



SIGTTO NEWS

MESSAGE FROM GENERAL MANAGER



SIGTTO celebrates 40th birthday in style

The Society marked its 40th anniversary with a well-attended Liquefied Gas Shipping Forum and reception in London in September

On 10 September 2019 SIGTTO staged a Liquefied Gas Shipping Forum in London to celebrate 40 years of operations. The anniversary festivities, which included a special evening reception following the afternoon Forum, took place on the top floor of Sea Containers House on the South Bank of the River Thames. This superb setting offered those attending the event stunning views out over the river and the city’s skyline as they renewed old acquaintances and met new friends. I would especially like to thank Mitsui OSK Lines, Smit Lamnalco and Excelerate Energy for their generous support of the event.

The Forum itself featured many of the Society’s past and present personnel in three separate panel sessions. During the proceedings the panelists were able to contribute their personal memories and recollections of their involvement with SIGTTO over the last four decades. It certainly was a notable occasion and a great honour for me to introduce the Forum and also moderate the first panel.

Our kick-off group consisted of three past SIGTTO General Managers and two Technical Advisers, and their combined reminiscences gave those attending a unique insight into the Society’s formative years, including the primary liquefied gas issues of concern and the industry’s



Panel 1 of our celebratory forum comprised four SIGTTO General Managers and two Technical Advisers; from left to right, Dick Chadburn, Robin Buncombe, Bill Wayne, James MacHardy, Robin Gray and Andrew Clifton

“Panelists in our three Forum sessions provided their personal memories and recollections of their involvement with SIGTTO over the last four decades.”

leading lights during those pioneering early days. One of our panelists, Robin Gray, the Society’s second General Manager, stole the show with his razor sharp memory and insightful and amusing recollections of events, projects and people during his time at the helm, from 1985 to 1991.

Panel 1, which focused on the Society’s early years, was followed by Panel 2, with its concentration on the middle years, and Panel 3, the participants in which gave their insights into the current situation and the principal challenges which lie ahead for the liquefied gas sector in general and

the Society in particular. In addition to the SIGTTO General Managers and Technical Advisers, we were very privileged to have with us many former and current Society directors and members, along with other industry stakeholders, and several of >

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MESSAGE FROM GENERAL MANAGER

> these participated in our Forum panels.

I am the eighth General Manager in the Society's history. Unfortunately, three of the past General Managers are no longer with us, namely Maurice Holdsworth, the first holder of the post, Alain Vaudolon, the fourth, and John Gyles, the fifth. We were very pleased to welcome Alain's wife, Therese, at our reception. As mentioned, I was joined by three of the past General Managers at the September Forum. Besides the aforementioned Robin Gray, we were pleased to have James MacHardy and Bill Wayne participating in Panel 1.

Several of our former colleagues were unable to be present at the Forum for various reasons and sent their apologies. Of this group, I would like to mention five in particular. The first is Bruce Keer, our third General Manager, and the second is Adele Ball, SIGTTO's extremely capable office manager during the first half of the Society's existence. The other three are all past SIGTTO Technical Advisers, namely Doug Brown, Marc Hopkins and Roger Roue. Doug and Marc both went on from their tenures as Technical Advisers to chair the Society's General Purposes Committee (GPC). Roger, SIGTTO's longest-serving Technical Adviser, had intended to be present but was taken ill on the morning of the Forum.

I would also like to thank all those who participated on the three panels, not least Chris Clucas and Iain Macneil, the moderators of Panels 2 and 3, respectively. Thanks also to everyone who contributed articles to *SIGTTO at 40 Years 1979-2019*, our 40th anniversary publication superbly put together and edited by Mike Corkhill. Several of our members have chosen to put a copy on each of their ships, while everyone attending the recent Gastech 2019 conference in Houston received a copy in their delegate bag. *SIGTTO at 40 Years* has received a wave of positive feedback and if you would like to receive copies of this unique publication, at no charge, please contact Erin Rydings, our receptionist, at reception@sigtto.org.

The gathering together of the global LNG industry for the Gastech 2019 conference and exhibition, a few days after our Forum, was another highlight for SIGTTO during the month of September. Although I have chaired the shipping sessions at several Gastechs, this was the first event in the series in which I participated as co-chair of the technical part of the conference. This new role made it a particularly busy week for me as I was involved in chairing five separate sessions at Gastech 2019. SIGTTO once again shared a

large Gastech exhibition stand with Witherbys, our publisher, and the availability of meeting facilities at the site was appreciated by our membership. Our Gastech week in Houston also accommodated the 80th session of the Society's GPC (GPC 80) as well as a rush of last-minute travel arrangements on the final day of the conference as those attending the event sought to deal with the flooding and travel disruptions caused by tropical storm Imelda!

For the year to date SIGTTO has organised Regional Forums in Houston, Singapore, Athens, Hamburg and Mumbai, while the spring Board of Directors meeting was held in San Ramon, California. In addition, in April 2019 the Society was in Shanghai for GPC 79 and participation in the international LNG 2019 event. As the Upcoming Meetings list on page 3 shows, SIGTTO will finish off 2019 with a flurry of Regional Forums worldwide.

I would like to finish by welcoming Uluc Kaypak, our latest Technical Adviser, to the Secretariat on a three-year secondment from Shell (see page 13 for information on Uluc's background) and also to thank my dedicated Secretariat team who continue to work hard in a small but very busy office.

PANEL MEETING

Maran Gas to host 65th Panel in Athens

Maran Gas Maritime Inc will host SIGTTO's 65th Panel Meeting in Athens on 22-23 April 2020. The gathering will be preceded by the 81st Session of the Society's General Purposes Committee (GPC 81) on 21 April. All the proceedings will take place at the Divani Apollon Hotel on the Saronic Gulf coast to the southeast of Athens' city centre. SIGTTO's 48th Panel was held at the same venue in September 2005.

Part of the Angelicoussis Group, Maran Gas Maritime was established in 2003 and was the first Greek shipowner to own an LNG vessel. That ship, the 145,000 m³ *Maran Gas Asclepius*, entered service in 2005 and since then Maran Gas has steadily built its LNG fleet to more than 40 vessels.

The company became a SIGTTO member in 2006 and Richard Gilmore, director gas fleet at Maran Gas, is currently the chair of the Society's Panel Meetings.

UPCOMING MEETINGS 2019

MEETINGS	DATE	LOCATION
South American Regional Forum	22 Oct	Buenos Aires
Singapore Regional Forum	14 Nov	Singapore
Autumn Board & AGM	19 Nov	Kuala Lumpur
Pan American Regional Forum	3 Dec	Houston
Middle East Regional Forum	4 Dec	Muscat
Australian Regional Forum	10 Dec	Perth
China Regional Forum	13 Dec	Shanghai

UPCOMING MEETINGS 2020

MEETINGS	DATE	LOCATION
8 th Human Element Committee	15 Jan	London
81 st General Purposes Committee	21 Apr	Athens
65 th Panel Meeting	22-23 Apr	Athens
Spring Board Meeting	28 May	London
European Regional Forum	17 Jun	Livorno
9 th Human Element Committee	2 Jul	London
Indian Regional Forum	27 Aug	Mumbai
Gastech 2020	8-10 Sep	Singapore
82 nd General Purposes Committee	11 Sep	Singapore
Autumn Board & AGM	19 Nov	Athens

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GENERAL PURPOSES COMMITTEE WORKING GROUPS

Floating LNG Installations

The Sub-Committee for Floating LNG Installations (SC), a subsidiary body of the General Purposes Committee (GPC), continues to direct the tasks being carried out by the three Working Groups established to develop specific areas for guidance. The three groups are dealing with topics relating to, respectively, site assessment, design criteria and operational guidance for nearshore/offshore floating LNG assets.

The Sub-Committee and its trio of Working Groups (WGs) have continued to generate and review content and produced a clean draft master document, encompassing all three areas of guidance, for initial editing. This version was submitted to the 80th session of SIGTTO's General Purposes Committee (GPC 80) in Houston in September 2019 for information/comment. The Working Groups will now work together in a combined effort to address any missing content and review the overall document. The target submission date for final publication approval remains GPC 81, which will take place in Athens in April 2020.

Reliquefaction and Propulsion

Kenny English of BP Shipping chairs

both of the Society's Reliquefaction and Propulsion Working Groups. WG members are collaborating to produce documents that will effectively upgrade existing industry best practice guidelines to consider recent technology advances.

The WGs have held a number of face-to-face and internet-based meetings and are now combining the various draft sections of the two documents prepared by the authors and producing complete drafts for further group review and revision. The documents will provide descriptions of the various systems available, encompassing a risk discussion and operational recommendations learned from industry experience. The finalised documents will be ready for approval at GPC 81.

Emergency shutdown (ESD) systems

The core purpose of the ESD Systems Working Group is to revise SIGTTO's publication *ESD Arrangements and Linked Ship/Shore Systems for Liquefied Gas Carriers - 2009*. The WG, which is chaired by Ajay Edakkara of Shell, has now met four times in SIGTTO's London office, most recently in October 2019. The Working Group has begun to identify key recommendations and will be reviewing its initial draft document before the end of 2019.

Gangways

Chaired by Rick Boudiette of Chevron Shipping, SIGTTO's Gangways Working Group has been compiling a document entitled *Guidance on Gas Carrier and Terminal Gangway Interface*. The completed document, which was approved at GPC 80, provides ship and terminal designers and operators with recommendations on gangway design, operations and compatibility determination.

The guidance covers different gangway types and configurations and provides recommendations designed to maximise safe access to the ship via the gangway. The document not only deals with shore gangways for large gas carriers but also highlights the specific challenges associated with access to smaller ships. In addition, the guidance encourages a structured approach to hazard management by the use of risk assessments.

Pressure relief valves

The completed *Recommendations for Relief Valves on Gas Carriers* document was approved at GPC 80. The new guidelines update gas carrier cargo system pressure relief valve (PRV) design and maintenance guidance previously issued by SIGTTO in 1998.

HUMAN ELEMENT COMMITTEE WORKING GROUPS

The following paragraphs update the progress being made by currently active SIGTTO Human Element Committee (HEC) working groups. Steve Allibone is the new HEC chair.

Cargo control room ergonomics

Under the chairmanship of Ray Gillet of GTT Training, the Cargo Control Room (CCR) Ergonomics Working Group completed its work on *Recommendations for Management of Cargo Alarm Systems* at its seventh meeting in October 2018. The document was approved by the Human Element Committee at its 6th meeting (HEC 06) in January 2019 and by the SIGTTO Board in May 2019, and has now been published.

The *Recommendations for Management of Cargo Alarm Systems* is the first document to be issued under the auspices of the Human Element Committee (HEC), a new SIGTTO body established in 2016. The publication recommends the implementation of alarm management philosophies for cargo alarm systems on gas carriers, specifically calling for shipowners to work with system designers, classification societies and shipyards to create a management system

for cargo alarms on each ship. Alarm management provides a good example of how human element considerations can lead to improved safety performance.

The Committee's CCR Ergonomics Working Group continues to press ahead on the development of additional guidelines, considering aspects such as control station layout, physical environment, operator interface, controls, displays and the human/machine interface (HMI). The aim is to



develop guidance for operators on how to improve the safety of cargo operations through detailed consideration of operational practice within the specification and design of CCR workstations and HMI.

SIGTTO Competency Guidelines

The initial Task Force for the GAP Analysis of SIGTTO Competency Guidelines has been expanded into a full-term working group and that body has continued to review and revise *LNG Shipping Suggested Competency*

Standard, Second Edition (2008). The introduction of new technologies has prompted the initiative and the intention is to establish methodology appropriate for a major revision of SIGTTO's crew competency publications. Steve Allibone of MOL LNG Transport is chairing this group.

The Working Group has made good progress and a draft master set of guidelines, incorporating issues highlighted from the initial GAP analysis document, is nearing completion. Updates will primarily deal with new technologies being used in the LNG industry. The Working Group is aiming to submit the draft document to the 8th Session of the Human Element Committee (HEC 08) in January 2020 for review.

Shore staff competencies

As a result of after discussions at HEC 07 in July 2019, the Working Group for Shore Staff Competencies has narrowed the scope of its workload to focus on the safety-critical elements of gas carrier owner/operator shore staff interaction. More specifically, aspects such as training, resources, infrastructure and systems are under consideration. Jo McDade of Chevron is chairing this group.

40TH ANNIVERSARY FORUM & RECEPTION

SIGTTO held a special Liquefied Gas Forum and reception at Sea Containers House in London on 10 September 2019 to commemorate its 40th birthday



Forum Panel 1 covered the Society's early days; from left to right, Dick Chadburn, Robin Buncombe, Bill Wayne, James MacHardy, Robin Gray and panel chair Andrew Clifton



Forum Panel 2 focused on the turn of the millennium, when the liquefied gas market and technology both began to gain momentum; from left to right, Mark Ross, Mike Corkhill, Ed Carr, John Cumming and panel chair Chris Clucas



Forum Panel 3 brought things up to date, looking at not only the current situation but also future prospects; from left to right, Anita Odedra, Steve Allibone, Mark Hodgson, Steffen Jacobsen, David Furnival and panel chair Iain Macneil



Andrew Clifton (centre) with a gathering of SIGTTO Presidents and Vice Presidents past and present; from left to right, Masayuki Ishida, Mark Ross, David Furnival, Andrew Steffen Jacobsen, Gary Smith and Blair MacIntyre



The reception provided an ideal opportunity to renew acquaintances and make new friends



Amongst those gathered together for the group photos were past and present members of SIGTTO's General Purposes and Human Element Committees

40TH ANNIVERSARY FORUM & RECEPTION



There was a good number of current and previous SIGTTO Directors present at the 40th anniversary celebrations; from left to right, Masayuki Ishida, Carl Henrickson, Riju Cherian, Iain Relf, David Furnival, Paul Oliver, Steffen Jacobsen, Anita Odedra, George-Paul Perantzakis, Peter Justesen, Ed Carr, Edwin Mortimer, Blair MacIntyre, Takeshi Hashimoto, Gary Smith, Mark Ross



Nice to get out of the office the SIGTTO Secretariat staff, from left to right, Sue Humphrey, Andrew Clifton, Erin Rydings, Uluc Kaypak, Cherian Oommen, Rob Farmer, Laura Else and Ian Harrison



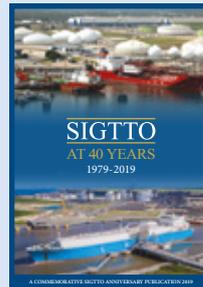
An array of past and present SIGTTO Technical Advisers; from left to right, Dick Chadburn, Paul Steele, Andrew Clifton, Chris Snape, Uluc Kaypak, Ian Harrison, Rob Farmer, Cherian Oommen, Robin Buncombe and John Cumming



The top floor of Sea Containers House offered panoramic views of the London skyline

PUBLICATIONS

SIGTTO at 40 special issue



SIGTTO has published a special 40th anniversary publication to celebrate the sterling service provided by the Society on behalf of the liquefied gas shipping and terminal industry over the past four decades.

The backbone of the 124-page *SIGTTO at 40 years: 1979-2019* publication is comprised of 31 contributed articles by people who have played key roles in SIGTTO

activities over the years. The compilation includes six submissions by SIGTTO General Managers, six by former Technical Advisers, five by past and present Presidents and Vice Presidents and eight by former and current members of the Society's General Purposes Committee (GPC). There are also six 'miscellaneous' contributions, including input from the Company Secretary, SIGTTO's publisher, the organiser of the Gastech series of meetings and a representative of the US Coast Guard.

Many of the contributors are SIGTTO multi-taskers, having served the Society in a diverse array of roles other than the one they are most renowned for. All have had long and varied careers in industry and their commentaries in this commemorative issue reflect how their day jobs and work for SIGTTO intertwined to the great and strategic benefit of both.

The technical detail in the personal commentaries, which highlight how the liquefied gas industry evolved and how SIGTTO helped gas ship and terminal operators meet all the safety challenges encountered along the way, are complemented by humorous anecdotes about people, places and situations encountered enroute. There is also no shortage of individual views on future challenges and optimum solutions.

There is much to enjoy in the *SIGTTO at 40 years: 1979-2019* commemorative publication. Complimentary copies can be requested by contacting Erin Rydings, SIGTTO Receptionist, at reception@sigtto.org.

Japan's golden LNG jubilee

Japan's, and Asia's, first LNG import cargo arrived at the newly commissioned Negishi receiving terminal near Yokohama in Tokyo Bay on 4 November 1969. The shipment, from the US state of Alaska, was transported by the 71,500 m³ *Polar Alaska*.

The delivery marked the start of not only LNG imports by Japan but also LNG exports from the US. In the process the US became only the second LNG export nation and Japan the third receiver of LNG. Also, *Polar Alaska*, and a few months later her sistership *Arctic Tokyo*, marked the entry into commercial service of the first membrane tank LNG carriers.

Mutual benefits

The pioneering Alaska-Japan project was mutually beneficial to both the sellers and the buyers of the natural gas, solving a particular set of problems that each faced. Marathon Oil had discovered the Kenai gas field on Alaska's south coast in 1959 while Phillips Petroleum and other partners found the nearby North Cook Inlet gas field in 1962. With no local demand, the US companies looked to overseas markets for the natural gas.

The customer search achieved success in March 1967 when Phillips and Marathon signed a 15-year agreement with Tokyo Electric Power (TEPCO) and Tokyo Gas for the delivery of 960,000 tonnes per annum of LNG to Japan over a period of 15 years. The Japanese partners were keen buyers as both were looking for a fuel that was less polluting than the coal on which they relied heavily.

Japan had undergone excessively rapid industrialisation in the latter half of 1960s, during which time the number of vehicles on its roads had also increased exponentially. As the country has only meagre fossil fuel resources of its own, it had relied on imports of coal and oil to fuel industrial growth. The heavy reliance on coal, to both fuel power plants and process for town gas, was causing major atmospheric pollution problems and compromising the health of many living in Japan's population centres.

Tokyo Gas was the first to realise the potential offered by the possibility of importing gas in the form of the Alaskan LNG being touted by Marathon and Phillips. However, the gas utility's needs were not sufficient to absorb all the LNG output that the liquefaction plant, which was planned for a site at Kenai in Alaska, would need to produce to be commercially viable. Fortunately, discussions with TEPCO



The modest Kenai terminal in Alaska helped launch Japan as the world's leading LNG importer, a position it has held for five decades

revealed a willingness on its part to give natural gas a chance as a power plant fuel and the capital city's electric utility signed up to take that LNG not required by Tokyo Gas.

Tokyo Gas and TEPCO agreed to build the Negishi LNG import terminal at a site adjacent to the electric utility's Minami Yokohama thermal power plant on Tokyo Bay's northern coast.

Membrane breakthrough

Phillips Petroleum took on the responsibility for providing the two LNG carriers that would be required to service the gas sales and purchase agreement (SPA). After weighing up the merits of the LNG containment systems available at the time, Phillips opted for the invar alloy membrane tank technology offered by Gaz Transport and in July 1967 ordered the 71,500 m³ pair at the Kockums Mekaniska Verkstads yard in Malmö, Sweden at the agreed price of US\$25 million per vessel.

Following the famous inaugural voyage of *Polar Alaska*, *Arctic Tokyo* carried her first LNG to the Negishi terminal in March 1970. Each of the steam turbine ships had six cargo tanks, an ice-strengthened hull and a service speed of 17 knots. Both were operated by Marathon Oil and both were provided with bow thrusters because it was expected that there would be no tug services regularly available at the Kenai terminal in Alaska to assist with berthing.

Driver of global LNG

The introduction of LNG as fuel at Minami Yokohama led to notable reductions in atmospheric pollution from the thermal power plant. In addition, the Alaska project enabled Tokyo Gas to increase the calorific value of the gas delivered to its customers, due to the inherently different properties of town and natural gas.

Using its Minami Yokohama experience

as a stepping stone, TEPCO built up its own commitment to LNG, not least by building a new 1 GW-class, gas-fired plant; converting existing oil-burning stations into LNG-based thermal units; and adopting gas turbine combined-cycle technology in the drive for enhanced thermal efficiency. Other Japanese gas and electric utility companies also woke up to the benefits offered by LNG and signed up their own purchases deals in the years that followed.

Japan commenced importing LNG from Brunei in 1972, from Abu Dhabi and Indonesia in 1977, Malaysia in 1983, Australia in 1989, Qatar in 1996, Oman in 2000, Russia in 2009 and Papua New Guinea in 2014. During the early years, Japan's aggregate long-term natural gas SPAs with overseas sellers far outweighed similar commitments by any other nation, and by 1984 Japan accounted for 72 per cent of the world trade in LNG.

Until recent years the rise in Japanese LNG import levels has been inexorable. While the country was purchasing LNG at the rate of 17 million tonnes per annum (mta) in 1980 and more than 45 mta in 1990, inbound cargoes had climbed to the 70 mta level by 2010. Then, in March 2011, the Fukushima Prefecture was struck by the devastating earthquake and tsunami which prompted the government to shut down the country's entire network of 55 nuclear power plants for rigorous safety checks.

Electric utilities quickly turned to the relatively flexible global LNG market to plug the energy gap and Japan's LNG imports jumped once again, this time at an unprecedented level. Purchases peaked in 2014, at 88.5 million tonnes, but since then have been dropping back towards the 80 mta level, due to improved energy efficiencies, slackening demand and the restart of a limited number of nuclear power plants.

Back to the future

Aside from a short period in 2012-13 during which the facility was mothballed due to dwindling gas supplies, the Kenai liquefaction plant continued to deliver cargoes to Japan for 46 years. When it loaded its final cargo in 2015, it was by far the oldest such facility in the world.

Japan's commitment to LNG over the years has been unprecedented. The country now hosts over 30 LNG receiving terminals and Japanese companies own or operate

more than a quarter of the world's LNG-carrier fleet. Japan has 25 SIGTTO members – more than any other country – or more than 10 per cent of the Society's total number.

Throughout these past five decades, Japan has remained the world's leading buyer of LNG. In 2018, although there are now 42 LNG import nations worldwide, Japan still accounted for 26 per cent of the global seaborne trade in the product.

Although China is set to be rivalling Japan at the top of the LNG importers league

table by the early 2020's, Japan will remain a major global force amongst purchasers of the product for the foreseeable future. For its part, TEPCO agreed with Chubu Electric in 2015 to establish JERA to combine the considerable LNG purchasing power of each of the two companies. With the integration process of their thermal power businesses completed in March 2019, the JERA arrangement has created an entity with an aggregate 35 mta LNG sales portfolio, the largest amongst global LNG buyers.

REGIONAL FORUM MEETING PRESENTATIONS

GTT membrane system refinements

Aziz Bamik of GTT North America was on hand at SIGTTO's Pan American Regional Forum in Houston on 13 May 2019 to update delegates on the latest developments with the two signature membrane tank containment systems of Gaztransport & Technigaz (GTT). LNG carriers have been fitted with membranes of the GTT Mark III and GTT NO96 family types for over 50 years and, as at the end of 2018, 70 per cent of the in-service LNGC fleet sported GTT tanks of one type or the other.

In recent years, with the introduction of more fuel-efficient propulsion systems requiring less cargo boil-off gas (BOG) as fuel, LNG cargo containment system (CCS) designers have been under pressure to refine their technologies with systems providing reduced BOG rates.

As the supplier of the most popular CCSs in the dynamic LNG sector, GTT has devoted considerable effort in recent years into improving the performance of its Mark III and NO96 systems. In the early years of the new millennium, with the four-stroke dual-fuel diesel-electric (DFDE) power train rapidly taking over from the traditional steam turbine as the most popular LNGC propulsion system, the Mark III and NO96 CCSs, both established technologies, provided a BOG rate of 0.15 per cent of the cargo volume per day.

Over the past 10 years, however, with the introduction of even more fuel-efficient two-stroke, dual-fuel engines for conventional LNGCs, GTT has been refining its Mark III and NO96 technologies to achieve further BOG rate reductions. As Aziz Bamik told the Society's Pan American Regional Forum, the Mark III system, with its characteristic waffled stainless steel primary barrier and Triplex secondary barrier, has been improved with the Mark III Flex and Mark III Flex+ systems, yielding BOG rates of 0.085 and 0.07 per cent, respectively.

Refinements to the NO96 system,

which features primary and secondary barriers of invar alloy with a 36 per cent nickel content, have also resulted in major BOG rate reductions. The new NO96 GW system provides a rate of 0.13 per cent, while NO96 LO3 offers 0.11 per cent and NO96 LO3+ 0.10 per cent.

The NO96 GW system differs from the established NO96 design through the replacement of perlite in the primary and secondary insulation boxes with glass wool. In the NO96 LO3 system not only is perlite replaced with glass wool in the top two insulation layers but a third insulation layer of reinforced polyurethane foam (RPUF) is added. With the newest NO96 approach, LO3+, the insulation system is simplified to a primary insulation box packed with glass wool and a secondary one of RPUF.

GTT LNG carrier cargo containment systems (CCSs)*

CCS type	In service	On order	Total
Mark I	1	0	1
Mark III	145	7	152
Mark III Flex	63	46	109
Mark III Flex+	0	8	8
NO85	1	0	1
NO88	4	0	4
NO96	137	2	139
NO96 GW	42	31	73
NO96 LO3	14	0	14
NO96 LO3+	0	4	4
CS1	3	0	3
Total	410	98	508

* as at end-March 2019; includes LNGCs, FSRUs, FSUs, FLNGs and LNG bunker vessels

Refinements to the Mark III family of GTT membranes have been relatively straightforward. The reduction of the BOG rate for the Mark III Flex system has been achieved primarily by increasing the thickness of the secondary insulation layer by 130 mm, to 300 mm. In all the Mark III systems the thickness of the primary insulation layer remains the

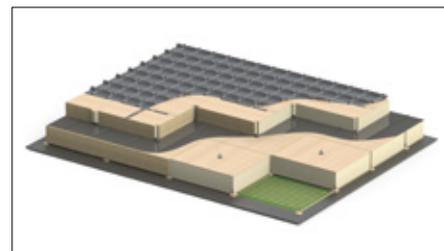
same, at 100 mm, and in all the Mark III systems the insulating material for both the primary and secondary layers is RPUF.

For the most recent Mark III Flex+ system design, GTT has achieved its BOG rate of 0.07 per cent per day by reinforcing the secondary Triplex barrier and boosting the thickness of its secondary barrier insulation by another 80 mm, to 380 mm.

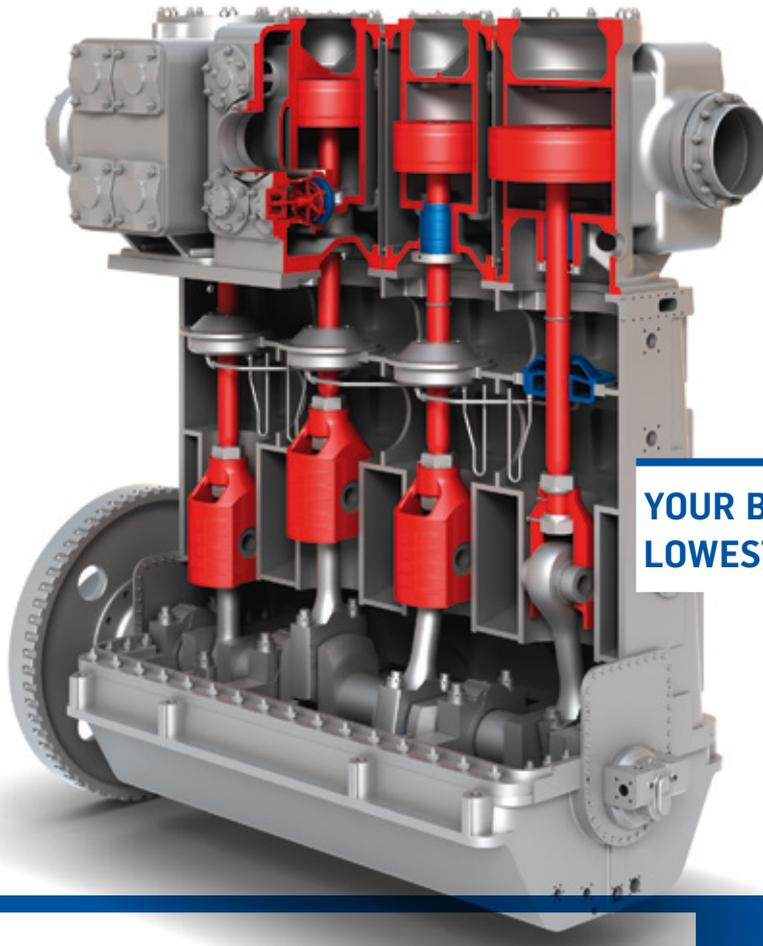
Aziz Bamik informed those attending SIGTTO's recent Pan American Regional Forum in Houston that the latest GTT membrane tank CCS design project is called NO96 Flex. This system, which includes elements of both the Mark III and NO96 approaches, is designed to achieve a BOG rate of 0.07 per cent, similar to that of the GTT Mark III Flex+ technology.

The GTT NO96 Flex system features a corrugated stainless steel primary barrier, of the type utilised in all the Mark III systems, but retains the NO96's invar secondary barrier. NO96 Flex also follows the Mark III system design by utilising RPUF for both the primary and secondary insulation layers.

Following its feasibility studies, GTT is moving to achieve final validation of its NO96 technology with the testing of a small-scale mock-up of the tank to assess the thermal and mechanical behaviour of the system under cryogenic, ballasted and mechanical loads. Final design studies are taking place through 2019 and GTT is seeking to complete the testing process in order to achieve general approval of the system in 2020.



GTT's latest containment system project – NO96 Flex – incorporates several elements of the Mark III design, including the waffled stainless steel primary barrier



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Recent gas-related developments at IMO

Sub-Committee on Ship Systems and Equipment – 6th Session (SSE 6)

The revision of *Guidelines for the approval of fixed dry chemical powder fire-extinguishing systems for the protection of ships carrying liquefied gases in bulk* (MSC.1/Circ.1315) continues and was under discussion once again at SSE 6 in March 2019. The guidelines were further developed, but not finalised. A correspondence group (CG) was re-formed to progress the work and will report to SSE 7 in March 2020.

The definition of “cargo area” for the purposes of firefighting arrangements (paragraph 11.1.4 in the revised International Gas Carrier (IGC) Code) was considered at SSE 5 in March 2018. At that meeting it was agreed that when there is a fuel tank adjacent to the cargo area, the weather deck area above should be considered as “cargo area”, in the same way that a void space or ballast tank would be. A revised Unified Interpretation (UI) to this effect was agreed by SSE 6.

A joint submission by SIGTTO and the International Association of Classification Societies (IACS) on installation testing for dry chemical powder fire-extinguishing systems (IGC Code 11.4.8), proposing a new UI, was agreed by the Sub-committee. This paper was concerned with the onboard installation test of dry chemical powder fire-extinguishing systems, with particular reference to the vague expression “sufficient amounts of dry chemical powder”. The UI makes it clear that testing arrangements should involve the discharge of dry chemical powder from all monitors and hand hose lines on board, but it is not required to fully discharge all the installed quantity of dry powder.

Marine Environment Protection Committee – 74th Session (MEPC 74)

A correspondence group reviewing the Energy Efficiency Design Index (EEDI) Phase 3 requirements with a view to potentially changing the implementation date and reduction requirements (including gas carriers) reported to MEPC 74 in May 2019. The Committee agreed to leave the reduction rate at 30 per cent for both “LNG Carriers” and “Gas Carriers”, but to advance the date to 2022, except for small gas carriers of less than 15,000 dwt which retain the original 2025 date.

Maritime Safety Committee – 101st Session (MSC 101)

MSC 101 formally approved several items,

At its 101st Session IMO’s Maritime Safety Committee agreed to a SIGTTO proposal that the provisions governing the entry into enclosed spaces, as applied to gas carriers, be reviewed



Photo courtesy IMO

including many UIs previously agreed at SSE 6 and the 5th Session of the Sub-committee on Carriage of Cargoes and Containers (CCC 5). These have subsequently been published in three MSC Circulars, i.e. MSC.1/Circ.1606, MSC.1/Circ. 1607 and MSC.1/Circ.1617.

A SIGTTO proposal (MSC 101/21/11) for a new output to refine Resolution A.1050(27) (*Revised recommendations for entering enclosed spaces aboard ships*) regarding its application to gas carriers was agreed. The item was placed on the agenda for consideration at CCC 7 in September 2020.

Sub-Committee on Carriage of Cargoes and Containers – 6th Session (CCC 6)

CCC 6, which took place in September 2019, considered over 20 proposed Unified Interpretations (UIs) of the IGC Code.

Those agreed include the following:

- (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 (5.13.1.2);
- (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, not 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, scavange spaces, exhaust system and crank case (16.7.1.4).

The UIs will be submitted to MSC 102 in May 2020 for approval. Once approved, they will be published in an IMO Circular.

Sign up for access to IMO information

IMO makes a considerable amount of information available to the public through its Public Web Accounts service. Registering for a free account allows users to access a range of resources related to shipping and activities at IMO.

One of the services an account provides is access to the IMODOCS public area. This area contains all publicly available IMO meeting documents and circulars. The *Programme* page provides documents for upcoming and past meetings, extending back to 2011.

One of the main attractions of an IMO Web Account is the Global Integrated Shipping Information System (GISIS) public area. This is a collection of data provided by IMO member states, organised into 23 modules, covering topics such as port and shipping data, regulations and incident reports.

Through GISIS, the *Ship and Company Particulars* module can be used to search the world fleet of ships for particulars such as IMO number, call sign, gross tonnage, date of build and registered owner. The information that can be found about companies includes the ships they operate and their country of registration. To register for the IMO Public Web Accounts service follow the instructions to sign up for a free public account at <https://webaccounts.imo.org>.



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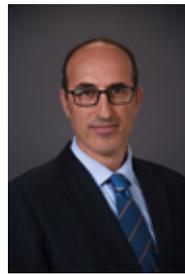
Hats off to SIGTTO in Mozambique

Mozambique may not have loaded any LNG cargoes as yet but it is poised to become a major exporter in the years ahead and the Society has already made its presence felt in the East African nation. The doorman at the Polana Hotel in Maputo quite famously collects pins for his hat and Andrew Brown of Smit Lamnalco and chair of one of the SIGTTO Floating Installations Sub-committee working groups was only too pleased to give him his SIGTTO pin to add to his collection.



PEOPLE

Uluc Kaypak joins SIGTTO team



A dual Turkish and US national, Uluc Kaypak has joined SIGTTO as a Technical Adviser on a three-year secondment from Shell. Uluc graduated from Istanbul Technical University (ITU) with a Bachelor

of Science (BS) degree in 1994 after completing maritime studies in preparation for a seafaring career. There followed 10 years at sea, sailing on a wide range of ocean-going bulk carriers operated by Turkey's Denak Shipping, initially as a deck officer and then, for the final two years of his tenure, as master.

In 2004 Uluc Kaypak moved to the US and joined the National Cargo Bureau in Savannah, Georgia as a marine surveyor specialising in dangerous cargo shipment training and certification. Another move in a westerly direction followed in 2007 when he was appointed by BG Global Shipping in Houston to serve as a marine assurance superintendent. The work involved the vetting and auditing of LNG terminals, Tanker Management and Self Assessment (TMSA) programmes and LNG carriers utilised by BG Group.

Promotions within BG Group brought him to Singapore in 2013, first as a senior marine quality assurance superintendent

and then as manager ports and terminals. In the latter role Uluc had responsibility for LNG, LPG and oil terminal approvals, LNG terminal commissioning, ship compatibility studies and operational incident/near-miss follow-ups.

Following the acquisition of BG Group by Shell, Uluc Kaypak moved in 2017 to London where, as LNG terminal assurance assessor based at Shell Centre, he became the company's subject matter expert (SME) on matters relating to LNG terminal quality assurance.

"I remember being asked about how familiar I was with the work of SIGTTO by my future line managers, Scott Ervin and Marc Hopkins, when I was being interviewed for my first BG Group job back in 2007," states Uluc Kaypak. "This was perhaps not surprising, considering Scott's and Marc's considerable involvement over the years in the preparation of many of the Society's sets of industry best practice guidelines.

"In my vessel and terminal quality assurance work with BG, I quickly came to appreciate the value of the body of knowledge accumulated by SIGTTO in its library of publications prepared for the industry. I feel highly privileged to be bringing my experience around full circle by joining the Society on secondment as Technical Adviser. I look forward to working "on the inside" in the compilation of new and revised publications in the ongoing drive to help Industry maintain its excellent safety record in this fast-growing, demanding and increasingly complex business environment."

OUTREACH

Refreshed SIGTTO website catches the eye

As befits an industry association now in its 40th year, representing a strong membership and a global maritime industry sector that is amongst the most dynamic and safety-conscious, SIGTTO has a website that contains a vast wealth of information.

The site has recently been updated to provide the viewer with even swifter and easier access to not only all the in-house information but also pathways not originally envisaged. For example, a simple click on the icons of any of the Society's member companies will lead to that company's home page and the rest of their own website.

Front covers of all the SIGTTO publications are displayed on the appropriate page and copies of the complimentary ones are instantly downloadable. Also accessible with a click are all the newsletters and annual reports produced by the Society

over the past decade, films about SIGTTO and the history of LNG and a gallery of LNG and LPG ship and terminal photos.

The members-only area of the site includes access to all past Regional Forum and Panel Meetings presentations, Working Group documents and members-only publications. Elsewhere, the News page keeps everyone abreast of the latest developments at the Society. The film of SIGTTO's 40th anniversary Liquefied Gas Forum and reception in London this past 10 September is notable in this respect.

The new/refreshed SIGTTO website came onstream on 20 August 2019. Over the first month it had over 4,000 visits. After the home page was viewed, the Publications section proved to be the most popular, with over 2,000 hits. The most frequently accessed publication has been the newly released *Recommendations for Management of Cargo Alarm Systems*, followed by the *SIGTTO at 40 Years* anniversary publication.

Members and visitors are encouraged to continue to log-in and view, as the site is being regularly updated.

SIGTTO is also building a strong social media presence. Compared to Twitter, the LinkedIn option is still fairly new. As of 1 October 2019 that social media presence comprised the following:

 2,271 followers  around 150 followers

 **YouTube:** The SIGTTO channel currently provides four videos, the most watched of which had 1,400 views



The new tile layout for SIGTTO's publications allows instant access to all titles



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NEW MEMBERS

Quartet joins the club

Four companies have joined the Society's membership since the Spring 2019 edition of SIGTTO News was published. The new members and their date of joining the Society are shown below. The SIGTTO membership now stands at 135 full members, 50 associate members and 28 non-contributory members.

Capital Gas Carriers Corp	1 Jun 2019
IndianOil LNG Private Ltd	1 Jul 2019
GNL Québec Inc	1 Jul 2019
Indian Register of Shipping	1 Oct 2019

Capital Gas Carrier Corp is a company established in 2018 by Greek shipowner Evangelos Marinakis to operate a planned

fleet of LNG carriers. To date Capital Gas Carrier has ordered seven 174,000 m³ LNG carriers at Hyundai Heavy Industries (HHI) in Korea for delivery in 2020 and 2021.

IndianOil LNG Private Ltd, a joint venture affiliate of IndianOil Corporation, has recently opened a new LNG import terminal at Kamarajar Port (formerly known as Ennore Port) on the outskirts of Chennai. The Kamarajar facility is the first LNG receiving terminal on India's east coast. It has the capacity to regasify up to 5 million tonnes per annum (mta) of LNG.

GNL Québec Inc is a Canadian project development, construction and operations company planning to build an LNG export terminal at Port Saguenay on

the Saguenay River, a tributary of the St Lawrence River downstream of Quebec City. The scheme calls for a facility able to liquefy up to 11 mta of LNG utilising natural gas piped from western Canada.

Indian Register of Shipping (IRClass) is one of the 12 members of the International Association of Classification Societies (IACS) and is this year's chair of the Association. The Mumbai-based class society has more than 1,829 ships totalling over 12.7 million gross tons on its register. In line with India's current growing commitment to LNG imports and transport, as well as the country's increasing interest in LNG-powered vessels, LNG has begun to feature more prominently on the agenda of IRClass.

VIEWPOINT

Insights from the GPC chair



Mark Hodgson writes ...

After three years as chair of the SIGTTO General Purposes Committee (GPC), my tenure has recently been extended for a further three years, to 2022. Industry has

been building on the successes of the past, particularly as regards gas shipping safety, and it is an exciting time for our business. I very much look forward to working with the Committee on initiatives aimed at maintaining not only our industry's safety record but also the drives to promote technological development, new maritime gas concepts and environmental improvements.

Beginning with this edition, and alternating in subsequent issues, *SIGTTO News* will feature columns compiled by the chairs of the Society's General Purposes and Human Element Committees (GPC and HEC). In this inaugural contribution to the series, I want to highlight recent key GPC developments, with an emphasis on the Committee's general direction, priorities and performance. In subsequent *SIGTTO News* articles, I will provide updates on our progress, with emphasis on our achievements and the issues we face going forward.

In 2017 SIGTTO's GPC carried out a survey to gauge the views of its membership on all aspects of maritime gas shipping and terminals. Based on the results, a prioritised strategic plan was developed to enable the Committee to address the most urgent and forward-looking issues in

our industry. Implementation of the plan led to, as a first step, the GPC's present guideline development activities, e.g. in the fields of floating gas terminals and new propulsion and gas-handling systems.

In addition, and in line with the wider SIGTTO Strategy, GPC has introduced agenda points and systems that go beyond straightforward guideline development in order to support the SIGTTO Strategy and deal with the issues confronting the liquefied gas industry in the appropriate manner. These initiatives include the following:

- **Ensuring balanced representation:** Figures 1 – 3 show how GPC is presently made up

Fig 1. GPC make up by region

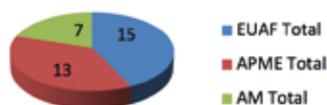


Fig 2. GPC make up by expertise

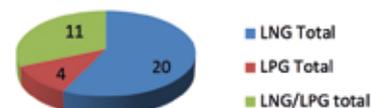
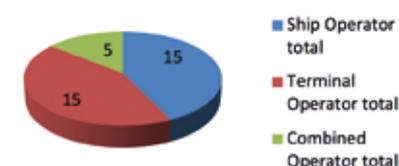


Fig 3. GPC make up by operator



by expertise (principally LNG/LPG); region (Americas, Europe and Africa; Asia Pacific); and operations (ship/terminal). Although the charts show a good general balance, there are opportunities for enhancements. The GPC membership is very active in the Committee's work, with 71 per cent of its member organisations currently participating in GPC working groups. In contrast, only 10 per cent of non-GPC SIGTTO members are engaged in the Committee's work. Although this percentage is rising, there is scope for more SIGTTO members to participate in GPC activities, which is highly valued.

- **Key performance indicators (KPIs):** A 12-point KPI list has been developed to ensure that GPC is properly focused on the issues identified in its strategic plan. The KPIs include GPC work output; assisting in standards development, e.g. at IMO; membership and industry engagement; and continuous learning with a process safety focus in the drive to reduce risk.

- **Environmental protection:** GPC has established an Environmental Sub-Committee, subject to SIGTTO board approval, to support its environmental improvement agenda.

- **Risk-based assessment:** Wherever appropriate, use will be made of prioritised and risk-based assessments in the review of topical subjects, including in the development of new and updated guidance, to ensure the quality and consistency of GPC decisions.

GPC, with the backing of the SIGTTO Board and the support of the SIGTTO Secretariat, has developed an active and comprehensive present and future agenda to deal with the current fast-moving pace of developments in our industry.

MEMBER PROFILE

MISC broadens its range of LNG asset solutions

Entrusted to support the Malaysian LNG supply chain in the maritime transport of the product worldwide, MISC's foray into the LNG shipping industry began more than 30 years ago. The partnerships that MISC has built with various global players over the years play a significant role in supporting growth towards a sustainable future.

MISC took delivery of its first LNG carrier, the 130,000 m³ *Tenaga Satu*, in September 1982. The ship made its historic maiden voyage carrying Malaysia's first LNG export cargo shortly afterwards, for delivery to the Sodegaura terminal in Japan's Tokyo Bay in February 1983.

Over the years MISC has developed a significant presence in the LNG sector, building a fleet of LNG carriers which currently numbers 29 vessels. More recently, the company has taken steps to broaden the scope of its LNG supply chain solutions at a time of exponential growth in the demand for gas worldwide. The initiatives include intensifying efforts to explore non-conventional LNG opportunities and develop new solutions for the gas industry, with ventures into floating storage and regasification units (FSRUs), LNG bunker vessels and LNG-to-power projects.

MISC made its first diversification move in June 2012, with the completion of the conversions of *Tenaga Satu* and *Tenaga Empat* into floating storage units (FSUs) for use at Malaysia's first regasification terminal, at Malacca.

In March 2017, one of the company's LNG carriers, *Seri Camellia*, participated in a milestone LNG floater operation when it became the first ever vessel to load a cargo from a floating LNG production (FLNG) facility. *Seri Camellia* is the first in a series of five new-generation Moss spherical tank ships built for MISC by Hyundai Heavy Industries.

Through its group of companies, MISC provides a comprehensive range of energy-related maritime solutions and services which support the growth and expansion of its various business segments. The cross-business synergies offered by Malaysia Marine & Heavy Engineering Sdn Bhd (MMHE) in marine and heavy engineering, Malaysian Maritime Academy (ALAM) in maritime education and training and Eaglestar in integrated marine services are key to the group's strategy for enhancing its growth potential through the provision of end-to-end maritime solutions aimed at meeting the world's LNG needs.

ALAM is a maritime education and training facility operated by Malaysian Maritime Academy Sdn Bhd (MMASB), a



The first of five Moss spherical tank LNG carriers built recently for MISC, *Seri Camellia* was recognised as one of the Great Ships of 2016 by Maritime Reporter & Engineering News

subsidiary of MISC. Through ALAM, MISC has, since 1977, nurtured the careers of more than 13,000 seafaring cadets, who have then gone on to serve on board the company's diverse fleet of vessels.

Established in 1973, MMHE became a subsidiary of MISC in 2006 and is listed on the Malaysia Bourse as Malaysia Marine & Heavy Engineering Holdings Berhad (MHB). Its facility at Pasir Gudang in Johor state in southern Malaysia is an established ship repair and conversion facility, including for LNG carriers.

Eaglestar was established in 2017 and provides a suite of integrated marine services that ranges from fleet management and operations to crew management and manning services and drydocking management. Eaglestar also provides project management services for newbuild construction and conversion projects.

Eaglestar's expertise in the management of LNG ship-to-ship (STS) cargo transfer operations, for example, has supported the ability of MISC to conduct recurring LNG STS operations in various parts of the world. Such operations are carried out through joint partnerships with various parties, including shipowners, government authorities and LNG consumers. Amongst the STS transfers with which MISC participates is the breaking-bulk type, by which LNG is discharged from a larger to a smaller ship. This operation enables the delivery of cargoes to small and mid-size terminals lacking the ability to accommodate conventional-size LNG carriers.

MISC has continued to build upon its major presence in the conventional LNG shipping sector this year. In September 2019 MISC agreed with Mitsubishi Corp and NYK line to co-own two LNG carrier newbuildings that Hyundai Samho Heavy Industries will build for delivery in 2021. The pair will serve Diamond Gas International Pte Ltd under an 18-year charter contract, mainly on the LNG Canada project.

In a quick follow-up MISC secured a 15-year time charter contract with ExxonMobil

in October 2019 covering the provision of two LNGCs for the carriage of the energy major's growing portfolio of LNG cargoes. Two 174,000 m³ newbuildings recently ordered at Samsung Heavy Industries will meet the needs of this arrangement.

"We congratulate SIGTTO on celebrating its 40th anniversary this year," states Capt Raja Sager, Managing Director & CEO of Eaglestar and also a SIGTTO Director. "Throughout the Society's long history it has played a significant role in the advancement of the gas industry.

"At MISC we hold our SIGTTO membership in high regard, not least due to the great benefit we have derived through the sharing of best practices and insights with the Society's wide membership. We will continue to provide our steadfast support to SIGTTO in driving change and improvements in the gas industry."

SIGTTO

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