

**SIGTTO**

Society for International Gas Tanker  
and Terminal Operators Ltd

Continually promoting best practice  
in the liquefied gas shipping and  
terminal industries for 39 years



## SIGTTO Purpose

SIGTTO has been organised to encourage the safe and responsible operation of liquefied gas tankers and marine terminals handling liquefied gas; 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 and terminals.



## SIGTTO 2020 Vision

**(Where the Society wishes to see itself in 2020, according to its Strategic Plan)**

SIGTTO will be recognised as the foremost gas shipping and terminal industry body - a modern centre of industry expertise - with all appropriate resources available to address industry technical and operational issues. It will 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 2017

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The global trade in LNG grew by 9.9 per cent in 2017 and edged towards the 300 million tonnes per annum mark



# SIGTTO outreach to members and industry pays dividends

I am pleased to present SIGTTO's 2017 annual report, the second of my tenure as the Society's President.



## It has been a landmark year for SIGTTO, most notably represented by the Society's first London liaison office move in 25 years.

The relocation to 42 New Broad Street on 23<sup>rd</sup> July 2018 was the culmination of months of meticulous planning by SIGTTO General Manager Andrew Clifton. This preparatory work ensured that there was no disruption to business and that the move was made on schedule and within budget.

The new office space is both larger and better equipped than the old and is an eminently suitable working environment that will provide resources for the Secretariat to exercise their talent and become even more productive. The availability of internal meeting facilities will promote more efficient and cost-effective planning for the Society's working groups.

An added bonus is the creation of a comfortable library to accommodate SIGTTO's large collection of gas shipping publications. This facility is available to any member and is highly recommended to those interested in research or education.

The objectives of the latest SIGTTO Strategic Plan continue to be achieved with the 2017 publication of *LNG Emergency Release Systems* and the 2018 completion of the *Ship/Shore Interface for LPG/Chemical Gas Carriers and Terminals and Guidelines for the Alleviation of Excessive Surge Pressures on ESD for Liquefied Gas Transfer Systems* publications. The appearance of these new sets of guidelines reinforces the Society's strong productivity record; SIGTTO has delivered eight paid publications in last four years.

Sales of SIGTTO publications continue to provide an important revenue stream for the Society. The new edition of SIGTTO's flagship publication, *Liquefied Gas Handling Principles*, has proved to be particularly popular amongst industry customers.

The income generated from publications, aligned to good governance on expenditure, has helped to underpin a

sound financial performance. This, in turn, has not only allowed membership fees to remain static but also enabled further investment in staff resources to be accommodated as part of the drive to deliver improved value to the gas shipping and terminal industry.

SIGTTO's General Purposes Committee (GPC), which is currently chaired by Mark Hodgson, has developed a very structured approach to identifying the most pressing challenges facing the gas shipping and terminal industry, and then applying the appropriate knowledge and resources. As a result, the levels of membership participation and individual contributions to SIGTTO's committees and working groups have increased significantly. This is reflected in the volume and high quality of SIGTTO working group output.

SIGTTO's new Human Element Committee (HEC), under the leadership of John Adams, has made considerable progress in the short time since it was established. Three HEC working groups have been assembled, dealing with cargo control room ergonomics, gap analysis of competency guidelines and shore staff competencies, respectively. The expertise offered by the members of these working groups is truly impressive and we expect the resulting publications to have a positive impact on industry safety.

Engagement with the Society's membership remains a key focus area for Andrew Clifton and his Secretariat team. Regional Forums have proved to be a particularly popular way of learning about the local issues of concern to members and of disseminating information about

the Society's latest work and global issues impacting the industry generally.

There is now a busy timetable of SIGTTO Regional Forums each year which encompass a wide range of locations that support gas tanker and terminal activity. The logistics challenges and travel commitments attendant on maintaining this full schedule are demanding.

To illustrate the point, at the time of writing, in October 2018, there are five Regional Forums that have been organised and need to be completed before the end of 2018. The events will be held in North America, South America, China, Japan and Australia. The overwhelmingly positive feedback we receive from our members about the Forums justifies the effort made and will ensure that a busy agenda of such meetings is maintained.

The SIGTTO Regional Forums, together with our participation in international events like Gastech and the liaisons we enjoy with key stakeholders such as the US Coast Guard, also represent opportunities to make the Society more visible globally. Such interactions build awareness of the SIGTTO's purpose and value, and help grow the membership base. The more members we have, the safer seaborne gas transportation will be in the future. This is an objective I feel sure we all share.

**David Furnival**  
SIGTTO President  
October 2018



Ineos and Evergas helped launch a new era in liquefied gas shipping - the deepsea transport of ethane



# SIGTTO Strategic Plan extended to 2025

The board and annual general meetings in Copenhagen in November 2017 agreed to revise SIGTTO's Strategic Plan to encompass the Society's work programme through to 2025.



**During 2017 six new members joined SIGTTO and seven resigned. As of 31 December 2017 we had a total of 183 full and associate members**

The SIGTTO directors met three times during 2017, as per the Society's byelaws. The spring board meeting, kindly hosted by Teekay, was held in Glasgow while the autumn board and annual general meetings took place in Copenhagen where Evergas was the host.

The Society is registered in Bermuda as a "not-for-profit" entity. However, we are allowed to retain surplus as reserves and each year we set the budget to generate a small surplus which goes to reserves. The reserve level we target is about one year's operating costs and we are comfortably in excess of this target. The Society's finances remain on a sound footing.

SIGTTO's General Purposes Committee (GPC) manages the Society's affairs. The Committee met twice in 2017, at Tokyo in April and Houston in October. The Society maintains a full programme of activities, most of which are addressed by working groups populated by experts selected from the member companies.

SIGTTO's new Human Element Committee (HEC) also met twice during 2017, both meetings being held in London. We hope to have the first output from HEC, in terms of published industry guidance, in 2018.

SIGTTO's 63<sup>rd</sup> Panel Meeting was held in Houston in October, in the days following the GPC's gathering in the same city. There was no Spring 2017 Panel Meeting due to the clash with Gastech 2017 event in Tokyo. SIGTTO Panels represent the main meeting forum for the members, and the Autumn 2017 Panel, like all the other events in the series, was well attended.

SIGTTO's Regional Forum meetings continue to be held on a regular basis in various locations around the world. The timing of such meetings is largely dictated by the members themselves.

The Society has 'observer status' as a non-governmental organisation (NGO) at the International Maritime Organisation (IMO). SIGTTO's Secretariat attends IMO committee and subcommittee meetings, as appropriate, and over the years has written/co-sponsored submissions to IMO on various matters related to the LNG/LPG sector of the maritime industry. A principal focus for us at IMO is revision work on the International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk (IGC Code) and the International Code of Safety for Ships using Gases or other Low-Flashpoint Fuels (IGF Code).

SIGTTO's Secretariat maintains close contacts with other NGOs, principally the Oil Companies International Marine Forum (OCIMF), the International Chamber of Shipping (ICS), the Society for Gas as a Marine Fuel (SGMF), the International Association of Independent Tanker Owners (Intertanko), the International Group of LNG Importers (GIIGNL) and BIMCO. Where appropriate, we co-ordinate our activities to ensure a consistent industry message is conveyed to the wider world.

For the Secretariat, 2018 will be dominated by SIGTTO's office move from St Helens Place to a new office within the traditional shipping area of the City of London. The new office will allow for an expansion in staff numbers and enable us to bring better resources to bear. The availability of a large meeting room on our premises, for example, will enable us to host a wide range of internal meetings, including those of many of our working groups, without the need to secure third-party venues.

Amongst its many roles, the SIGTTO Secretariat maintains a programme of external engagements to promote the Society's profile. These include speaking to various bodies and chairing and presenting papers at international conferences such as Gastech and the LNG series of conferences. In April 2017, for example, SIGTTO had a high-profile

presence at the Gastech conference in Tokyo where I had the opportunity to chair the event's shipping session.

As LNG shipping embarks on its second half century, it is important that the very proud safety record established by our industry is not forgotten. As the industry leader for disseminating best practice procedures and providing technical support for companies active in liquefied gas shipping and terminals, SIGTTO is at the forefront of efforts to maintain this safety record.

It incumbent on SIGTTO to adapt to meet ever-changing industry requirements and to ensure that the Society remains relevant and fit for purpose to meet the needs and expectations of the membership in the 21st century.

As part of the ongoing effort to fulfil its duties, SIGTTO completed an updated Strategic Plan in 2016 and this is presently being implemented. The Plan outlines the direction the Society intends to take for the rest of the current decade, and progress in achieving the agreed goals will be reviewed at each Board meeting. At the autumn board and annual general meetings in Copenhagen in November 2017 it was agreed to further revise the Plan to encompass the Society's work programme up to 2025.

The Society continues to be the principal voice for the liquefied gas industry. It is an industry which is currently experiencing both strong expansion and high levels of technological innovation.

This is a very exciting and challenging time to be SIGTTO General Manager. I look forward immensely to working closely with the membership to meet the needs of our dynamic industry in the year ahead.

**Andrew Clifton**  
General Manager November 2018

# SIGTTO members (as at 31 December 2017)

### Full Members

Aegis Logistics Ltd	Freeport LNG Development LP	Oman LNG LLC
AES Andres	GasLog LNG Services Ltd	Osaka Gas Co Ltd
Alphagas SA	Gate Terminal BV	Pertamina Transportation LNG - JMG
Anthony Veder Rederijzaken BV	Gazocean	Petrobras Transporte SA – Transpetro
Atlantic LNG Company of Trinidad & Tobago	Geogas Maritime SAS	Petronet LNG Ltd
Avance Gas Holding Ltd	GNL Quintero SA	POSCO
Bahia de Bizkaia Gas SL	Golar Management Norway AS	Prime Gas Management Inc
Bernhard Schulte Shipmanagement Ltd	Golden Pass LNG	Pronav Ship Management
B-Gas Ltd	Höegh LNG	PT Donggi Senoro LNG
BP Berau Ltd	Hyproc Shipping Company	PTT LNG Company Ltd
BP Shipping Ltd	Hyundai LNG Shipping Co Ltd	Qatar Petroleum (Industrial Cities Ports)
Brunei LNG Sdn Bhd	Iino Kaiun Kaisha Ltd	Qatar Gas Transport Company Ltd
Bumi Armada Berhad	Ineos	Qatar Shipping Company SPC
BW Gas AS	Inpex Corporation	Qatargas Operating Company Ltd
BW LPG Ltd	International Gas Transportation Co Ltd	QCLNG Operation Company Pty Ltd
Calor Gas Ltd	International Gas Transportation Co Ltd	RWE Supply & Trading GmbH
Cameron LNG	Iwatani Corporation	Santos GLNG
Canaport LNG	Japan Petroleum Exploration Co Ltd	Saudi Arabian Oil Co (Saudi Aramco)
Centrica LNG Company Ltd	JXTG Nippon Oil & Energy Corporation	SCF Management Services (Dubai) Ltd
Chemgas Shipping BV	Kansai Electric Power Co Inc	Sempre LNG
Cheniere LNG Inc	Kawasaki Kisen Kaisha Ltd	Shell International Trading & Shipping Co Ltd
Chevron Shipping Company LLC	Kinder Morgan Inc	Shipping Corporation of India
China LNG Shipping (International) Company Ltd	Knutsen OAS Shipping	Shizuoka Gas Co Ltd
Chubu Electric Power Co Inc	Koch Shipping Pte Ltd	SK Shipping
Chugoku Electric Power Co Inc	Korea Gas Corporation	Sonangol Marine Services Inc
ConocoPhillips Global Marine	Kuwait Oil Tanker Co SAK	South Hook LNG Terminal Co Ltd
Consolidated Marine Management Inc	Lake Charles LNG Company LLC	Stena LNG Services AB
CPC Corporation, Taiwan	Lauritzen Kosan A/S	Synergy Maritime Pvt Ltd
DESFA Hellenic Gas Transmission System Operation	LNG Japan Corporation	Teekay Marine Solutions (Bermuda) Ltd
Dorian LPG Management Corp	LNG Shipping SpA	Teekay Shipping
Dragon LNG Ltd	Malaysia LNG Sdn Bhd	TEPCO Fuel & Power Inc
Dubai Supply Authority	Maran Gas Maritime Inc	The Bahrain Petroleum Company BSC (Closed)
Dynagas Ltd	Marubeni Corporation	Thenamaris LNG
Egegaz Anonim Sirketi	Meiji Shipping Co Ltd	TMS Cardiff Gas Ltd
Egyptian Operating Company for Natural Gas Liquefaction Projects	Mitsubishi Corporation	Toho Gas Co Ltd
Elengy	Mitsui & Co Plant Systems Ltd	Tohoku Electric Power Co Inc
Empresa Naviera Elcano SA	Mitsui OSK Lines Ltd	Tokyo Gas Co Ltd
Enagas Transporte SAU	Naftomar Shipping & Trading Co	Total SA
Energy Transfer Partners	National Gas Shipping Company Ltd	Uniper Global Commodities SE
Engie	National Grid Grain LNG	V Ships Ltd
Enterprise Product Partners LP	Nigeria LNG Ltd	Wilhelmsen Ship Management Sdn Bhd
Evergas A/S	Norgas Carriers Private Ltd	Woodside Energy Ltd
Excelerate Energy LP	Northern Marine Management Ltd	YPF SA
Exmar NV	NYK Line (Nippon Yusen Kaisha)	
ExxonMobil - SeaRiver Maritime	Oiltanking Antwerp Gas Terminal NV	
Fluxys LNG	OLT Offshore LNG Toscana SpA	



## Associate Members

ABS	ExxonMobil PNG Ltd	Milford Haven Port Authority
Anadarko Petroleum Corporation	FLEX LNG	Moran Towing Corporation
Angola LNG Ltd	Fratelli Neri SpA	NextDecade LLC
Angola LNG Marketing Ltd	Gas Sayago SA	Polish Oil and Gas Company
Babcock International Group	Gazprom Marketing & Trading Singapore Pte Ltd	Polskie LNG SA
Boluda Towage and Salvage	GTT Training Ltd	Port of Rotterdam Authority
Bureau Veritas Marine & Offshore	Guangdong Dapeng LNG Co Ltd	Port of Sheerness Ltd
China Energy Ship Management Co Ltd	Hazira Port Private Ltd	Saga LNG Shipping Pte Ltd
ClassNK	H-Energy Gateway Private Ltd	Singapore LNG Corporation Pte Ltd
CNOOC-Fujian LNG Co Ltd	Jordan Cove LNG LLC	Smit Lamnalco
Combined Marine Terminal Operations Worldwide NV	Korean Register	Steelhead LNG Corp
DNV GL	Kotug International	Svitzer A/S
Dunkerque LNG	Lloyd's Register	Total E&P Norge AS
ElectroGas Malta Ltd	LNG Canada Development Inc	Venture Global LNG Inc
Etki Liman Isletmeleri Dogalgaz	Maritime and Port Authority of Singapore	Vitol Services Ltd
Ithalat Ve Ticaret AS	Maritime Safety Queensland	Warsash Maritime Academy (Southampton Solent University)
		Woodfibre LNG Ltd

## BENEFITS OF SIGTTO MEMBERSHIP

SIGTTO members are actively encouraged to promote membership when dealing with any new players in the industry. Please direct them to our website and to the London Liaison Office for further details of how to join.

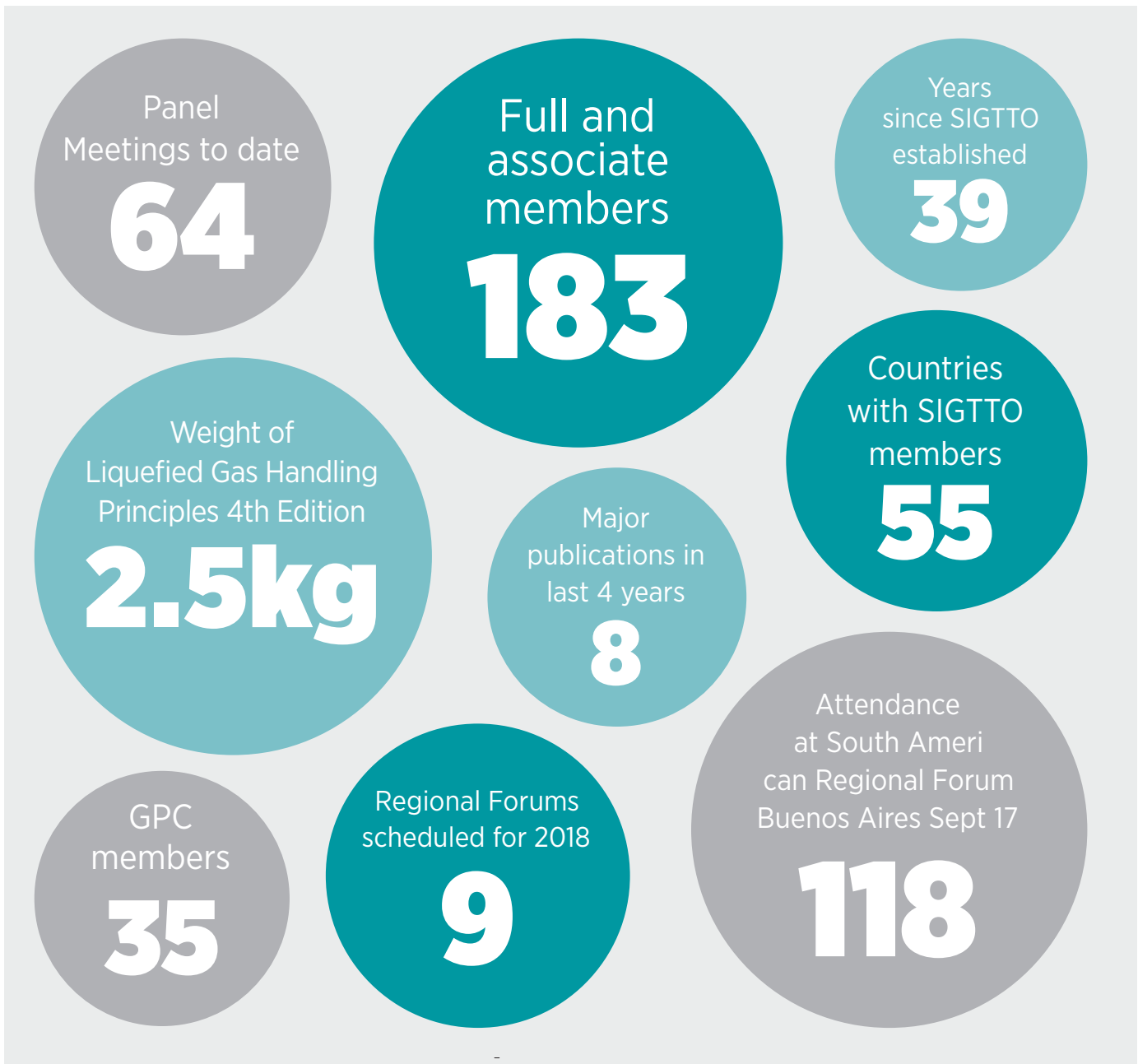
### In addition to the credibility in the industry that membership brings, SIGTTO members benefit by:

- Access to information that is exclusive to members, such as casualty information and industry statistics
- Regular updates on matters affecting the industry such as legislation, either new or pending, technical or operational developments
- Access to the very comprehensive technical library maintained in the London Office
- Submitting proposals for projects and studies to the General Purposes Committee
- Access to the Technical Advisers in the London Liaison Office who can give advice and obtain advice, on behalf of a member, from within the Society
- Participating in discussion forums with other members each year on topics of particular and mutual interest
- New members receive a copy of all publications, free of charge, produced by SIGTTO
- Free access to the LNGwebinfo portal for updated LNG information as required to conduct compatibility studies. This information is restricted to members of SIGTTO and GIIGNL only

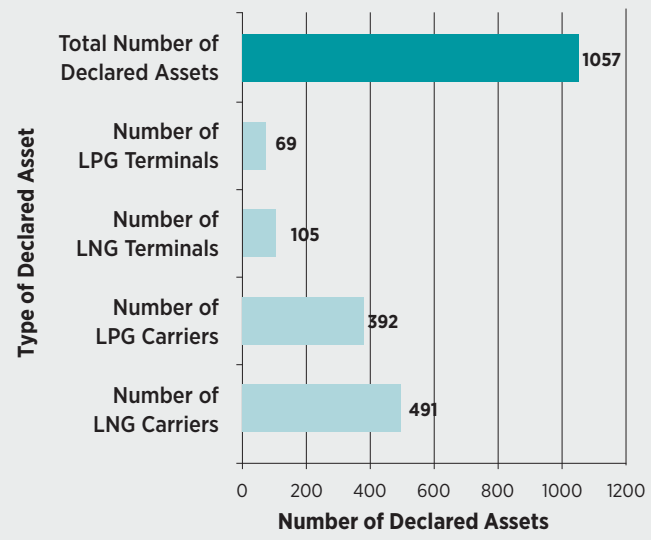
SIGTTO's new Floating LNG Installations Subcommittee will be preparing guidelines on a range of topics, including cargo transfer options and offloading systems







**SIGTTO Members' Declared Assets**



## SIGTTO Board of Directors (as of 31 December 2017)



General Manager Andrew Clifton updates delegates to the LNG Solutions: Fuelling the Future Summit event in Nice in October 2017 on progress with SIGTTO's work programme

<b>Mr David Furnival</b>	Bernard Schulte SM [President]	<b>Mr Abdullah Al-Sulaiti</b>	Nakilat
<b>Mr Masayuki Ishida</b>	Tokyo Electric [Vice President]	<b>Mr Hisaichi Yoneyama</b>	Osaka Gas
<b>Mr Chris Bailey</b>	BP Shipping [Vice President]	<b>Mr T Hashimoto</b>	MOL
<b>Mr Luc Gillet</b>	Total SA	<b>Mr Riju Cherian</b>	BW Gas
<b>Mr S Tschudi-Madsen</b>	Höegh LNG	<b>Mr Iain Relf</b>	Teekay Shipping
<b>Mr Peter Justesen</b>	Engie	<b>Mr Keith Trotter</b>	SeaRiver Maritime (ExxonMobil)
<b>Mr A Kono</b>	NYK	<b>Ms Karrie Trauth</b>	Shell
<b>Mr Lloyd Bland</b>	Chevron Shipping	<b>Mr Steffen Jacobsen</b>	Evergas
<b>Mr Paul Oliver</b>	China LNG Shipping	<b>Mr P Pearman</b>	Conyers Dill & Pearman
<b>Mr Raja Sager Muniandy</b>	MISC	<b>Mr E Mortimer</b>	Company Secretary



There was a good turnout for the 63rd SIGTTO Panel Meeting in Houston in October 2017

## SIGTTO Secretariat Staff



**Andrew Clifton**  
General Manager



**Cherian Oommen**  
Technical Advisor



**Ian Harrison**  
IMO Representative



**Rob Farmer**  
Technical Advisor



**Dave Ervin**  
Consultant Technical Advisor



**Susan Humphrey**  
Membership Manager



**Erin Rydings**  
Receptionist



# SIGTTO committee structure upgraded



SIGTTO's Human Element Committee has the ergonomics of gas ship cargo control rooms in focus

The General Purposes Committee (GPC), SIGTTO's technical body, has traditionally originated and coordinated all the internal projects generated at SIGTTO. Completion of the project work itself is carried out by working groups comprising relevant experts from amongst the membership. The technical publications which are the end-result of these projects are effectively the best practice procedures, recommendations and standards that guide the industry's day-to-day operations.

To deal with a growing and increasingly diverse industry, the Society's committee structure has been upgraded in accordance with the current Strategic Plan 2016. Amongst the measures that have been implemented is the establishment of a Human Element Committee (HEC). In addition, it was agreed that a range of subcommittees should be created to support and augment GPC and HEC. The first of these, on floating LNG installations, has now been formed.

GPC and HEC both meet twice a year and report to the SIGTTO Board. Smooth interfacing arrangements between the various committees and

subcommittees are an integral part of the restructuring exercise. For example, the HEC chair is also a GPC member and vice versa with the GPC chair.

### General Purposes Committee (GPC)

Having held its 2016 Board of Directors and Annual General Meetings in the port of Nagoya in November 2016, SIGTTO returned to Japan for the 75<sup>th</sup> session of the General Purposes Committee (GPC) and the Gastech conference and exhibition in April 2017. Tokyo was the venue for both events. Mark Hodgson of Shell is the current GPC chairperson.

Participants in the 76<sup>th</sup> GPC meeting in Houston in October 2017 took the opportunity to examine the Committee's strategy in more detail. GPC had conducted a survey in summer 2017 on topics worthy of further consideration by the Society.

The appraisal of the results of this survey carried out in Houston resulted in several important decisions regarding SIGTTO's future organisation, prioritisation and responsibilities as well as the issues to be addressed. An improved structure

will be implemented as a result of these decisions in order to achieve productivity and efficiency gains for the Society.

The work of GPC itself is now guided by an updated set of key performance indicators (KPIs) which reflect the evolving needs of today's gas carrier and terminal operators.

At their 76<sup>th</sup> session the GPC members recognised two areas as top priorities for further development. They are floating concepts, including floating LNG production (FLNG) vessels, floating storage and regasification units (FSRUs), floating regasification units (FRUs) and floating storage units (FSUs), and propulsion systems in tandem with cargo reliquefaction.

Following identification of these priorities, the GPC 76 attendees established SIGTTO's new Floating LNG Installations Subcommittee and a working group on propulsion systems/cargo reliquefaction to develop relevant guidelines. An additional discussion in Houston on gangway landing areas prompted the creation of a separate working group to consider this topic and the development of appropriate guidance.

### Floating LNG Installations Subcommittee

The remit of SIGTTO's new Floating LNG Installations Subcommittee is to provide guidance on operations with the growing fleet of floating process vessels now being utilised by the LNG industry. As mentioned, the installations that come under the new group's purview are FLNG vessels, FSRUs, FRUs and FSUs.

The Floating LNG Installations Subcommittee is a standing subcommittee of GPC, and will coordinate the activities of individual working groups established to consider issues of topical concern in the floating LNG vessel sector.

The new Sub-Committee will have up to 16 members, including a chairperson and vice-chairperson but exclusive of the appointed SIGTTO Technical Advisor. Ed Scott, chief operating officer of Excelerate Energy, has been appointed to chair the new group.

As the LNG floater sector grows and diversifies, new participants with no experience of such operations are joining the community. SIGTTO believes there is a need to make the experience and expertise of the pioneering companies in this field amongst its membership generally available through published guidance and recommendations.

Going forward, the Floating LNG Installations Subcommittee will be preparing guidelines on a range of topics, including site selection, cargo transfer options, vessel design, mooring and fendering, offloading systems, operational safety and contingency planning.

### Human Element Committee (HEC)

SIGTTO's decision to form HEC recognises the critical importance of the human factor and training in gas carrier and terminal operations as part of the ongoing effort to sustain a safety performance which to date is unmatched by any other maritime sector. The HEC's remit includes, but is not limited to, competency and training, design and ergonomics and the human element side of incident investigation.



SIGTTO members will be able to bring a wealth of experience to bear on the development of guidance by the new Floating LNG Installations Sub-Committee

The Human Element Committee (HEC) met for the first time in September 2016 and twice more 2017 under chairperson John Adams of Teekay. Similar in setup to GPC, HEC holds its biannual meetings in Northern Europe, approximately six weeks before GPC meetings if possible.

HEC has 13 members and two observers, and the two initial meetings were focused on establishing the general scope and activities of the new Committee. The definition of the human element, the management of incidents and a review of the design and ergonomics of cargo control rooms were amongst those topics identified as worthy of consideration.

At the third meeting of Human Element Committee (HEC 3), which was held in London in August 2017, the working group on cargo control room (CCR) ergonomics identified alarm management as the initial topic on which progress should be made. The decision involves prioritising cargo alarms as per the *IMO Code on Alerts and Indicators, 2009*.

The working group is also reviewing the ship/shore checklist and providing information on the importance of both safety-critical systems and the timely activation of emergency shutdown systems (ESDs). After the alarm management task is completed the CCR working group will consider the layout of screens in the cargo control room. It was also agreed at HEC 3 that the Committee would take on two new agenda items going forward.

They are the discussion of incidents from a human element perspective and consideration of the need for a structured approach to training shore staff. Task forces will be established to assist in progressing both work items.

Also at HEC 3, John Adams proposed that the Committee should establish a framework that demonstrates how its work programme accords with an overall vision and specific targeted goals. The first draft of such a 'Strategy Structure' chart was compiled and opened for comment to facilitate future discussions and strategy development. HEC members are hopeful that the chart, in its final form, will provide a mechanism with which SIGTTO can connect with its members and the industry at large on the topic of the human element.

HEC will maintain the Strategic Framework plan on an ongoing basis. The 'live document' will itemise agenda items in progress and worthy of consideration grouped under the Committee's four strategic objectives, or pillars, i.e. human element/safety critical analysis, measurement tool/incident review, design and ergonomics, and competence.

SIGTTO continues to focus on accident prevention, not least through the use of major accident/process safety risk management tools like "bow tie" and the prioritisation of training on major incident risks and avoidance. HEC will adapt its activities to accommodate ongoing developments in this field.



# SIGTTO participation in IMO rulemaking process



The definition of “each drydocking” in the IGC Code has been clarified, with particular reference to ship hull surveys

**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 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.

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. In

the past IMO liaison work was handled by one of the Society’s technical advisers. However, in February 2017 SIGTTO appointed as Ian Harrison as its first IMO representative.

The new position highlights the increasing complexity of the issues discussed at this UN agency and the importance of these issues to liquefied gas shipping operations. Ian Harrison’s presence has enabled the Society’s technical advisers to focus their attention on other projects of topical concern to the membership.

The following paragraphs detail IMO considerations impacting on the design, construction and operation of gas carriers and gas-powered ships during the course of 2017.

### IGF Code update

The International Code of Safety for Ships using Gases or other Low-Flashpoint Fuels (IGF Code) entered into force on 1 January 2017. The new Code initially dealt only with the use of liquefied gases as marine fuel. IMO’s

Carriage of Cargoes and Containers (CCC) Sub-committee is engaged in work on Phase 2 of the IGF Code, covering the use of fuel cells, methanol and ethanol as means of propulsion.

At the 4<sup>th</sup> Session of the CCC Sub-committee (CCC 4), held on 11-15 September 2017, draft amendments to and Unified Interpretations (UIs) of part A-1 of IGF Code were agreed. In addition, CCC 4 made further progress in developing safety provisions for ships using fuel cells in the IGF Code’s proposed new part E on fuel cell power installations. CCC 4 established a correspondence group to continue work on the provisions as they could not be finalised during the meeting.

### IGC Code refinements

The revised International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk (IGC Code) entered into force on 1 January 2016 for vessels whose keels are laid on or after 1 July 2016. At the 96<sup>th</sup> Session of IMO’s Maritime



Safety Committee (MSC 96) in May 2016 it was agreed that the possible use of high-manganese austenitic steels in cryogenic service merited consideration as a possible amendment to the revised IGC Code. It has been proposed that such steels would be a suitable material for cargo tanks, fuel tanks and piping of LNG carriers and LNG-fuelled ships.

CCC 4 progressed discussions on the proposal. It was agreed that, should the suitability of high-manganese austenitic steel for cryogenic service be established, draft Interim guidelines for its application should be developed rather than amend the IGC Code. CCC's high-manganese steel correspondence group was re-established to progress the work, limiting its scope to steel plates only, to consider pertinent criteria and available information.

The CCC 4 delegates also considered proposed UIs to the IGC Code. These related to the definition of "each drydocking" and the testing of high-level alarms. It was agreed that the expression "each drydocking" is considered to be the survey of the outside of the ship's bottom required for the renewal of the Cargo Ship Safety Construction Certificate and/or the Cargo Ship Safety Certificate. The UI proposing that the sensor operating the automatic shutoff valve, as required by IGC Code 13.3.2, need not be tested with liquid after docking was rejected.

Hydrogen has emerged as a potential liquefied gas carrier cargo in recent years. While such transport is still in the concept phase, interest in developing relevant regulatory requirements has been growing in order to facilitate the launch by the industry of pioneering liquefied hydrogen shipping projects.

While there are currently no specific requirements in the IGC Code governing the design and construction of LH2 carriers, IMO adopted *Interim Recommendations for the Carriage of Liquefied Hydrogen in Bulk* in November 2016 in response to the growing interest in hydrogen transport.

### Gas carrier firefighting

Following a proposal, IMO's Maritime Safety Committee, at its 98<sup>th</sup> Session

(MSC 98) on 7-16 June 2017, agreed to consider amendments to the *Guidelines for the approval of fixed dry chemical powder fire-extinguishing systems for the protection of ships carrying liquefied gases in bulk (MSC.1/Circ.1315)*.

The proposal highlighted the lack of detailed "fire-extinguishing capability test" requirements and the fact that the current guidelines specify only the use of powder based on the salts of potassium when other media are available.

MSC 98 approved the new work programme item, although some concerns were expressed about the potential use of sodium bicarbonate-based powders. The technical detail and proposed amendments were placed on the agenda for discussion at the 5<sup>th</sup> Session of IMO's Sub-committee on Ships Systems and Equipment (SSE 5) in March 2018.

### Nitrogen oxide emissions

At its 71<sup>st</sup> Session on 3-7 July 2017 IMO's Marine Environment Protection Committee (MEPC 71) adopted amendments to Annex VI of the Marine Pollution (MARPOL) Convention which establish the North and Baltic Seas as nitrogen oxides (NOx) Tier III emission control areas (ECAs). Under the new provisions ships the keels of which are laid on or after 1 January 2021 must comply with the NOx Tier III emission limits while sailing in the ECAs.

There are some limited exemptions from this new regulation. For example, dual-fuel, Tier II-compliant vessels entering or leaving these ECAs (gas-free) as a new ship, for repair or maintenance, will not have to meet NOx Tier III requirement.

### Mooring operations

At its 5<sup>th</sup> Session in January 2018 IMO's Sub-committee on Ship Design and Construction (SDC 5) considered regulations and guidelines on mooring operations. Delegates agreed amendments to SOLAS Regulation II-1/3-8 that require the design of the mooring arrangement and the selection of appropriate mooring equipment, including lines, to be based on guidelines being developed. An amendment requiring such equipment to be maintained in a suitable condition has also been included, along with supporting guidelines. The extant guidelines on mooring (MSC.1/Circ.1175) are also being revised.

The important role of industry guidelines has been recognised, particularly the recently revised Oil Company International Marine Forum (OCIMF) Mooring Equipment Guidelines, and these will be referenced within the IMO guidelines. This work will continue through a correspondence group with a view to finalising both the SOLAS amendments and guidelines, as a complete package, at the SDC 6 meeting in 2019.



The use of high-manganese austenitic steel is under consideration for use on LNG carriers

## Gas shipping and terminal timeline 2017

A roundup of key gas shipping and terminal developments in 2017 highlights many aspects of a dynamic industry. 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.

In 2017 the in-service LNG carrier fleet passed the 500-ship mark and logged its 90,000<sup>th</sup> safely delivered cargo, while the seaborne trade in LPG grew strongly and continued to surge past the 90 million tonnes per annum (mta) level.

### January

- The International Code of Safety for Ships using Gases or other Low-Flashpoint Fuels (IGF Code) entered into force on 1 January 2017
- The Dunkirk LNG import terminal, with three 200,000 m<sup>3</sup> storage tanks and the capacity to regasify up to 9.6 mta of LNG, was officially commissioned.
- The Etki LNG import terminal in Turkey's Candarli Bay on the Aegean Sea received its inaugural cargo. The facility is based on the use of the 2009-built, 145,000 m<sup>3</sup> floating storage and regasification unit (FSRU) *Neptune* (ex-*GDF Suez Neptune*).
- Malta received its first cargo of LNG. The shipment was delivered to the 1985-built, 125,000 m<sup>3</sup> floating storage unit (FSU) *Armada LNG Mediterranea* (ex-*Wakaba Maru*).
- Petronas and JX Nippon Oil & Energy started up the ninth train at Bintulu in the Malaysian state of Sarawak. The 3.6 mta unit boosts Malaysia's overall LNG export capability to 30 mta.

### February

- Shizuoka Gas carried out its first LNG reload at the Sodeshi LNG terminal in Shimizu. The facility is the first of Japan's import terminals to undertake such an operation.



*PFLNG Satu*, the world's first floating LNG production (FLNG) vessel, under construction

### March

- Petronas put the world's first floating LNG production (FLNG) vessel, *PFLNG Satu*, into service. The 1.2 mta vessel is positioned off Bintulu.
- Cheniere produced the commissioning cargo from the third 4.5 mta LNG train at its Sabine Pass export plant in the US state of Louisiana.
- The LNG regasification plant that serves the 115 MW Bogue power plant in Jamaica's Montego Bay was commissioned. The associated small-scale terminal features seven 1,000 m<sup>3</sup> 'bullet' tanks.



The new FSRU-based Etki terminal in Turkey

## April

- Qatar lifted its self-imposed moratorium on developing the North Field, the huge deposit which accounts for nearly all Qatar's gas production and 60% of its export revenue.
- The Hanjin yard in Korea completed the 5,100 m<sup>3</sup> *Engie Zeebrugge*, the world's first purpose-built, seagoing LNG bunker vessel.



*Engie Zeebrugge*, the world's first purpose-built LNG bunker vessel

## May

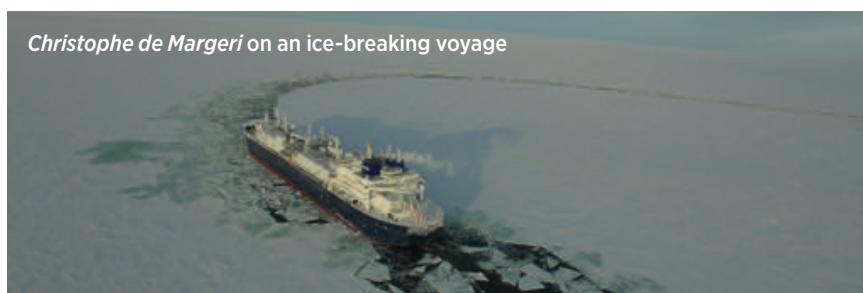
- The 216,000 m<sup>3</sup> *Al Kharaitiyat* delivered the commissioning cargo to the 2 mta Yuedong terminal, CNOOC's eighth Chinese LNG import facility.
- RasGas shipped its 2,000<sup>th</sup> cargo to Korea. The shipment was transported by the 138,000 m<sup>3</sup> *SK Summit*, the ship that carried the first RasGas cargo to Korea, in August 1999.
- The 147,800 m<sup>3</sup> *Cygnus Passage* lifted a cargo which marked the export of 30 million m<sup>3</sup> of LNG from the Sakhalin 2 terminal since it opened in 2009. *Cygnus Passage* lifted 240 of the cargoes loaded at the Sakhalin terminal over this period.
- Nigeria LNG (NLNG) exported the 4,000<sup>th</sup> cargo from its Bonny Island terminal. The shipment, to the Marmara receiving facility in Turkey, was loaded onboard *LNG Sokoto*. Marmara was also the recipient of NLNG's 3,000<sup>th</sup> consignment, in 2014.

## June

- Guanghai Energy opened its 0.6 mta Qidong LNG terminal, to the north of Shanghai. There are no regas facilities at the terminal; all the LNG is trucked to end-users.
- The Panama Canal Authority (ACP) celebrated the completion of the first year of operations with its new enlarged locks. Over the 12 months very large gas carriers (VLGCs) transporting LPG accounted for 31.5% of the vessel transits and LNGCs 9.1%.
- Eni and its partners in the Coral South LNG project in Mozambique agreed to proceed with the scheme. The initiative is based on the use of a 3.4 mta FLNG vessel which the partners ordered at Samsung Heavy Industries for delivery in 2021.

## July

- The 172,000 m<sup>3</sup> *Christophe de Margerie*, with a cargo loaded at Norway's Snøhvit terminal for South Korea, completed the first solo voyage by a laden LNGC along the Northern Sea Route (NSR) and the first voyage by an icebreaking LNGC through the Russian Arctic.



*Christophe de Margerie* on an ice-breaking voyage



## Gas shipping and terminal timeline 2017

### November

- Operations commenced at Pakistan GasPort (PGP), Pakistan's second LNG import terminal. Like the first, the second receiving facility is based on the use of an FSRU stationed at Port Qasim, in this case the 170,000 m<sup>3</sup> *BW Integrity*. The vessel is able to process up to 5.6 mta.
- Total agreed to acquire Engie's portfolio of upstream LNG assets for US\$1.49 billion. The new group will manage an overall LNG volume of 40 mta by 2020, making it the second largest global player in the LNG market, with a 10% share.
- Petronas received the first commercial LNG cargo at its newly commissioned Pengerang regasification terminal in the southern Malaysian state of Johor. The 3.5 mta RGTP terminal is Malaysia's second LNG receiving facility.
- The Manga LNG terminal in the Finnish port of Tornio, at the head of the Bay of Bothnia, received its first cargo.



The Manga LNG terminal receives its inaugural commissioning cargo

### December

- The Yamal LNG terminal in the Russian High Arctic loaded its first cargo. The shipment, produced by the first of the facility's three 5.5 mta trains, was loaded on the icebreaking LNGC *Christophe de Margerie*, for transport to the Grain terminal in the UK.
- The Soma LNG terminal of Japan Petroleum Exploration (Japex) in Soma Port received its first LNG commissioning cargo.
- Total agreed to supply CMA CGM with 0.3 mta of LNG, commencing in 2020, for use as bunker fuel for nine 22,000 TEU, LNG-powered container ships currently under construction.



CMA CGM's new boxships will be LNG-fuelled



US exports of LPG accounted for one-third of LPG moved by sea in 2017

### Summary

The seaborne trade in LNG increased by 9.9% in 2017 compared to the previous year, to 289.8 million tonnes (mt). The world's first FLNG vessel and five new shore-based liquefaction trains were commissioned, building global LNG production to the 365 mta level. China, with a 42.3% leap in imports in 2017, to 39.1 mt, overtook Korea to become the second largest buyer of LNG. Malta

joined the LNG importers club in 2017, boosting the membership to 40, while five new regasification terminals were commissioned.

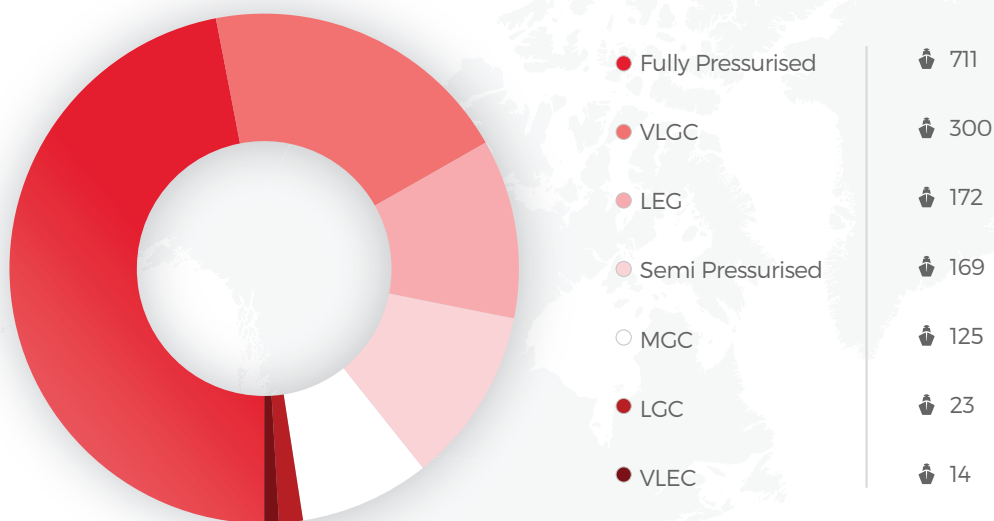
The seaborne trade in LPG rose by 2.4% in 2017, to reach 92.9 mt. A 16.5% jump in US exports, to 29.6 mt, underpinned the growth in global trade. A total of 18 very large gas carriers (VLGCs) joined the LPGC fleet during the year.



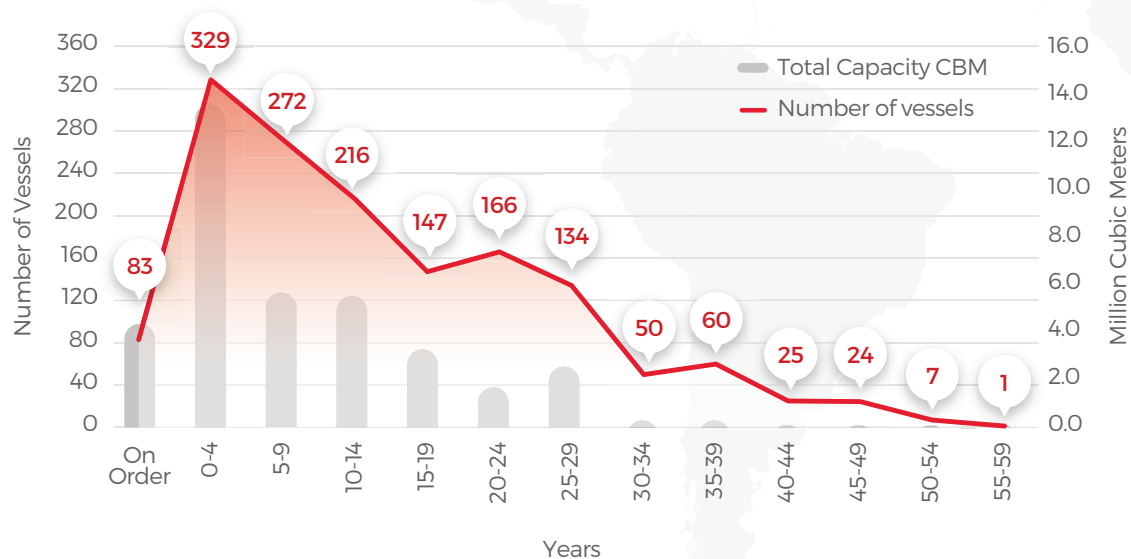
Plain sailing ahead - the seaborne carriage of liquefied gases is the most buoyant of today's commercial shipping markets

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

## LPG FLEET BY NUMBER OF VESSELS



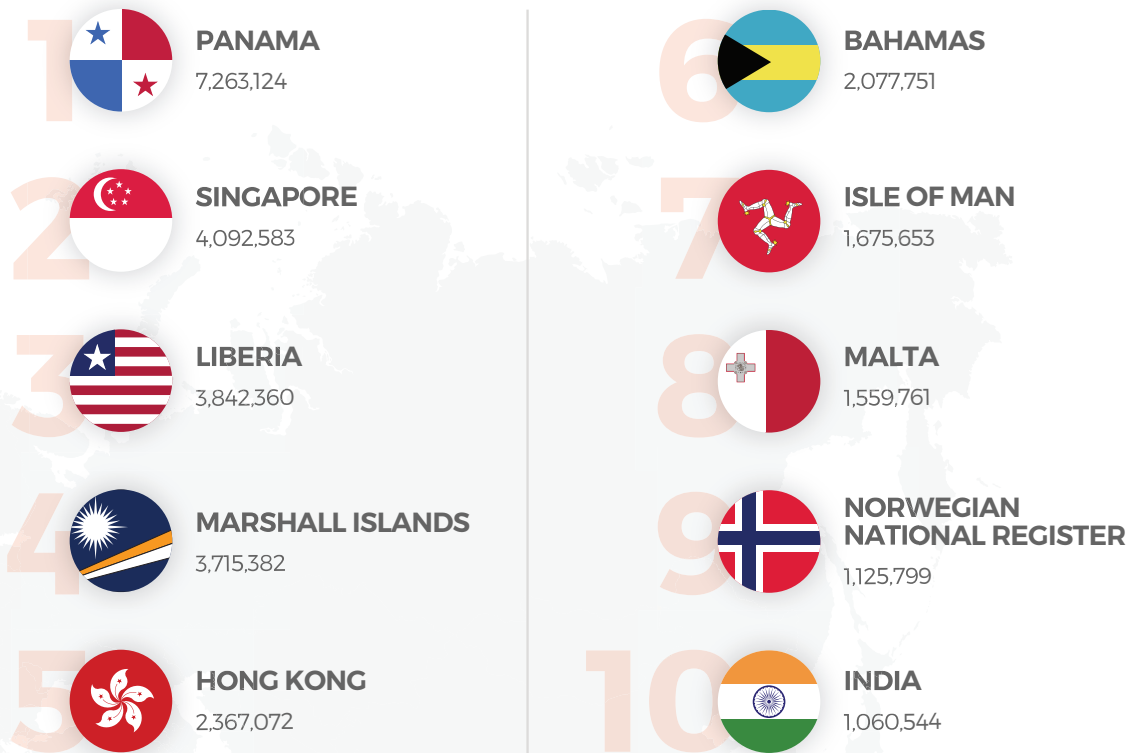
## LPG FLEET AGE PROFILE



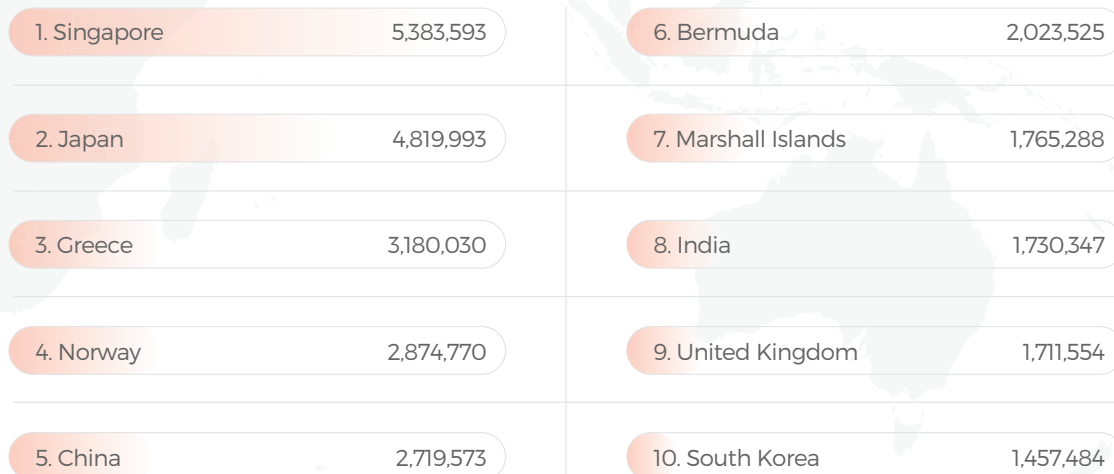
**Disclaimer:** VesselsValue data as September 2018. Does not include floating production vessels.



**TOP LPG FLAG STATES BY CAPACITY CBM**



**TOP LPG OWNER NATIONS BY CAPACITY CBM**



**Disclaimer:** VesselsValue data as September 2018. Does not include floating production vessels.

# SIGTTO meetings enhance two-way communications



Attendees of the 63rd Panel Meeting had the opportunity to visit the Enterprise Hydrocarbons Terminal in Houston, the world's busiest LPG export facility

**SIGTTO's busy schedule of Panel Meetings and Regional Forums enables the Society to maintain a regular and ongoing dialogue with its full membership. The events provide opportunities for not only the Secretariat and members participating in current project working groups to highlight the key issues concerning the greater industry but also the greater membership to contribute to the discussions and raise new matters to consider.**

Panel Meetings are the main SIGTTO events, attracting global audiences of member companies and guest speakers for a busy two days of presentations and discussions. Usually of a single day's duration, Regional Forums extend the outreach, being aimed at the Society's members within particular geographical areas.

SIGTTO normally organises two Panel Meetings per annum, one in the spring and one in the autumn, while the Regional Forum programme has gradually been built up to the extent that there now around 11/12 such events around the world each year.

### Houston Panel

There was no spring Panel in 2017, as the event would have clashed with the international Gastech 2017 conference in Tokyo where Andrew Clifton, SIGTTO's General Manager, chaired the shipping session. The autumn Panel - the 63rd in the series to date - was held in Houston on 4-5 October 2017, kindly hosted by GTT Training.

Members attending the gathering had the opportunity to hear 25 speakers make presentations on the latest technical and regulatory developments impacting gas shipping and terminal operations. While several of the speakers dealt with US-specific topics, to bring attendees up to date with the latest developments in the region, most of the presentations were international in scope, with worldwide applicability.

The Houston Panel was a memorable occasion. The good attendance and quality presentations were augmented with technical visits to the Enterprise Products Partners (EPP) LPG terminal on the Houston Ship Channel and the Freeport LNG facility in Freeport, Texas.

EPP is a new SIGTTO member and at

the 63<sup>rd</sup> Panel Meeting the company's Greg DeLong brought delegates up to date with the record-breaking volumes of LPG shipments handling by his terminal. Thanks to the shale gas phenomena in that country, the US climbed past Qatar to become the world's leading exporter of LPG in 2014.

Of the 29.6 million tonnes of LPG exported from the US in 2017, 50 per cent was loaded at EPP's Enterprise Hydrocarbons Terminal (EHT) on the Houston Ship Channel in Texas. US LPG exports account for about 32 per cent of the global trade in the product and are around three times the volume of its nearest rival.

EPP has rapidly expanded its Texas gas infrastructure and treatment capabilities in recent years. LPG loading is concentrated at EHT which now has seven ship and two barge docks and is the largest such facility in the world. In 2016 approximately 50 per cent of the EHT exports were directed to Asia, 14 per cent to Europe and Africa, 12 per cent to South America and 23 per cent to destinations elsewhere in North America.

In September 2016 EPP opened

a new Texas gas export terminal which is another world No 1 of its type. The company's Morgan's Point ethane facility, at the mouth of the Houston Ship Channel, is able to load fully refrigerated cargoes at a rate of 6.5 million tonnes per annum.

Greg DeLong pointed out that Houston is the best-appointed of the Texas ports in terms of ship-handling and, despite the surge in gas carrier traffic, still has the capacity to handle more movements of deep-draft vessels. The Channel, which can handle two-way traffic and offers designated barge lanes, accommodated the arrival of 8,300 seagoing ships in 2016.

Freeport LNG commenced operations in 2008 as an LNG import terminal but the current construction of three liquefaction trains at the site is providing the terminal with a bi-directional capability. Freeport LNG expects to commence LNG exports in 2019 and is seeking permission to build a fourth train.

### Regional Forums thrive

SIGTTO's Regional Forums continue to deliver interest and engagement with the membership at a more local level. In April 2017 Warsash Maritime Academy kindly hosted the European Regional Forum on its campus and the proceedings included an opportunity to interface with the training establishment's liquefied gas handling simulators.

Amongst the busy 2017 schedule of Regional Forums were a spate of three held in June. These were the spring Pan American Regional Forum in Houston, hosted by Mitsui OSK Lines (MOL), the Mediterranean Regional Forum in Athens hosted by Naftomar and the Singapore Regional Forum hosted by Singapore LNG. All were very well attended and participants engaged in in-depth discussions which covered a range of issues.

The South American Regional Forum was held in Buenos Aires in early September and, once again, was kindly hosted by YPF. At 110, the attendance the 2016 Buenos Aires meeting set the record for a SIGTTO Regional Forum.

Records are made to be broken, as they say, but the South Americans

appear determined to hang on to it. A total of 118 delegates signed up for the 2017 event. The South American Regional Forum once again included a technical visit to the Escobar LNG import terminal near Buenos Aires which is based on the use of a floating storage and regasification unit (FSRU).

The 2017 Regional Forum calendar finished with a flourish, with December meetings in Houston, Shanghai and Perth.

### US Coast Guard liaison

SIGTTO's December 2017 Pan American Regional Forum in Houston aligned, for the third year running, with the new series of Liquefied Gas Senior Executive Forums that was organised by the US Coast Guard (USCG) in tandem with SIGTTO and the Society for Gas as Marine Fuel (SGMF). The combined, three-day event attracted a turnout of over 180.

The popularity of this new event in the liquefied gas calendar reflects the current high level of interest in gas carrier and terminal activities in the US, due not least to record LPG exports, the start of worldscale LNG and ethane exports and the introduction of LNG-powered ships and LNG bunkering.

Reflecting the popularity of floating storage and regasification units (FSRUs) as a means of fast-tracking

LNG imports at relatively low cost, the presentations on regas vessels at the Senior Executive Forum attracted a particularly attentive audience. Capt Doug Brown, LNG/marine manager for Poten & Partners, got the ball rolling by looking at the issue of site selection for FSRU-based receiving terminals.

Given the greater focus today on offshore terminal facilities in more exposed locations, his comments on open sea operations and the impact of sea states on the ability to carry out cargo transfers were especially topical.

Cargo transfers are usually halted if the wave period is above 8 seconds and wave heights exceed 2 metres. Options such as protective breakwaters and weathervaning by means of internal or external turret mooring arrangements can be considered as part of efforts to mitigate the effect of sea states. If the project makes use of an offshore fixed jetty, or 'sea island', this is oriented to suit prevailing wind and wave conditions in the area.

Compared to a conventional shore terminal jetty, where the water depths are typically around 14-18 metres, dredged enough to provide an adequate underkeel clearance, internal submerged turret loading (STL) systems and external turret mooring arrangements are utilised in deeper waters, usually of more than 50 metres.



SIGTTO's December 2017 Pan American Regional Forum in Houston tied in with the US Coast Guard-backed Liquefied Gas Senior Executive Forum for the third year running



# Augmenting industry best practice guidance library

**SIGTTO completed a range of major undertakings in 2016, enabling the Society to catch up on a range of other projects involving the development of industry best practice guidelines.**

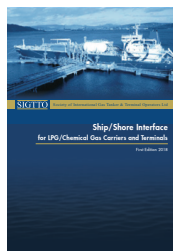
The three major undertakings completed were as follows:

- (a) the entry into force of the revised International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk (IGC Code) in July 2016;
- (b) the new International Code of Safety for Ships using Gases or other Low-Flashpoint Fuels (IGF Code) in January 2017; and
- (c) the publication of the 4th Edition of *Liquefied Gas Handling Principles: On Ships and in Terminals (LGHP4)*

The clearing of the decks with these major projects enabled the finalisation of three new SIGTTO publications during 2017. These documents, which were duly approved and published early in 2018, brought the number of paid publications that SIGTTO has delivered over the last four years to eight.

This is a notable level of productivity for a small secretariat and it could not have been accomplished without the contribution of the Society's members through their participation in the various working groups that developed these publications.

The three publications completed by SIGTTO in 2017 are described below.



## LPG/chemical gas ship/shore interface guidance

The first edition of the *Ship/Shore Interface for LPG/Chemical Gas Carriers and Terminals*

guidance document has also been completed. It was submitted to the 77<sup>th</sup> meeting of SIGTTO's General Purposes Committee (GPC 77) in April 2018 and received approval at that session.

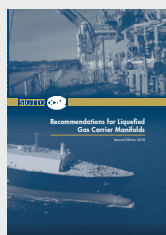
The new publication recognises the technological advances that have been made over the past two decades and supersedes a 1997 SIGTTO publication entitled *Ship/Shore Safe Working Practice for LPG and Chemical Gas Carriers*, which has now been withdrawn.

SIGTTO has prepared this document to identify the potential hazards that can arise at the LPG/chemical gas ship/shore interface; to provide safe working practice guidelines through reference to industry publications; to minimise the risk of incidents occurring; and to help raise overall safety awareness at the interface.

As part of highlighting the principal

risks present in the interface zone, the publication describes risk assessment and hazard identification techniques that gas carrier staff and terminal operators are able to make use of.

In many respects the interface between LPG/chemical gas carriers and terminals is a more complex zone than that encountered in the LNG sector. Whereas LNG carrier and terminal operators are dealing with a homogeneous cargo, staff handling LPG and chemical gas carrier cargo transfers have to deal with a matrix that encompasses a range of different cargoes, temperatures and pressures as well as a variety of vessel and terminal types.



## Update on gas carrier manifolds

The Second Edition of *Recommendations for Liquefied Gas Carrier Manifolds*,

a joint SIGTTO/Oil Companies International Marine Forum (OCIMF) publication, was published in March 2018. The document, which updates the previous, 2011 edition, provides recommendations on the layout, strength and fittings for gas carrier manifolds.

The aim of the new publication is to bring together, in one document, the manifold arrangements and cargo strainer guidelines for LNG, LPG and chemical gas carriers in order to promote improved standards of safety and efficiency in ship operations. The guidance will also assist in planning the position of loading and discharging facilities on new jetties. The recommendations do not apply to existing ships.

Amongst the key changes in the latest version of the manifold publication are the following:

- New categories created for small-scale LNG
- Bunkering manifold

- provisions extended to include LNG bunkering as an option
- A new approach to laying down the recommendations on manifold design was achieved by specifying the following requirements:
    - Pipe schedule, denoting wall thickness of the pipework
    - Allowable loads on manifold support
    - Minimum mechanical properties of material used
    - Pressure rating of flange reducers and spool pieces
  - Clarified *Presentation flange* dimensions and *face finish* to conform to the ASME B 16.5 standard

SIGTTO decided to revise the manifold guidelines at the 72<sup>nd</sup> meeting of its General Purposes Committee (GPC 72) in September 2015. The working group responsible for the revision work had four meetings, and the resultant guidance document received approval from the respective SIGTTO and OCIMF committees in October 2017.

SIGTTO and OCIMF recognise that some new gas carrier designs may not be able to conform to all of the recommendations in this new publication. However, the document is intended to serve as a starting point with a view to minimising differences as much as possible.

An understanding of surge pressure concepts will help avoid the generation of excessive pressures during loading and discharge operations



## Understanding excessive surge pressures

The new *Guidelines for the Alleviation of Excessive Surge Pressures on ESD for Liquefied Gas Transfer Systems* publication has been prepared by SIGTTO to enable project teams and operators of terminals and liquefied gas carriers to review the design, engineering and operation of their cargo transfer systems. Such reviews may assist in avoiding the generation of excessive surge pressures and momentum change in transfer systems on activation of emergency shutdown (ESD) devices or other events.

The purpose of this document is to provide familiarisation with the concepts of surge pressure and to

provide practical guidance and recommendations to the designers, engineers and operators of liquefied gas carrier and terminal loading and unloading systems. This knowledge and familiarity are intended to assist such personnel to:

- (a) recognise the potential hazards of surge pressure;
- (b) understand the factors that affect or create surge pressures;
- (c) avoid the generation of excessive surge pressures and momentum change;
- (d) review the engineering and operating procedures of the cargo transfer system;
- (e) understand aspects of surge pressure control on the other side of the ship/shore interface to enable mutual understanding

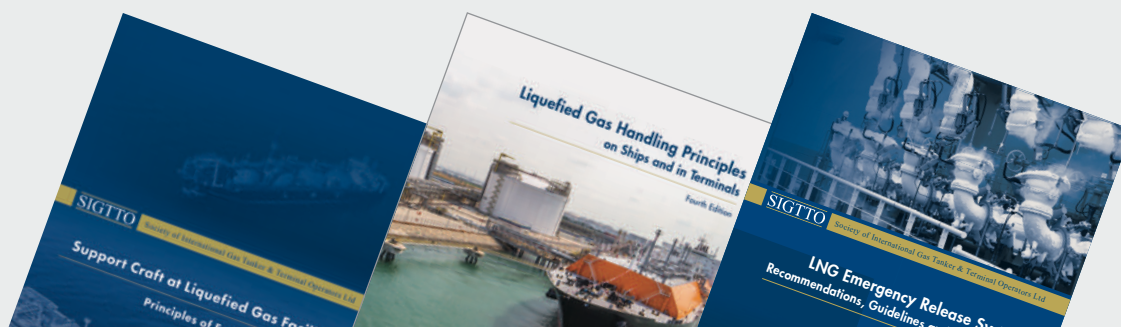
of safe transfer procedures; and (f) understand the potential benefits of a linked ship/shore ESD system in mitigating surge pressures.

The document's description of the generation of surge pressures features both a high-level overview and a more detailed technical explanation so that it is applicable to surge experts and novices alike. One recommendation that is particularly highlighted is the practice of utilising linked ship/shore ESD arrangements as an effective means of reducing surge pressure.

This document also received approval at the 77<sup>th</sup> meeting of SIGTTO's General Purposes Committee (GPC 77) in April 2018.



## SIGTTO Paid Publications



**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)

**SIGTTO Information Papers, Consolidated Ed 2014**  
(2014; £175.00)

**Guidance for LNG Carriers Transiting the Panama Canal**  
(2014; £125.00)

**Ship-to-Ship Transfer Guide for Petroleum, Chemicals and Liquefied Gases** (2013; £225.00)

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

**Liquefied Gas Fire Hazard Management Video, 2nd Ed**  
(2011; £550.00)

**Application of Amendments to Gas Carrier Codes Concerning Type C Tank Loading Limits**  
(2011; £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)

**LNG Shipping Suggested Competency Standards, 2nd Ed**  
(2008; £125.00)

**Jetty Maintenance and Inspection Guide** (2008; £175.00)

**Hydrates in LPG Cargoes**  
(2008; £75.00)

**Ship Vetting and its Application to LNG** (2004; £50.00)

**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)

**LNG Log 24** (2000; £50.00)

**Guidelines on the Shipboard Odourisation of LPG**  
(2000; £40.00)

**Guide to Contingency Planning for the Gas Carrier Alongside and Within Port Limits, 2nd Ed**  
(1999; £40.00)

**Contingency Planning and Crew Response Guide for Gas Carrier Damage at Sea and in Port Approaches, 3rd Ed** (1999; £40.00)

**A Risk Based Approach for the Evaluation of Firefighting Equipment on Liquefied Gas Jetties** (1999; £40.00)

**Introduction to the Design and Maintenance of Cargo System Pressure Relief Valves Onboard Gas Carriers** (1998; £40.00)

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

**Quantity Calculations LPG and Chemical Gases, 2nd Ed**  
(1997; £40.00)

**Accident Prevention (IP No 4) The Use of Hoses and Hard-Arms at Marine Terminals Handling Liquefied Gas, 2nd Ed**  
(1996; £40.00)

**Guidelines for the Alleviation of Excessive Surge Pressures on ESD**  
(1987; £30.00)

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



# SIGTTO

## Society of International Gas Tanker and Terminal Operators Limited

### Statement of Comprehensive Income for the year ended 31 December 2017

	<u>Note</u>	<u>2017</u>	<u>2016</u>
<b>Revenue</b>			
Members' annual dues		1,333,349	1,316,593
Royalties		179,450	321,404
Interest receivable		1,042	2,000
	2(b)	<u>1,513,841</u>	<u>1,639,997</u>
<b>Expenditure</b>			
Employee benefit expense	4	524,192	413,401
Office supplies, web and library costs		60,922	61,934
Members' meetings		200,905	184,360
Rents, rates and services		125,643	127,518
Bad debts		-	5,600
Professional fees		292,389	395,899
Project costs		18,552	978
Communications		3,949	3,989
Depreciation	5	4,695	1,461
Miscellaneous expenses		6,737	6,375
		<u>1,237,984</u>	<u>1,201,515</u>
<b>Surplus for the year</b>		<u>£ 275,857</u>	<u>£ 438,482</u>

The company has no items of other comprehensive income.

# SIGTTO

## Statement of Financial Position at 31 December 2017

	<u>Note</u>	<u>2017</u>	<u>2016</u>
<b>Non-current Assets</b>			
Property, plant and equipment	5	12,786	4,239
Trade and other receivables	6	-	116,667
		<hr/>	<hr/>
		12,786	120,906
<b>Current Assets</b>			
Trade and other receivables	6	940,352	965,933
Cash and cash equivalents		2,619,505	2,241,132
		<hr/>	<hr/>
		3,559,857	3,207,065
<b>Total Assets</b>		£ 3,572,643	£ 3,327,971
		<hr/> <hr/>	<hr/> <hr/>
<b>Current Liabilities</b>			
Trade and other payables	7	784,328	816,658
<b>Total Liabilities</b>		<hr/>	<hr/>
		784,328	816,658
<b>Capital and Reserves</b>			
Called up share capital	8	32,934	31,789
Retained earnings		2,755,381	2,479,524
<b>Total Equity</b>		<hr/>	<hr/>
		2,788,315	2,511,313
<b>Total Liabilities and Equity</b>		£ 3,572,643	£ 3,327,971
		<hr/> <hr/>	<hr/> <hr/>



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# SIGTTO

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