG imports of up to 1.9 mta.
- Another FSRU-based project that commenced operations as the year ended was Gas Natural Açú's LNG-to-power scheme in the Brazilian port of Açú. The inaugural shipment to the terminal's FSRU, the 173,400 m³ *BW Magna*, was delivered by the 2007-built, 155,000 m³ *Kmarin Emerald* (ex-*British Emerald*), owned by BP Energy. *BW Magna* has been fixed to Gas Natural Açú for 23 years and will supply regasified LNG to two combined cycle thermal power plants with a combined generation capacity of 3 GW. The first power plant was formally commissioned in January 2021 while the second is due onstream in January 2023.
- Energy Transfer completed an LPG expansion project at its multi-product export terminal in Nederland, Texas, building its LPG loading capacity by 6.3 mta to 15.7 mta. In December the company also completed its new ethane export complex at the Nederland facility as a joint venture with the US arm of China's Zhejiang Satellite Petrochemical. The ethane facility was provided with a 120,000 m³ storage tank and the capacity to produce up to 5.2 mta of this particular natural gas liquid (NGL). The 98,000 m³ dual-fuel *Seri Everest*, the world's largest VLEC (see November), departed Nederland with the new project's first cargo in January 2021. The 51,750-tonne shipment was the largest volume of ethane ever taken onboard by a single gas carrier.
- On 17 December the 84,000 m³ very large gas carrier (VLGC) *BW Gemini* became the first ship to be powered by LPG as fuel when it departed EPP's Enterprise Hydrocarbon Terminal on the Houston Ship Channel. The vessel had loaded 49,000 tonnes of LPG as cargo and for use as fuel, a volume which was the largest load of LPG ever taken on a single hull. *BW Gemini* was the first of 15 existing company VLGCs that BW LPG is upgrading to dual-fuel running by converting the conventional two-stroke engine on each ship to enable it to also run on LPG fuel. As part of the conversion *BW Gemini* was provided with two 900 m³ deck-mounted LPG fuel tanks, each 35 metres long and 6 metres in diameter.



BW Gemini's two deck tanks hold up to 1,800 m³ of LPG fuel

Very large gas carrier (VLGC) traffic through the Panama Canal surges, in tandem with US LPG exports



Summary

Despite an estimated 5 per cent year-on-year reduction in global energy demand caused by the Covid-19 pandemic in 2020, seaborne movements of LNG actually increased, by 0.4 per cent to 356.1 million tonnes (mt). According to statistics compiled by GIIGNL, LNG sold in the spot and short-term markets increased by 23.5 mt in 2020, a 19.8 per cent jump, to reach 142.5 mt. Spot and short-term cargoes thus accounted for 40 per cent of the LNG market, up from 34 per cent in 2019.

Australia, with shipments of 77.8 mt, moved past Qatar, with loadings of 77.1 mt, to become the world's leading LNG export nation for the first time. In third position was the US, with shipments of 44.8 mt. Five large-scale liquefaction trains were completed in the US in 2020, enabling an annual increase in US LNG exports. That year-on-year growth would have been twice as great were it not for the cancellation of 200 LNG cargoes that US export terminals had planned to ship in 2020. Offtakers requested the annulments due to the negative impact of Covid-19 on demand.

Of the 42 LNG import countries in 2020 China recorded the greatest year-on-year expansion of cargoes purchased, with inbound shipments up 7.2 mt, or 11.7 per cent, to reach 68.9 mt. China is expected to become the leading LNG importing country in 2021, ending Japan's 50-year reign in the top spot. Eight new LNG import terminals were commissioned in 2020, comprising two in Brazil and one each in Bahrain, Croatia, India, Indonesia, Myanmar and Puerto Rico.

Unlike 2019, when six new liquefaction projects, covering an additional LNG production capacity of 71 mta, were given the green light to

proceed, only one new LNG scheme achieved a final investment decision in 2020. Sempra decided to press ahead with its plan to build a 3.25 mta liquefaction train at its Energia Costa Azul (ECA) import terminal at Ensenalda in Mexico. The facility is due onstream in late 2024.

GIIGNL reports that a total of 47 LNGCs were delivered in 2020, up from 44 in 2019. Despite the tumultuous economic conditions pertaining in 2020, 40 new LNG ships were contracted during the year, adding to 62 newbuildings ordered in 2019. The global fleet of LNGCs stood at 642 vessels at the end of 2020, including 43 FSRUs and 58 vessels of less than 50,000 m³. The LNGC orderbook as of 31 December 2020 stood at 147 ships, of which 72 were scheduled for 2021 delivery, including five of the seven contracted FSRUs.

Global seaborne movements of LPG slipped by 2 per cent in 2020, to 106.8 mt from 109.1 mt in 2019. However, US loadings continued their inexorable rise. The country cemented its position, gained in 2019, as the world's largest LPG export region. US terminals shipped 47.1 mt of LPG to world markets in 2020, 15.8 per cent above the previous year's 40.8 mt. Middle East LPG exports totalled 37 mt in 2020, down from 39 mt a year earlier.

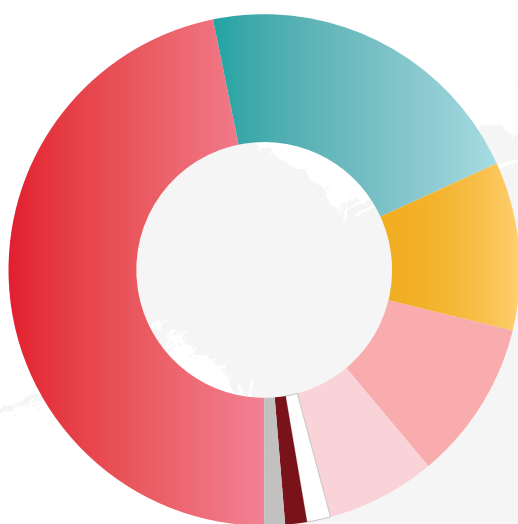
China and India remained the two largest LNG importers in 2020. China's purchases, at 19.6 mt, were 4.7% down on 2019's 20.5 mt. Indian imports jumped 12%, from 14.5 mt in 2019 to 16.3 mt in 2020.

At the end of 2019 there were 303 very large gas carriers (VLGCs) in service, following the completion of 21 newbuildings during the year, and 40 such vessels on order.

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

GLOBAL LPG CARRIER FLEET 2020

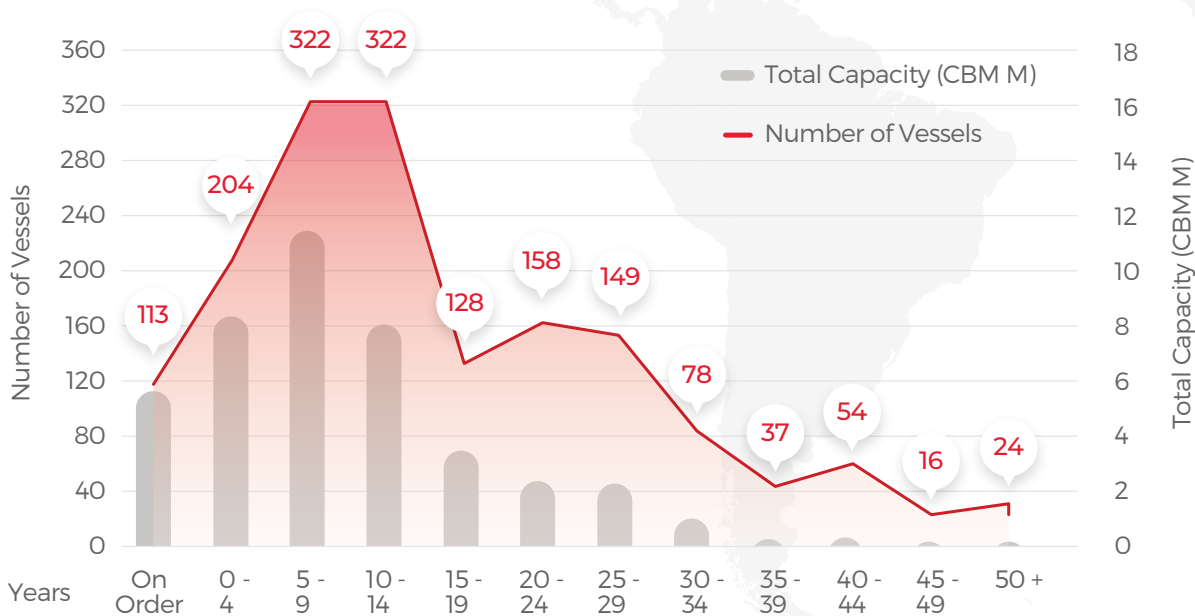
LPG FLEET BY NUMBER OF VESSELS



LPG Type	Number of Vessels	Total Capacity (CBM M)
Fully Pressurised	751	2.56
VLGC	343	28.27
LEG	171	1.99
SP FR LPG	162	1.88
MGC	111	4.10
HGC	24	0.54
VLEC	22	2.07
LGC	21	1.25

Total of **1,605** vessels, **113** of which are currently on order

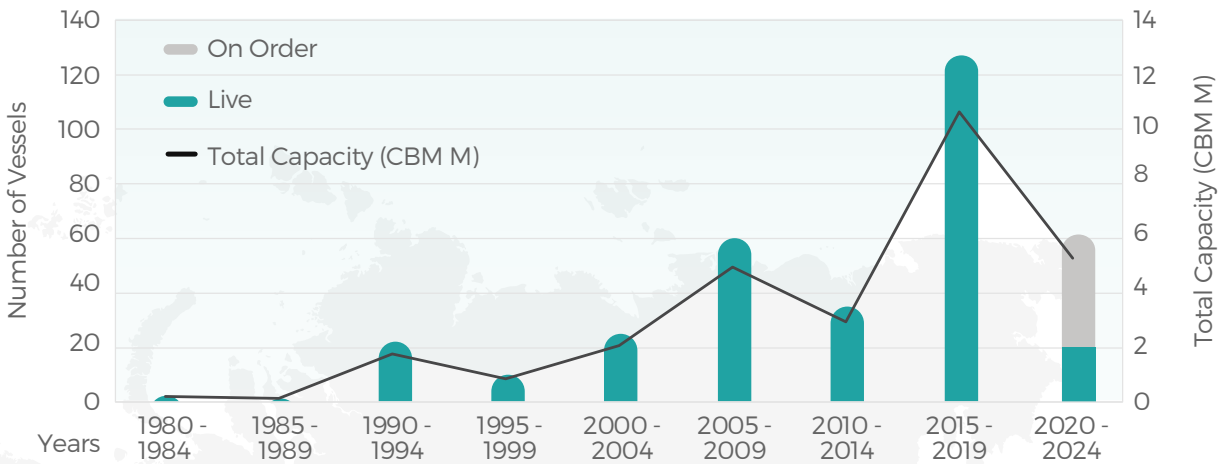
LPG FLEET AGE PROFILE



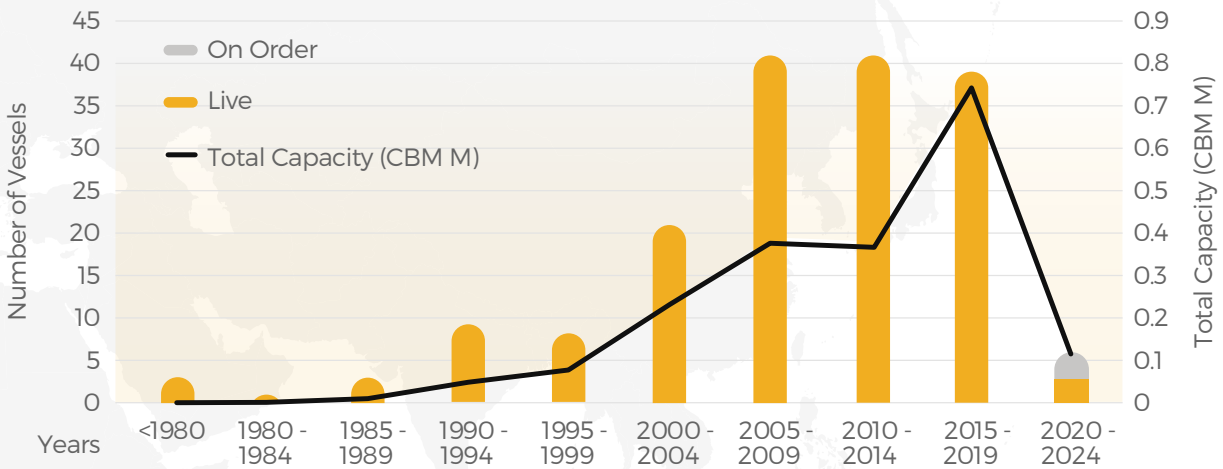
Source: VesselsValue as of 31st December 2020
Does not include floating production vessels.



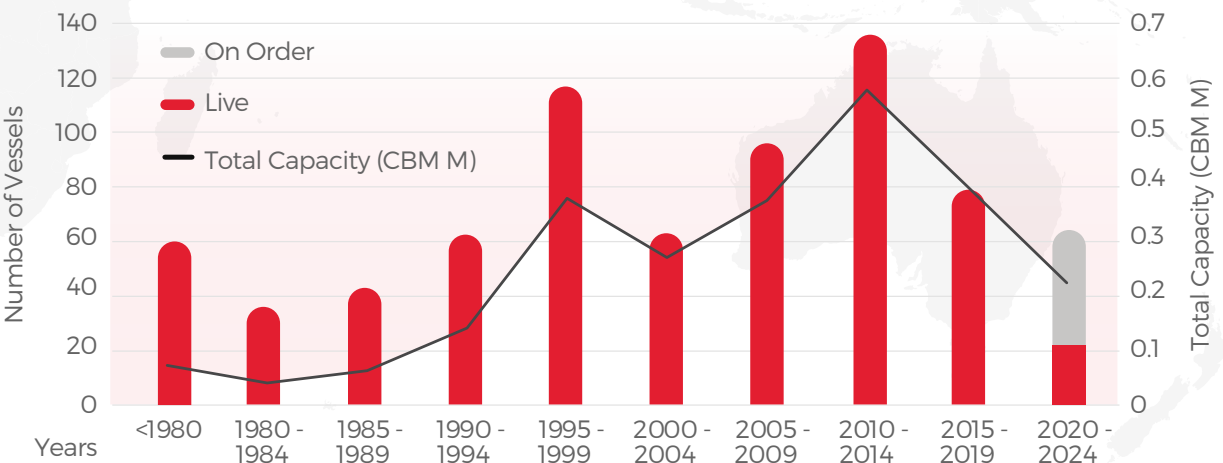
VLGC DELIVERY SCHEDULE



LEG DELIVERY SCHEDULE



FULLY PRESSURISED DELIVERY SCHEDULE





Enterprise Products Partners (EPP) opened its Morgan's Point facility on the Houston Ship Channel as an ethane loading terminal in 2016; EPP, in partnership with Navigator Gas, added an ethylene export capability in 2020

Ensuring global outreach during Covid

The Covid-19 pandemic brought unprecedented challenges to the maritime industry in 2020. Although the slump in world trade, by 5.3 per cent, last year was less than initially expected, it was still the biggest drop since 2009, when the repercussions of the September 2008 global financial meltdown severely limited business activity.

While trade in general fell in 2020, worldwide seaborne movements of liquefied gases continued to grow, albeit not so strongly. And, although Covid brought a halt to the SIGTTO's face-to-face meetings, the Society's work programme continued to expand last year.

The number of SIGTTO working groups and technical projects has been rising steadily in recent years, reflecting trade growth, the introduction of new vessel types and technologies, the ongoing diversification of the gas supply chain and the increasing number of industry participants. The portfolio of SIGTTO working groups reached its highest-ever level with the establishment of the Society's Environmental Sub-committee (ESC) in May 2020. Member companies quickly signed up for four new ESC working groups in the drive to examine, assess and guide environmental impacts and improvements within the liquefied gas shipping and terminal sectors.

The SIGTTO agenda is also poised to take on two new types of liquefied gas carrier - hydrogen and carbon dioxide (CO₂) ships - as work items. Hydrogen has been identified as a marine fuel for the "zero emissions" future and large-capacity vessels will be required to lift the product from production centres for distribution to bunkering stations worldwide. While there are a handful of long-serving CO₂ carriers in service, they are relatively small and engaged in the transport of product for the European beverage industry. In the years ahead there will be a call for CO₂ carriers of up to 15,000 m³, more than 10 times the size of the current vessels, to serve carbon capture and storage (CCS) projects worldwide.

Results of the Society's work programme are reflected in the growing library of industry best practice publications produced by SIGTTO. This body of

knowledge provides an effective and valuable way for the Society's members to influence the liquefied gas industry, sustain its exemplary safety record and achieve operational excellence. Since it was established in 1979 SIGTTO has published more than 50 publications, recommendations and guidelines, most of the titles having been revised and updated several times over the years. Around 10,000 copies of SIGTTO publications have been sold in the last six years, across 69 countries and six continents. During 2020 and the first half of 2021 the Society issued two free documents and three paid publications.

As part of efforts to keep the membership informed of this growing workload and output, SIGTTO mounted a strong marketing campaign in 2020. The initiative had the added benefits of (a) maintaining lines of communication amongst the membership when the Society's busy timetable of face-to-face meetings around the world was not possible and (b) making potential new members, including in key demographic areas, aware of the progress being made by SIGTTO on the issues of the day and hence the benefits of membership.

The Society's targeted marketing campaign got underway early in 2020, with extensive use being made of various digital and customer relationship management (CRM) marketing tools.

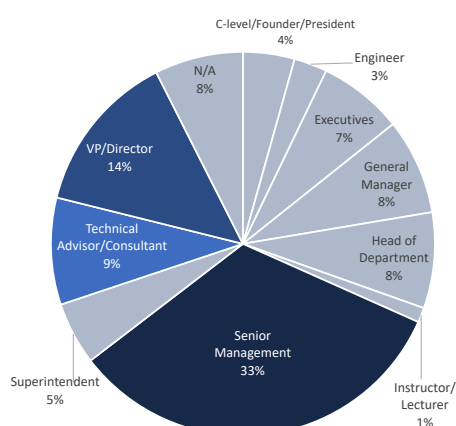
The initiative resulted in an organic growth of more than 400 per cent in the number of followers of the Society on LinkedIn and a huge boost in total online impressions amongst all channels.

SIGTTO website followers from China tripled after the employment of Mandarin resources and two social media accounts on the biggest Chinese social content platforms - Weibo and WeChat. This approach was taken because Twitter and LinkedIn are not available to view within this fast-growing liquefied gas market. In October 2020, building on its outreach successes in China, SIGTTO also created a Japanese page with translated resources to make the online content more approachable for all viewers in this, the world's largest LNG import country.

As part of the effort to support members and keep them apprised of the Society's progress during a time of lockdowns worldwide, SIGTTO staged three webinars during 2020 as well as a Virtual Panel Meeting in April 2021. These virtual meetings, the agendas for which took into account member feedback on topics of interest, were attended by 322 registrants from 115 member companies, along with a limited number of guests. The Society utilised a platform for the Virtual Panel Meeting which encompassed one-to-one messaging and video chat features to ensure that the event provided valuable opportunities for networking.

Participation in the SIGTTO Virtual Panel Meeting, April 2021

Registrant Job Titles (Out of 322)



SIGTTO Spring Virtual Panel 2021

322
Registrants

115
Member companies

229 / 71%
Attendees / Attendance Rate

* Recordings were shared with all the registrants after the event.

SIGTTO virtual meetings cover face-to-face gap



The -253°C carriage temperature for liquefied hydrogen on Suiso Frontier represents new territory for gas ships

As SIGTTO General Manager Andrew Clifton points out on page 7, during the course of a normal year the Society would stage 11 or 12 Regional Forums for local members at various locations around the world as well as a Panel Meeting open to the full membership and invited guests.

As soon as the full magnitude of the Covid-19 virus became known, and lockdowns were introduced, in early 2020, SIGTTO, like all other industry associations, developed means of communicating with its membership virtually. The Society's first priority in the application of the sophisticated online platform technology it utilised was to link the Board of Directors and the members of its committees and working groups to ensure an uninterrupted continuation of SIGTTO's busy work programme.

As soon as this regime was operating smoothly, however, attention switched to the need to communicate the latest Board decisions and the progress being made with the many SIGTTO projects then underway to the general membership. As a first step the Secretariat organised a series of webinars in the second half of 2020. Held in July, October and December, these online sessions proved to be extremely popular, the internet

technology employed enabling SIGTTO members to join and interact with other members from their own offices and homes. In this way members were not only apprised of progress with the work projects but also updated with general Society news and details of key industry issue developments.

Virtual Panel

SIGTTO followed the webinars up with a Virtual Panel Meeting in April 2021. The day-long online gathering was modelled on the Society's long-running series of face-to-face Panel Meetings, and featured 10 topical presentations by the Society's members and invited guests. The Swapcard platform technology chosen for this event enabled networking and virtual exhibition stands. As part of the networking package, SIGTTO was able to supply a one-to-one meeting service for those attendees wishing to discuss with a SIGTTO officer any matter relating to the Society's activities. There was also an opportunity to ask the speakers questions after each presentation.

Feedback following the Virtual Panel Meeting highlighted participant satisfaction with the choice of subject matter for the presentations and their content. The subjects chosen were all timely, highlighting, as they did,

issues and technologies currently of great interest to the membership. Details of all the meeting papers are given on the SIGTTO website.

The following paragraphs cover three of the Virtual Panel Meeting presentations. Two of these deal with new types of liquefied gas carrier while the third describes a new approach to shoreside LNG deliverability that is opening up additional marketing opportunities for natural gas.

First liquefied hydrogen carrier

Hydrogen has been identified as a global fuel of the future and the tightening regime governing the control of greenhouse gas (GHG) emissions is driving efforts by naval architects and cryogenics engineers to find ways of transporting and storing quantities of hydrogen safely and efficiently.

Yukichi Takaoka of HySTRA and Ahmer Saeed of Shell were on hand to tell SIGTTO Virtual Panel Meeting attendees about the HySTRA project and its construction of *Suiso Frontier*, the world's first liquefied hydrogen (LH2) carrier. *Suiso Frontier* is part of a pilot project investigating the feasibility of the marine transport of hydrogen, and involves shipments from

Hastings in South Australia to Kobe in Japan. The hydrogen to be liquefied in Hastings will be generated using brown coal gasification technology and the cargo that *Suiso Frontier* discharges in Kobe will be stored in a 2,500 m³ spherical tank.

Built by Kawasaki Heavy Industries, *Suiso Frontier* has a single, double-walled Type C tank of 1,250 m³ which is vacuum-insulated. The containment system allows for pressure build-up in the cargo tank over the duration of the voyage, obviating the need for sophisticated boil-off gas management arrangements. A three-week laden voyage is planned during which the liquefied hydrogen will be carried at its boiling point temperature of -253°C.

The speakers described the novel gas carrier technologies that have been embraced for *Suiso Frontier*, including the double-wall, stainless steel cargo tank, the vent mast design, the gas detection arrangements and emergency response planning. The introduction of these technologies necessitated the use of safety design and risk assessment studies beyond the scope of any previously carried out.

The availability of *Suiso Frontier* will enable evaluation of the equipment, instrumentation and insulation technology employed onboard and assist in choosing the optimum cargo containment and propulsion systems for the larger LH2 carriers that will be required in future. Experience with *Suiso Frontier* should also prove invaluable in the development of rules specifically for hydrogen for future inclusion in the International Gas Carrier (IGC) Code and the International Code of Safety for Ships using Gases or other Low-flashpoint Fuels (IGF Code).

Although the Covid pandemic has delayed the inaugural trial voyage of *Suiso Frontier*, from Kobe to Hastings and back, the aim is to complete this operation in either late 2021 or early 2022.

Carbon dioxide (CO₂) carriers

Another type of gas carrier likely

to feature more prominently in the future is the carbon dioxide (CO₂) carrier. Although not strictly speaking “new” – a handful of small fully pressurised gas carriers of up to 1,500 m³ in capacity have been carrying CO₂ around northern Europe on behalf of the beverage industry for many years – ships of a much greater size will be needed for the volumes of CO₂ likely to be generated by envisaged carbon capture and storage (CCS) projects. The idea behind these bigger CO₂ ships is that they would transport their cargoes from shoreside terminals to safe disposal sites, most likely depleted offshore oil and gas fields, for deep underground sequestration.

Frank Ollerhead of Shell presented a paper at the Virtual Panel Meeting outlining Norway’s Northern Lights CCS project. Shell is participating in the scheme, along with Total and Equinor, and has responsibility for the design and construction of the project’s gas carrier.

CO₂ presents a unique set of hazards when shipped in bulk by sea. It is an invisible, heavy gas which collects at low points and has no smell. It also has toxic and asphyxiant properties and is corrosive in combination with free water. CO₂ is very cold, i.e. less than -78°C, if released from dense conditions and pressure relief from dense conditions can lead to solid dry ice formation.

The initial focus of the design team developing a vessel for the Northern Lights project is a gas carrier with two Type C tanks of 7,500 m³ total capacity. While the design would adhere to LPG shipping basics, it would also have to accommodate CO₂’s unique thermodynamic properties. The concept calls for a cargo containment system able to handle a design working pressure of 19 bar and a carriage temperature of -35°C. The resultant CO₂ carrier is a gas ship that falls somewhere between the fully pressurised (FP) and semi-pressurised/fully refrigerated (semi-ref) designs.

A number of other potential CCS schemes are also under investigation and CO₂ ships of up to 15,000 m³

are on the drawing board. The distance between the loading and discharge points will be instrumental in determining ship size.

LNG-to-Powership

In his presentation Christian Bale, Director Offshore for Mitsui OSK Lines (MOL), provided details of his company’s 2018 link-up with Karpowership of Turkey that enables utility companies to make use of the partnership’s new LNG-to-Powership option to fast-track gas purchases and generate electricity.

With this supply chain approach an MOL delivery LNG carrier will offload its cargo to an MOL floating storage and regasification unit (FSRU) at a nearshore location by means of a ship-to-ship transfer operation. The FSRU will then send the regasified cargo through a floating hose to a nearby Karpowership power station vessel where electricity is generated and passed through a shore substation to the local grid.

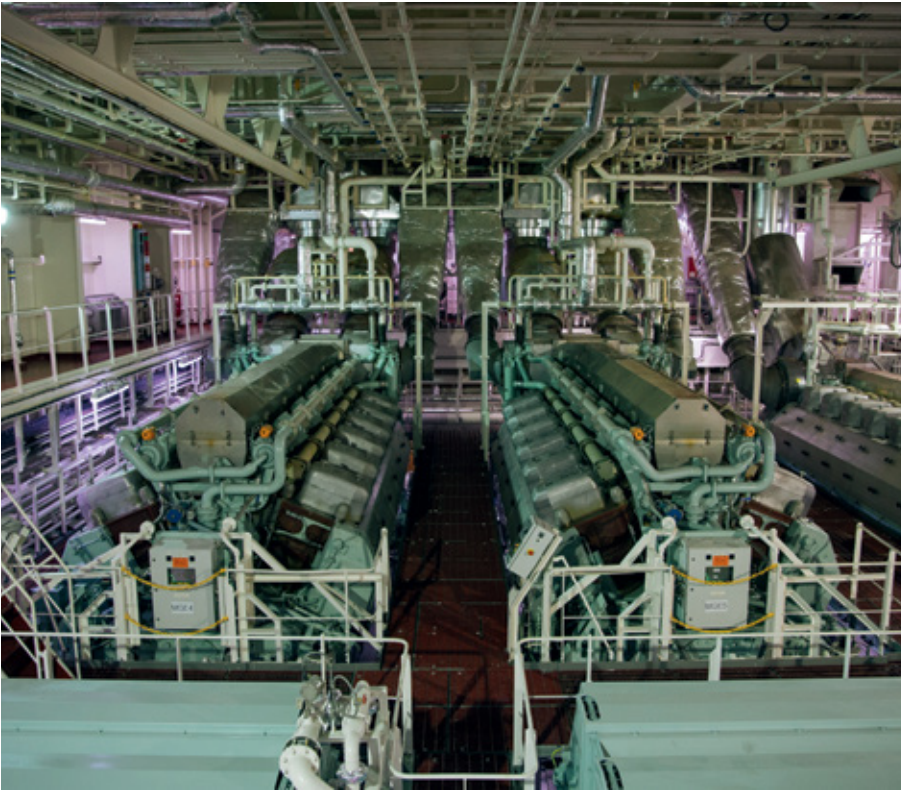
Karpowership operates the world’s only floating power plant fleet. Termed Powerships, the floating plants can be mounted on either barges or self-propelled hulls. Following its many years of experience with oil-fired floating power stations, Karpowership has recently used its joint venture with MOL to launch the first LNG-to-Powership project, in Indonesia. The project makes use of an existing oil-fired Karpowership vessel whose generating plant’s reciprocating engines had been converted to enable them to run on natural gas. Two more LNG-to-Powership projects making use of converted Powerships, in Senegal and Mozambique, are set for imminent start-ups.

Christian Bale highlighted the advantages offered by the LNG-to-Powership approach, including very short project start-up times; streamlined permitting procedures; the ability to serve locations not covered by permanent gas or LNG infrastructure; cost-competitiveness; and flexible redeployment options.



Labels help identify individual lines in the complex array of a gas carrier's deck pipework

SIGTTO input vital to IMO gas ship rulemaking



The shipping industry's drives for improved fuel efficiency and reduced emissions are evolving on a number of fronts

At any one time a number of rulemaking initiatives are underway at the International Maritime Organization (IMO), the European Union (EU) and the US Coast Guard (USCG) which impact gas carrier operators engaged in international trade. Because close alignment of systems and procedures at the ship/shore interface is critical to safe and reliable gas ship operations, many maritime legislative decisions also affect terminal operators.

SIGTTO plays a key role in the rulemaking processes of the various agencies, 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.

A UN agency, IMO is the leading international body for maritime safety and environmental protection affairs

and has a busy schedule of committee and subcommittee meetings each year. SIGTTO has had 'observer status' as a non-governmental organisation (NGO) at IMO since 1983. The Society's Secretariat attends IMO meetings as appropriate and SIGTTO makes submissions to IMO on various matters related to the LNG/LPG sector either by itself or jointly with other parties. Amongst notable recent SIGTTO achievements in this respect are its work with the International Gas Carrier (IGC) Code, including the Society's coordination of the 2016 revision of the Code; input into the Code's Unified Interpretations (UIs); and initiating a review of the Code to be conducted over the next few years.

The following paragraphs detail decisions impacting the design, construction and operation of gas carriers taken by IMO's Maritime Safety and Marine Environment Protection Committees during the course of 2020. MSC and MEPC are the IMO bodies responsible for maritime safety and environmental protection matters, respectively.

Maritime Safety Committee

IMO's Maritime Safety Committee met virtually for its 102nd Session (MSC 102) in November 2020. Although working on a much-reduced agenda, the Committee did consider several issues relating to gas carriers. These had been previously agreed at IMO's Sub-committee on Carriage of Cargoes and Containers (CCC).

MSC 102 adopted an amendment to the IGC Code on welding (paragraph 6.5.3.5.1) and approved an amendment on watertight doors (paragraph 2.7.1), to be adopted at the next session. In addition, 15 Unified Interpretations (UIs) of the IGC Code were approved, covering the following areas:

- (a) tee welds in type A or type B independent tanks (concerning paragraph 4.20.1.1 of the IGC Code);
- (b) welds of type C independent bi-lobe tanks with centreline bulkheads (4.20.1.2);
- (c) outer duct in gas fuel piping systems (5.4.4 and 5.13.2.4);
- (d) cargo sampling (5.6.5);
- (e) cargo filters (5.6.6);
- (f) cargo piping insulation (5.12.3.1);
- (g) type testing requirements for valves (5.13.1.1.2);
- (h) guidance for sizing pressure relief systems for interbarrier spaces (8.1);
- (i) emergency fire pumps (11.2 and 11.3.4);
- (j) fire pumps used as spray pumps (11.3.4);
- (k) level indicators for cargo tanks (13.2.2);
- (l) inhibition of cargo pump operation and opening of manifold emergency shutdown (ESD) valves with level alarms overridden (table 18.1, note four and 13.3.7);
- (m) oxygen deficiency monitoring equipment in a nitrogen generator room area (13.6.4);
- (n) integrated systems (13.9.3); and
- (o) suitable pressure relief system for air inlet, scavenge spaces, exhaust system and crank case (16.7.1.4).

A SIGTTO paper proposing a further and focused review of the IGC Code was considered at MSC 103, held in May 2021, where it was agreed to take the issue on as a new work item. >



Engineer officers monitor machinery performance on the 84,000 m³ BW Gemini, the first LPG carrier to have its engine converted to dual-fuel use and the option to run on LPG

Marine Environment Protection Committee

IMO's Marine Environment Protection Committee met virtually for its 75th Session (MEPC 75) in November 2020. The cut-down agenda mainly focused on measures for the reduction of greenhouse gases (GHG). The measures concerned are those given in the Energy Efficiency Design Index (EEDI) and the newly established Energy Efficiency Existing Ship Index (EEXI) and Carbon Intensity Indicator (CII).

The Energy Efficiency Design Index (EEDI)

The EEDI regulations were introduced in 2011 for new ships in the drive to promote the use of more energy-efficient vessel equipment and engines. EEDI requires a minimum energy efficiency level per capacity mile for different ship type and size segments and, through periodic reassessment of targets and performance, encourages a process of continued innovation and technical development in the fuel efficiency of new ships.

The EEDI regulations include a clause requiring a review of the status of technological developments and, if proven necessary, amendment of the time periods, the EEDI reference line parameters and reduction rates. Such a review has recently been conducted and MEPC 75 adopted an amendment to MARPOL Annex VI to bring forward Phase 3 for LNG carriers and gas carriers of greater than or equal to 15,000 dwt to 1 April 2022. The established 2025 deadline date remains in place for smaller gas carriers.

The Energy Efficiency Existing Ship Index (EEXI) and Carbon Intensity Indicator (CII)

Pursuant to the initial IMO GHG Strategy, MEPC has recently been considering short-term measures for the reduction of GHG with a view to agreement by 2023. MEPC 75 approved a package of new measures including the Energy Efficiency Existing Ship Index (EEXI) and an annual operational Carbon Intensity Indicator (CII).

The draft amendments to MARPOL Annex VI were considered for adoption

at MEPC 76 in June 2021. The EEXI and CII measures were agreed and are set for entry into force on 1 November 2022.

Further work on the supporting guidelines has been carried out in a correspondence group for consideration at MEPC 76. An impact assessment is also being developed.

In essence, EEXI is the application of EEDI to existing ships, with additional guidance to aid application to the existing fleet. It will apply to the same ship types as EEDI and will use the same EEDI baselines.

The reduction factor for LNG carriers in the proposed MARPOL Annex VI amendments is 30 per cent from the baseline, while for other gas carriers it is between 0 and 30 per cent, depending on ship size. Verification that the ship's attained EEXI is in accordance with the requirements is to take place at the first annual, intermediate or renewal survey after 1 January 2023. EEDI must be calculated for each ship and be accompanied by an EEXI technical file, which will form the basis for verification by the flag administration or recognised organisation on its behalf.

A ship subject to the EEDI regulations may use the verified EEDI to demonstrate compliance, provided the attained EEDI is equal to or less than the required EEXI. Verification will be documented in the International

Energy Efficiency (IEE) Certificate.

The proposed CII, applicable to ships of 5,000 gross tonnage and above, determines the annual reduction factor needed to ensure continuous improvement of the ship's operational carbon intensity within a specific rating level.

The actual annual operational CII achieved will be documented and verified against the required annual operational CII. This will enable the operational carbon intensity rating to be determined. The rating will be given on a rating scale - A, B, C, D or E - indicating a major superior, minor superior, moderate, minor inferior or inferior performance level.

The performance level should be recorded in the ship's Ship Energy Efficiency Management Plan (SEEMP). A ship rated D for three consecutive years or E in any one year would have to submit a corrective action plan, to show how the required index (C or above) would be achieved.

Fourth IMO GHG Study

In November 2020 MEPC 75 also approved the Fourth IMO Greenhouse Gas (GHG) Study (2020). The document contains an overview of GHG emissions from shipping between 2012-2018 and covers developments in carbon intensity and emission projections towards 2050.



The proposed EEXI requirements would impose the ship energy efficiency regime on existing vessels, including gas carriers



Kotug infield support vessel assists in the side-to-side berthing of GasLog's 170,000 m³ Methane Julia Louise and Shell's floating production (FLNG) vessel Prelude

Keeping industry best practice portfolio up to date

Continually refreshed, SIGTTO's portfolio of publications provides an unparalleled source of sound advice on safe gas ship and terminal operations.

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 42 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 portfolio includes nine publications issued in the six years to December 2020, although one of these, the Panama Canal guidance for gas tankers, is no longer in the SIGTTO portfolio. Witherbys, the Society's publisher, has taken on responsibility for the title and revised the document to make it applicable for all ship types. 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 2020 publishing achievements.

LNG Shipping Suggested Competency Standards

Approved by the SIGTTO Board in September 2020 and published early in 2021, the *LNG Shipping Suggested Competency Standards* is the first output of the Human Element Committee's (HEC's) review of its four competency related publications. It updates and replaces the previous edition, *LNG Shipping Suggested Competency Standards (2008)*.

The new, third edition provides additional clarification and updates to existing topics and incorporates advances in technologies currently being used in the LNG industry. Specifically new to this version



SIGTTO's new guidance on gas carrier cargo control room design cross-references an important set of ISO standards

is the development of suggested competencies for floating storage and regasification unit (FSRU) cargo operations as a standalone annex for FSRU personnel.

Standards to ensure consistent levels of competence can help to improve safety on an industry-wide basis. The revised *LNG Shipping Suggested Competency Standards* document benefits from the experience and knowledge of SIGTTO members in the fields of training and LNG cargo operations. The update, which is expected to add value to a company's competence management system, reflects technological advances and lessons learnt from incidents since the previous edition was published.

Steve Allibone of MOL, the HEC chair, also chaired the working group responsible for preparing the new edition of the *LNG Shipping Suggested Competency Standards*.

Recommendations for Designing Cargo Control Rooms

Approved by the SIGTTO Board in September 2020 and published shortly thereafter, *Recommendations for Designing Cargo Control Rooms* is the second publication prepared by the HEC's Cargo Control Room

(CCR) Ergonomics Working Group. The group is chaired by Ray Gillett of GTT Training and its first document, *Recommendations for Management of Cargo Alarm Systems*, was published in 2019.

The Recommendations for Designing Cargo Control Rooms document recommends the application of ergonomic design principles to gas carrier CCRs, more specifically that shipowners work with system designers, class societies and shipyards to create an operational philosophy to guide the implementation of these design principles in the development of CCRs.

The publication also recommends that the guidance given in *ISO 11064-Ergonomic design of control centres*, an established set of ISO standards, be adopted as they could help in improving the design of cargo control rooms on new gas carriers. The new SIGTTO CCR design recommendations cover aspects such as control station layout, physical environment, operator interface, controls and displays.

The CCR Ergonomics group's third and final publication, *Recommendations for Cargo Control Room HMI*, dealing with the user-friendly design of the CCR human/machine interface, has >

New Publications



Floating storage and regasification units (FSRUs) are amongst the vessels whose operations are covered by the new Floating LNG Installations publication

also been completed, enabling SIGTTO Board approval in spring 2021. All three of the CCR Ergonomics Working Group publications are available at no charge.

Guidance on Gas Carrier and Terminal Gangway Interface

The document produced by the Rick Boudiette-chaired SIGTTO Gangways Working Group, *Guidance on Gas Carrier and Terminal Gangway Interface*, was approved by the Society's Board in November 2020. It was quickly made available to download, at no charge, from the SIGTTO website.

Gangways are the primary means of safe access to a ship that is alongside a jetty. However, due to the variety of gas carrier and terminal designs, it is difficult to get a perfect fit between the two in every situation. The new gangways document has been provided as a means of addressing this compatibility issue and to minimise, as much as possible, any access difficulties that may arise.

The document provides ship and terminal designers and operators with guidance on gangway design, operations and compatibility determination. The guidelines cover different gangway types and configurations and provide recommendations designed to maximise safe access to the ship via the gangway.

After laying down guidance on shore gangways utilised for access to large gas

carriers, the document then highlights specific challenges associated with the use of gangways on smaller ships. The main focus of the guidance is to provide items to consider when designing a gangway system and the ship landing area. The document also encourages the use of a structured risk-based approach to gangway design and hazard management and provides references for human factor considerations.

Floating LNG Installations

Also approved by the SIGTTO Board in November 2020 is the Society's new *Floating LNG Installations* publication. Now available to purchase, the document is the result of investigations into possible gaps in available SIGTTO guidance covering nearshore and offshore floating LNG assets.

The *Floating LNG Installations* publication was prepared under the auspices of SIGTTO's Floating Systems Sub-committee (FSSC), a recently formed GPC subsidiary body. FSSC established three working groups, dealing with site assessment, design criteria and operational guidance, respectively, to compile the *Floating LNG Installations* document.

Chaired by Edward Scott, FSSC first of all directed the three working groups to identify the hazards associated with the siting, design and operation of floating LNG installations. The groups then set about creating the guidance that serves to mitigate against such hazards. The

floating LNG installations covered by the new document encompass floating storage units (FSUs), floating storage and regasification units (FSRUs) and LNG floating production, storage and offloading (LNG FPSO) units.

The document's guidance is primarily aimed at developers of projects making use of floating LNG installations; LNGC owners whose vessels are called upon to serve floating LNG installations; and organisations that interact with floating LNG installations, including port authorities and marine service providers.

The new *Floating LNG Installations* publication primarily focuses on the floating asset, with consideration of the interfaces with topside equipment and systems, fixed marine structures, and gas/LNG operations within project boundaries or established battery limits.

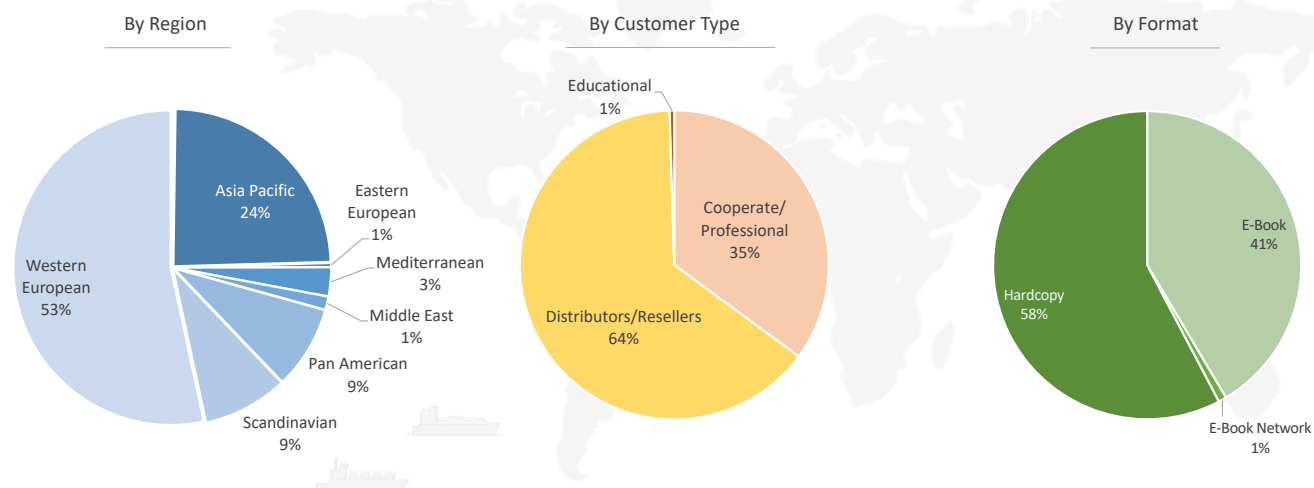
The finished document is split into two parts, namely a technical assessment section and an operations section. The technical assessment part addresses site assessment and design considerations chronologically, covering the entire asset lifecycle in the process. It recommends the early gathering and assessment of data, with the goal of improving data quality. The guidance in this section covers floating LNG installation considerations and concepts, physical site assessment criteria, project and statutory considerations, technology and safety study considerations and the project lifecycle.

The operations section of the document reinforces safe operations within established limits, with the guidance primarily focused on commissioning and start-up, operational safety, standard operations and emergency response planning.

The preparation of the *Floating LNG Installations* publication benefitted from broad industry support. A total of 24 SIGTTO member companies and four classification societies contributed to the drafting and finalisation of the document, while various industry subject matter experts and original equipment manufacturers were similarly engaged throughout the project.

SIGTTO Publications selling across 69 countries, 6 continents

9,600+ publication copies sold in the last 6 years



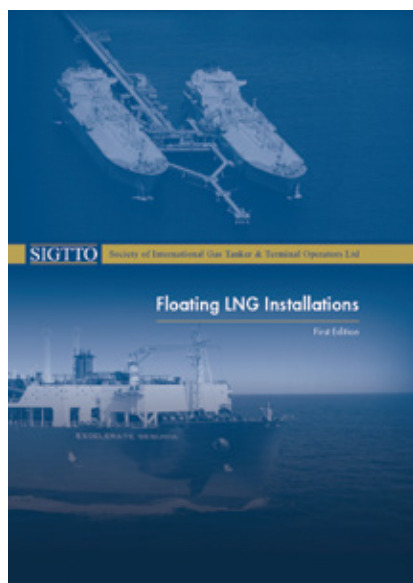
Source: Customer analysis of 9 SIGTTO Paid publications (data range: Jul 2014 – Dec 2020)

SIGTTO Paid publications in last six years

Cover	Title	Sales quantity	Sales duration / Published date
	Liquefied Gas Handling Principles on Ships and in Terminals, (LGHP4) 4th Edition	3,398	54 months Jul 2016
	Recommendations for Liquefied Gas Carrier Manifolds 2nd Edition	2,206	34 months Mar 2018
	Recommendations for Relief Valves on Gas Carriers 3rd Edition	1,559	10 months Feb 2020
	Guidance for LNG Carriers Transiting the Panama Canal (Withdrawn)	554	72 months Jul 2014
	Ship/Shore Interface for LPG/Chemical Gas Carriers and Terminals	559	30 months Jul 2018
	Guidelines for the Alleviation of Excessive Surge Pressures on ESD for Liquefied Gas Transfer Systems 2nd Edition	473	30 months Jul 2018
	LNG Emergency Release Systems - Recommendations, Guidelines and Best Practices	464	48 months Jan 2017
	Support Craft at Liquefied Gas Facilities. Principles of Emergency Response and Protection – Onshore	248	64 months Sep 2015
	Support Craft at Liquefied Gas Facilities. Principles of Emergency Response and Protection – Offshore	237	51 months Oct 2016

*Data since publication until 31/12/2020

SIGTTO paid publications



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)

SIGTTO Information Papers, Consolidated Ed 2019 (2019; £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)

Crew Safety Standards and Training for Large LNG Carriers: Essential Best Practices for the Industry (2003; £75.00)

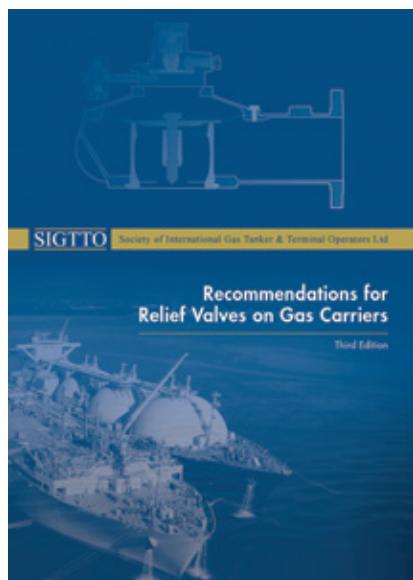
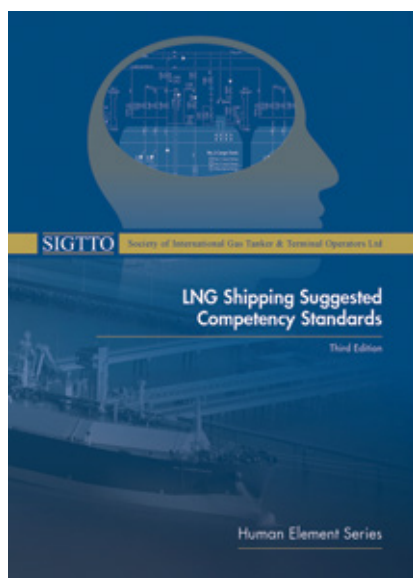
LNG Operations in Port Areas (2003; £75.00)

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 2020

	<u>Note</u>	<u>2020</u> £	<u>2019</u> £
Revenue			
Members' annual dues		1,286,056	1,326,446
Royalties		288,201	177,384
Interest receivable		1,047	1,120
	2(c)	1,575,304	1,504,950
Expenditure			
Employee benefit expense	5	776,788	702,121
Office supplies, web and library costs		65,714	83,505
Members' meetings		7,139	298,524
Rents, rates and services		119,454	206,514
Professional fees		197,562	281,184
Project costs		1,201	-
Communications		8,390	9,162
Depreciation	6	83,823	84,784
Amortisation of right-of-use	8	150,808	150,808
Miscellaneous expenses		4,832	8,253
Finance expense	7	58,838	39,782
		1,474,549	1,864,637
Surplus/(deficit) for the year		100,757	(359,687)

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 2020

	<u>Note</u>	<u>2020</u> £	<u>2019</u> £
Non-current Assets			
Property, plant and equipment	6	109,023	185,711
Right-of-use assets	8	1,055,656	1,206,464
		<u>1,164,679</u>	<u>1,392,175</u>
Current Assets			
Trade and other receivables	9	527,021	636,848
Cash and cash equivalents		2,666,948	2,443,041
		<u>3,193,969</u>	<u>3,079,889</u>
Total Assets		<u><u>4,358,648</u></u>	<u><u>4,472,064</u></u>
Current Liabilities			
Trade and other payables	10	584,864	603,456
Lease liabilities	8	100,267	144,170
		<u>685,131</u>	<u>747,626</u>
Non-current Liabilities			
Lease liabilities	8	1,069,148	1,220,168
Total Liabilities		<u><u>1,754,279</u></u>	<u><u>1,967,794</u></u>
Capital and Reserves			
Called up share capital	11	24,246	24,904
Retained earnings		2,580,123	2,479,366
Total Equity		<u><u>2,604,369</u></u>	<u><u>2,504,270</u></u>
Total Liabilities and Equity		<u><u>4,358,648</u></u>	<u><u>4,472,064</u></u>



PHOTO CREDITS: Front cover – Exmar; Page 2 - BW LNG; Page 4 – Minerva Gas; Page 6 – Tokyo Gas; Page 14 – Mitsui OSK Lines; Page 15 – Guangdong Dapeng LNG; Page 16 – Teekay; Page 17 – Cheniere Energy; Page 20 – Enterprise Products Partners; Page 21 – Cameron LNG, Total; Page 22 – Nakilat, Exmar; Page 23 – NYK Lines, MISC; Page 24 – Golar LNG, BW LPG; Page 25 – Nakilat; Page 28 – Enterprise Products Partners; Page 30 – Reuters/Yuka Obayashi; Page 32 – Exmar; Page 33 – Teekay; Page 34 – BW LPG; Page 35 – Chevron; Page 36 – Kotug; Page 38 – STS Marine Solutions; Page 43 – Cameron LNG

SIGTTO


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