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Picture: Höegh LNG

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Sandy Gwee is Principal Consultant (Energy and Smart Cities) at NRI Singapore. She is based in Singapore and reports to Kazauki Ohara, President of NRI Singapore and Head of Consulting. In an exclusive interview with Petromin Fuels & Power, Sandy Gwee shares her insights on the energy transition and carbon neutrality, as it affects the shipping industry.

Front cover picture: Höegh LNG



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## EDITORIAL



# CONGED UP

It is one of the most talked about stories of the 20th Century. China does not figure, as it is too busy with activities that gets the hackles of the West up.

The new poster boy which has been in the limelight for several years now, is Vietnam. It proved to the world how well it could handle the COVID-19 pandemic with just 35 deaths. Just how did it do it, has been anybody's wonder?

But just why is Vietnam back again? It is now the new frontier say many with an eye for a commercial chance. It is making a definite break from coal for good reason and to avoid the 'hiding' that some nations unwittingly get.

Its LNG potential is great, and it has a superb coastline. Its maritime credentials are glowing and its Gross Domestic Product per capita, just keeps growing from US\$3,415.46 in 2019 to US\$3,609.28 in 2021.

And there is also no lack of drive wherever the Vietnamese authorities go. They have enacted every manner of laws and have 'overhauled' their once rueful and forbidding business climate to make the nation ever more alluring. The ebullience and euphoria to turn around a lumbering ship of state has been nothing short of admirable.

In no time, Hanoi quickly emerged as one of the most promising LNG importing markets in Asia. The global supply glut coupled with favourable conditions on the ground have motivated investors – both domestic and global – to pin their hopes on the rapid scale up of Vietnam's LNG-to-power sector, says the Institute of Energy Economics and Financial Analysis (IEEFA). A resultant market frenzy is bubbling, and it was and is something that promises to turn the ship of state around.

IEEFA's research, indicates that at least 30 projects with implied capacity of nearly 93 GW of LNG-fuelled power capacity have been proposed by investors and local authorities.

But is the nation, truly 'conged' up to be what it is?

In Vietnam as in elsewhere, LNG-to-power infrastructure projects are complex projects. They are multi-stage development projects with numerous moving parts and multiple risks—involving upstream, downstream, counterparty, and construction interests."

From the pool of projects on the drawing board, only nine projects with 17.6 GW in combined capacity have been formally approved for the current power master plan (PDP7R). None of them has finalised power purchase agreements (PPA) with the state utility Electricity of Vietnam (EVN), declares the IEEFA.

"Significant planning and implementation delays are very likely considering how the updated regulatory environment seems incompatible with the contractual demands of developers who insist on utilising older legal models governing either build-operate-transfer (BOT) or independent power projects (IPP).", acknowledged the report.

All things said, it is still a new dawn ahead and nothing ever will stop the nation from forging ahead in the new promising era of a new power calculus.

Jaya Prakash  
Editor

# FUEL AMMONIA SUPPLY CHAIN FROM AUSTRALIA TO JAPAN

“ FEASIBILITY  
STUDY WILL LOOK AT  
THE ENTIRE SUPPLY  
CHAIN, INCLUDING THE  
PRODUCTION OF CLEAN  
FUEL AMMONIA IN  
AUSTRALIA AND MARINE  
TRANSPORTATION TO  
JAPAN. ”

Woodside Energy Ltd., Japan Oil, Gas and Metals National Corporation, Marubeni Corporation, Hokuriku Electric Power Company and The Kansai Electric Power Co., Inc (hereinafter, the “Parties”) have signed a joint research agreement under which they will conduct a feasibility study into the development of a clean fuel ammonia supply chain from Australia to Japan, according to a Marubeni press release.

Ammonia does not emit CO<sub>2</sub> during combustion and is considered a promising next generation zero-emission fuel for energy intensive thermal power plants and marine engines. Given existing proven technologies for the production, storage, and transportation of ammonia, it is expected to have early take-up as a zero-emission fuel.

Japan’s Green Growth Strategy established on 26th December 2020 and further refined on 21st June 2021, has also positioned fuel ammonia as one of the key opportunities for Japan to achieve carbon neutrality by 2050.

In relation to Australia, the “Japan-Australia Partnership on Decarbonization through Technology” including fuel ammonia was announced at the Japan-Australia Summit Meeting on 13th June 2021 and Joint Statement at the Australia-Japan Ministerial Economic Dialogue on 15th July 2021 mentioned that Japan and Australia will work together to promote clean fuel ammonia.

Under the joint agreement, the Parties will conduct a feasibility study of the entire supply chain, including the production of clean fuel ammonia in Australia from natural gas with CO<sub>2</sub> abatement methods such as CCS and bio-sequestration; marine transportation to Japan; utilisation of ammonia as a fuel for power generation and marine use; and financing.

## EIA EXPECTS GROWTH IN ELECTRICITY SALES AND GENERATION FROM RENEWABLES THROUGH 2022

EIA forecasts U.S. retail sales of electricity will increase by 2.8% in 2021, led by a 5.1% increase in sales to the industrial sector. In the most recent release of the Short-Term Energy Outlook, forecast electricity sales will also grow in the commercial sector, though at a slower rate of 2.1%, as many workers continue working from home.

“The increase in electricity sales to the industrial sector is a strong sign of rising levels of economic output as the COVID-19 pandemic recedes in the United States,” said EIA Acting Administrator, Steve Nalley.

Renewable energy should contribute a greater share of U.S. electricity generation through 2022, reaching a 23% share, up from 20% in 2020. About 50 gigawatts of solar and wind capacity is scheduled to come online in the United States during the next 18 months, with 2022 as the first year that growth in utility solar capacity will outpace wind capacity growth.

“We forecast an 11% decrease in electricity generation from hydropower in California and the Northwest in 2021 because of weather conditions and a 12% decrease nationwide,” added Nalley.

“The extreme drought in the Northwest and California is straining water reserves, which we expect to cause a significant decrease in electricity from hydropower this year,” Nalley said.

## NOW HERE’S TO REDUCING CHEMICALS IN GAS

Singapore LNG Corporation Pte Ltd (SLNG) will be working with Keppel Infrastructure (KI) through its wholly owned subsidiary Keppel Energy Pte Ltd (KE) and another industry partner on the front end engineering design (FEED) for an NGL Extraction Facility at the SLNG Terminal on Jurong Island.

The purpose of the collaboration is for nothing more than to remove ethane or propane (also known as NGL) from LNG. The design of the Facility will adopt a sustainable approach.

Mr Tan Soo Koong, CEO, SLNG, said, “This project is part of SLNG’s continuing efforts to not just meet but exceed our Energy Security mandate; and to do so in an environmentally sustainable way. At the same time, it is also another step forward in our pursuit of our Vision to Catalyse New Possibilities in the Energy Transition. We are very excited to partner with established companies like Keppel on this project, which we believe will add significant value for the LNG ecosystem and Chemicals industry in Singapore, and beyond.”

Ms Cindy Lim, Chief Executive Officer, KI, said, “Together with our like-minded partners, Keppel Infrastructure is privileged and pleased to be involved and contribute towards the use of more sustainable sources of energy on Jurong Island through this FEED study. This effort is an important initiative for Keppel as we leverage our strong development capability and engineering expertise to create solutions and capture opportunities arising from the global energy transition. This is in line with Keppel’s Vision 2030, which places sustainability firmly at the core of its strategy”.

A Keppel Infrastructure spokesman told Fuels and Power, ‘The project was envisioned a year ago and would cost millions. “FEED studies” he says, ‘typically takes 12 – 18 months to complete.’

“We are watching this development closely”, said Cindy Lim. She continued, “The NGL extraction project has the potential to increase the competitiveness and sustainability of our Chemicals industry by unlocking natural gas-based feedstock – an important energy transition fuel and harnessing cold energy from the existing LNG regas terminal to reduce power consumption and carbon emissions respectively” said Mr Ow Kai Onn, Vice President & Head, Chemicals & Materials, Singapore Economic Development Board (EDB). “This is aligned with EDB’s interest and commitment to working closely with companies to create solutions in environmentally sustainable production as the Energy and Chemicals sector adapt to a low carbon future.”

# ICS COMMITS SHIPPING TO AMBITIOUS CO2 REDUCTION OBJECTIVES

“ ICS URGES IMO TO  
ADOPT CO2 REDUCTION  
OBJECTIVES THAT WILL  
IMPACT LONG TERM FUTURE  
OF INDUSTRY. ”

At its AGM in Istanbul, the International Chamber of Shipping (ICS) has agreed to urge the International Maritime Organization (IMO) to adopt some dramatic CO2 reduction objectives – on behalf of the international shipping sector as a whole – in order to match the ambition of the Paris Agreement on climate change.

In a submission to IMO Member States, being made in conjunction with other shipping organisations, ICS will propose that IMO should adopt three Aspirational Objectives:

- To maintain international shipping’s annual total CO2 emissions below 2008 levels;
- To reduce CO2 emissions per tonne-km, as an average across international shipping, by at least 50% by 2050, compared to 2008; and
- To reduce international shipping’s total annual CO2 emissions by an agreed percentage by 2050, compared to 2008, as a point on a continuing trajectory of CO2 emissions reduction.

ICS Chairman, Esben Poulsson, commented: “It is very important that IMO sends a clear and unambiguous signal to the global community that shipping’s regulators have agreed to some ambitious objectives, with numbers and dates, for reducing the sector’s CO2 emissions, in the same way that land-based activity is now covered by government commitments under the Paris Agreement.”

ICS wants IMO to remain in control of additional measures to address CO2 reduction by ships and to develop a global solution, rather than risk the danger of market-distorting measures at national or regional level.

“Shipping has a very good story to tell about reducing CO2, but this is difficult to convey so long as there is no clear signal from IMO as to what our collective CO2 reduction objectives should be,” said Mr Poulsson.

ICS will suggest that IMO should adopt these objectives as part of the initial IMO CO2 reduction strategy to be agreed in 2018, following the adoption of an IMO Roadmap at the request of the industry in 2016.

Importantly, acknowledging concerns of developing nations about the possible impacts of CO2 reduction for trade and sustainable development, ICS emphasises

that any objectives adopted by IMO must not imply any commitment to place a binding cap on the sector’s total CO2 emissions or on the CO2 emissions of individual ships.

“Dramatic CO2 reductions alongside increasing trade can only be achieved with the development of alternative fossil-free fuels – something which needs to be identified by the IMO strategy,” Mr Poulsson emphasised.

He added, “The long term future of the industry, like the rest of the world economy, must eventually be fossil fuel free. The trajectory for getting there, not least the development of alternative fuels, could well take us several decades. But this will only be achieved if the industry itself pushes for the adoption by IMO of some suitably ambitious objectives so that all concerned are under no illusion about the scale of the task ahead.”



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# TOTAL REINFORCES COMMITMENT TO DEVELOP SINGAPORE INTO LNG HUB

“THIRD LNG BUNKER SUPPLIER LICENSE REAFFIRMS TOTAL’S COMMITMENT.”



Photo: Total

*Singapore is well positioned to become a major hub for LNG as a marine fuel.*

The Maritime and Port Authority of Singapore (MPA) has awarded a third Liquefied Natural Gas (LNG) bunker supplier license to Total’s subsidiary in charge of worldwide bunkering activities, Total Marine Fuels Private Limited, for a five-year term starting January 1, 2022.

This achievement follows a 10-year agreement signed by Total back in 2019, to develop an LNG bunker supply chain in the port of Singapore. It reaffirms the Company’s commitment to contribute to the country’s ambition in becoming a key LNG bunkering hub for Asia. It also underscores Total’s confidence in the role of natural gas for the global maritime industry’s energy transition and in its potential to further reduce carbon emissions from ships, through the development and future introduction of carbon-neutral bioLNG.

*“We are proud to be awarded by the Maritime and Port Authority of Singapore the licence to supply LNG. Singapore, as the world’s largest conventional bunkering hub with a market share of 20 percent, is well positioned to become a major hub for LNG as a marine fuel,” underlined Alexis Vovk, President, Marketing & Services at Total. “Asia’s demand for LNG bunkering is growing and the contribution of Singapore is of essence for the development of a global LNG bunkering market. Moving forward, Total will continue to step up investments to bring greater value of our integrated natural gas supply chain to customers serving this important region, ultimately contributing to our target of serving more than 10% of the global LNG bunker market.”*

Total has actively invested in LNG infrastructure, critical to support its shipping customers’ uptake of LNG as a marine fuel. Since November 2020, Total has been

operating the world’s largest LNG bunker vessel, the “Gas Agility”, at the Port of Rotterdam. By 2022, the Company will launch another newly built LNG bunker vessel in Marseille (France), while serving the port of Singapore through a third one. As part of its strategy to reduce greenhouse gases emissions in maritime transportation, Total has in parallel chartered two VLCCs (Very Large Crude Carriers) and four Aframax-type vessels, all equipped with LNG propulsion, which will be delivered in 2022 and 2023 respectively.

Total’s active efforts to develop LNG bunkering for maritime transport are in line with the Company’s climate ambition to get to net-zero emissions by 2050, together with society. Furthermore, it embodies Total’s broader marketing strategy towards the industries it serves, focusing on solutions to reduce the carbon intensity of the energy products used by its customers worldwide.

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# INDUSTRY MILESTONE TESTAMENT TO SAFE AND RELIABLE OPERATIONS



Photo: Excelerate

Milestone is testament to hard work and dedication

“SAFE STS TRANSFERS  
ALLOW FOR A MORE  
RESILIENT GAS AND POWER  
GRID.”

Excelerate Energy LP (Excelerate) completed its 2000th commercial ship-to-ship (STS) transfer of liquefied natural gas (LNG) on April 03, 2021, at Excelerate's Moheshkhali Floating LNG (MLNG) terminal located offshore Bangladesh in the Bay of Bengal. Using Excelerate's floating storage regasification unit (FSRU) Excellence and a conventional LNG carrier, 144,191 cubic meters of LNG were transferred using the double-banked LNG transfer system. To date, Excelerate has successfully transferred over 236,405,000 cubic meters of LNG using its STS protocol. "Having achieved this milestone safely is a testament to the hard work and dedication of our team and vessel crews worldwide," stated Chief Operating Officer Cal Bancroft. "Operating in challenging locations like the Bay of Bengal is why customers can count on our teams to deliver much-needed energy."

Since 2018, Excelerate has provided clean, reliable energy to Bangladesh through its two FSRUs located offshore in the Bay of Bengal. Both projects have represented a 20 percent uplift in gas supply to the country, allowing for a more resilient gas and power grid for the Chattogram region, which is home to residents, fertiliser factories, and several industries that were previously underserved. MLNG was the country's first LNG import facility.

Excelerate conducted the industry's first commercial STS transfer of LNG in 2007. Since then, STS transfers have been commercially accepted and proven in a wide range of environments, including open ocean and protected bodies of water at various locations between the LNG load ports and market delivery points.

Excelerate has successfully imported over 157 cargoes of LNG and delivered an excess of 500 million MMBtu of natural gas into the Bangladeshi market to date. In March, the country reached its highest level of gas output with around 837 million cubic feet per day (MMcf/d) of natural gas as the government continues to increase its LNG imports to meet the rising domestic demand.

# OLAV NORTUN ELECTED TO NBAS BOARD OF DIRECTORS



Photo: Thome

Olav Nortun – NBAS

The Norwegian Business Association Singapore (NBAS) has elected Thome Group's CEO Olav Nortun to its board of directors and to its committee for Shipping, Offshore and Energy transition. NBAS is actively involved in promoting trade, investments, finance and industry between Norway and Singapore using the appropriate channels in both countries.

It also provides expert advice and information by staying connected with a variety of Singaporean, Nordic and Norwegian companies, stakeholders, partners, and customers. Close to 200 Norwegian companies are established in Singapore. These companies represent one of the highest concentrations of Norwegian business interests in any city in the world outside Norway.



# INDIA'S FIRST FSRU ARRIVES AT JAIGARH TERMINAL IN MAHARASHTRA

“ FIRST FSRU MARKS  
NEW CHAPTER IN  
GROWTH OF LNG  
INFRASTRUCTURE. ”



Photo: H-Energy

Showcasing India's first FSRU based LNG regasification terminal

India's first Floating Storage and Regasification Unit (FSRU) - has arrived at H-Energy's Jaigarh Terminal in Maharashtra, the FSRU Höegh Giant which sailed from Keppel Shipyard, Singapore was berthed at Jaigarh terminal in Maharashtra on 12th April, 2021.

Expressing his views on the occasion Mr. Darshan Hiranandani, CEO, H-Energy said "With immense pride H-Energy welcomes the FSRU Höegh Giant, at Jaigarh Terminal in Maharashtra, India. This will be India's first FSRU based LNG regasification terminal, which marks a new chapter in India's mission for accelerated growth of LNG infrastructure. FSRU based LNG Terminals aim at providing the ability to enhance the pace of natural gas import capability in an environment friendly and efficient manner".

"We are committed to the growth of LNG market in India. We aim to contribute to the overall development of natural gas value chain, aligned with the Hon. Prime Minister's vision of increasing the share of natural gas in India's energy mix from present 6% to 15% by 2030," Mr. Hiranandani added further.

With the berthing of the FSRU Höegh Giant, the LNG regasification terminal will be ready to start testing and commissioning activities soon.

Key features of the project:

- This will be India's first FSRU based LNG receiving terminal and the first year around LNG terminal in the state of Maharashtra

- The 2017-built Höegh Giant has storage capacity of 170,000 cubic metres and installed regasification capacity of 750 million cubic feet per day (equivalent to about 6 million tons per year). H-Energy has chartered the FSRU for a 10 year period.
- Höegh Giant will deliver regasified LNG to the 56-kilometre long Jaigarh-Dabhol natural gas pipeline, connecting the LNG terminal to the national gas grid.
- The facility will also deliver LNG through truck loading facilities for onshore distribution, the facility is also capable to reload LNG onto small-scale LNG vessels for bunkering services.
- H-Energy also intends to develop small-scale LNG market in the region, using the FSRU for storage and reloading LNG onto smaller vessels.

H-Energy has developed the LNG terminal in accordance with world-class engineering & safety standards. The LNG terminal is located at JSW Jaigarh Port in the Ratnagiri district of Maharashtra, on the west coast of India. The port is the first deep water, 24/7 operational private port in Maharashtra.

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# KARMOL'S FIRST LNG TO POWER FSRU BEGINS JOURNEY TO SENEGAL

“TECHNOLOGY  
BRINGS LNG TO POWER  
TO COUNTRIES WITH  
NO DOMESTIC GAS  
SUPPLY.”

KARMOL's first Floating Storage Regasification Unit (FSRU) was delivered on March 15 at Sembcorp Marine in Singapore and has begun sea trials off Singapore ahead of its deployment to Senegal.

The FSRU, called KARMOL LNGT POWERSHIP AFRICA, will enable KARMOL (a Joint Venture between Karpowership and Mitsui OSK Lines) to offer LNG-powered electricity to the West African country for the first time using its floating Powership, Karadeniz Powership Ayşegül Sultan.

In Senegal, Karpowership is operating a 235MW capacity Powership, around 15% of the country's supply, since August 2019. The first FSRU, operated by KARMOL will soon sail to the West African country and the Powership will switch to operating with LNG before the end of June.

KARMOL's unique technology means a combination of Powerships and FSRU's will bring LNG to Power to countries with no domestic gas supply. The company plans to switch its entire fleet of Powerships to LNG, a sustainable, affordable and environmentally responsible fuel. Under the same joint venture, another FSRU is already under construction which is planned for deployment to Mozambique.

KARMOL Board Member Gokhan Kocak-said: "This is a big moment for West Africa and the wider continent, and an exciting time for KARMOL."

"We have a bold ambition to offer LNG to Power across the world and especially within Africa. Usage of FSRUs mean we can unlock the benefits of clean and affordable electricity for millions of people, even where countries have no domestic gas production or infrastructure."

"I am looking forward to the ship completing its sea trials and beginning its voyage to Senegal."



Photo: MOL

Naming ceremony on March 13

"The use of FSRUs and Powerships is a ground-breaking solution which opens up the prospect of stable electricity, powered by efficient, cleaner fuels, to many more countries."

"Our KARMOL partnership is at the core of a long-term plan to bring reliable, economical and green electricity to our current partners and new customers."



Photo: MOL FSRU "KARMOL LNGT POWERSHIP AFRICA"

KARMOL Representative Kensuke Ito-said: "The vessel symbolizes MOL and Karpowership's continued partnership and represents our strong commitment to providing LNG-to-Power solutions to the African region."

"This milestone has been achieved against the most challenging of backdrops with the ongoing global COVID pandemic which makes this all the more satisfying."

The Senegal FSRU and another vessel each have a capacity of 125,000 cubic meters. Singapore-based Sembcorp Marine has done the construction and conversion work. Following gas trials, the FSRU is expected to depart Singapore early April, expected to arrive in Senegal in mid-May, with operations planned to begin in June.

# THAILAND: MOVING AHEAD WITH LNG

“ THAILAND READIES  
A SLATE OF LNG IMPORT  
TERMINALS IN THE INTEREST  
OF ENERGY SECURITY AND  
OPENS UP LNG ENERGY  
SUPPLY MARKET. ”

Thailand is betting big and taking a long position on LNG in many ways, going by the number of planned LNG import terminals lined up in the coming years.

The latest joint development project between the PTT and EGAT may be viewed as an attestation to this sentiment. This is the development of a FSRU floating vessel to supply regasified natural gas to a power plant in the Southern part of Thailand.

Fluor is providing consultancy services to EGAT for a planned floating storage and regasification unit (FSRU). This includes reviewing the feasibility study and performing the front-end engineering and design (FEED) of the FSRU, jetty and onshore and offshore pipelines with facilities. EGAT is planning to build a 5 MTPA offshore LNG terminal, floating storage and regasification unit (FSRU), to supply the natural gas to EGAT's current and future gas power plants by the year 2024.

Fluor has started the front-end engineering and design work for Electricity Generating Authority of Thailand's (EGAT) planned floating storage regasification unit (FSRU) and associated facilities in the upper Gulf of Thailand.

“In addition to our extensive FSRU and liquefied natural gas project experience, Fluor has a proud history of executing some of Thailand's most prominent oil and gas projects,” said Ken Choudhary, president of Fluor's Energy & Chemicals business for the Asia-Pacific region. “We are honored to develop Thailand's first FSRU and help meet the country's power needs.”

Located 20 kilometers off the coast of Thailand, the FSRU will enable LNG to be received from cargo ships and transferred as natural gas to pipelines and power plants. Fluor's scope includes the FSRU, marine berth and jetty, and onshore and offshore pipeline connections. Presently, EGAT is in the process of preparing the environmental impact assessment report (EIA) and acquiring the permits from relevant government agencies for the project. Once EGAT obtains the approval for EIA and permits, the FSRU project will then go ahead.

The supply of LNG to the main electricity provider has almost nearly always been a state-run monopoly until recently.

In the interest of energy security, and in securing the energy future of the nation, the market for LNG supply to the main state electricity provider may be opened up to other players.

According to Enerdata Intelligence and Consulting, the new joint project would supply gas to a new 1,400 MW gas-fired power plant developed by EGAT in Surat Thani's Phunphin district, which should be commissioned between 2027 and 2029.

Thailand is also looking at diversification of gas supply, owing to the impending expiration of gas supply contracts with countries such as Myanmar.

Electricity Generating Authority of Thailand (EGAT), Energy Regulatory Commission (ERC), PTT Public Company Limited comprising of PTT TSO and PTT LNG Co., Ltd, and Petroleum Institute of Thailand held a workshop via web conference in accordance with the Government's precautionary measures to limit the spread of Covid-19, to get prepared for the import of the second 65,000-ton LNG cargo slot in April.



Photo: EGAT

Workshop via web conference for planned LNG cargo import

On March 26, 2020, Electricity Generating Authority of Thailand (EGAT), in cooperation with Energy Regulatory Commission (ERC), joined a meeting via the web conference for preparation of purchasing the second spot LNG cargo. The meeting was chaired by Mr. Werasak Werathammo, Assistant Secretary General of ERC and attended by Mr. Prasit Siritiprussamee, Assistant Secretary General of ERC, Mr. Sahathape Thammatat, Executive Vice President of Natural Gas Transmission, Mr. Cherdchai Boonchoochuai, Assistant President, Gas Business Unit of PTT Pcl, Mrs. Ranee Kositvanich, EGAT Assistant Governor - Fuel Management together with executives and related officers of EGAT, PTT Public Company Limited, PTT LNG Co., Ltd, and Petroleum Institute of Thailand.

The EGAT Assistant Governor - Fuel Management said that the meeting aimed to call for preparation of importing the second spot 65,000-ton LNG cargo that will arrive at Map Ta Phut LNG Terminal, Rayong Province on April 21, 2020. This fuel was to be delivered to Bang Pakong Power Plant Block 5, Wang Noi Power Plant Block 4, and South Bangkok Power Plant Block 4. The preparation that was discussed included procurement process, power plant test, and coordination with related parties for the completion of the import.

During the COVID-19 pandemic, EGAT followed the Ministry of Public Health's precautionary measures to limit its spread. EGAT has worked with Petronas LNG Ltd. to make sure that the LNG shipment to Thailand is strictly in accordance with the regulations and rules of Department of Disease Control, the Ministry of Public Health and those of PTT LNG Co., Ltd.

A PTT Public Company Limited document has stated that PTT, in cooperation with EGAT signed an MOU on a feasibility study on the investment and development of infrastructure to support LNG import, or LNG receiving facilities in the South.

The study was in order to support the government policy and strategy on the power development plan (PDP2018), of which consisted of the Khanom Power Plant of Electricity Generating Public Company Limited with a capacity of 930 MW, Surat Thani Power Plant Units 1 - 2 with a combined capacity of 1,400 MW (to supply electricity to the grid (COD) in 2027 and 2029) and New Power Plant (COD in 2035) with a capacity of 700 MW.

The joint feasibility study on LNG receiving facilities aimed to support the import of LNG and ensure energy security in the future.



# FSRU ORCHESTRAL MANOEUVRES

“FSRU MARKET EXPECTED  
TO EXPERIENCE ABOVE  
AVERAGE GROWTH IN THE  
NEAR TERM.”



Photo: Exceleerate  
Exceleerate's FSRU Exemplar Returns to Bahia Blanca. The FSRU will deliver LNG to support Argentina in managing peak energy demand, while providing cost savings and emissions reductions

The demand for Floating Storage and Regasification Unit (FSRU) is anticipated to be high for the next few years according to a report by Business Industry Reports. This report studies the Global Floating Storage and Regasification Unit (FSRU) Market over the forecast period of 2020 to 2025. The Global Floating Storage and Regasification Unit (FSRU) Market is projected to witness an above-average growth over the next couple of years.

According to the market report analysis, rapid growth in the natural gas production, owing to the shale gas revolution and consequently falling prices, increasing global LNG trade and rising LNG import demand from power plant and automotive sectors are some of the factors driving the growth of the Global Floating Storage and Regasification Unit (FSRU) Market.

Exceleerate Energy LP (Exceleerate) announced that its floating storage and regasification unit (FSRU), the Exemplar has begun operations in Bahia Blanca, a port city located 400 miles south of the Argentine capital Buenos Aires. The Exemplar, with a storage capacity of 150,900 m3, will deliver liquefied natural gas (LNG) for the 2021 winter season in Argentina, providing reliability and stability to the country's energy system despite operating in the challenging conditions of the South Atlantic.

“We are excited to return to Bahia Blanca and continue our partnership with IEASA and YPF to deliver an energy solution that is flexible, cost-effective, and environmentally-friendly during a critical period of peak demand,” said Daniel Bustos, Exceleerate's Chief Commercial Officer. “We are confident the Exemplar can perform again with our local Argentine crew to support the country's energy transition and post-COVID economic recovery this winter.”

The return of Exceleerate's FSRU comes after the company won an international, competitive tender for seasonal regasification service in Bahia Blanca earlier this month. Exceleerate developed the Bahia Blanca GasPort, South America's first LNG import terminal in 2008 and has also operated GNL Escobar, an LNG import terminal along the Paraná River, since 2011.

Known as clean, flexible, and accessible, LNG helps countries like Argentina, reduce their dependence on carbon-intensive and more expensive fuel sources. Between 2016 and 2020, Argentina reduced its CO2 emissions by approximately 9.5 million tons through the use of LNG instead of diesel and other liquid fuels.

## ACCELERATING EXCELERATE

GTT SA subsidiary GTT North America has signed a 5-year Global Technical Services Agreement with the ship-owner Exceleerate Energy LP. GTT will support Exceleerate Technical Management (ETM) with the maintenance and operation of 9 FSRUs equipped with GTT's NO96 technology. This agreement includes GTT on-site technical assistance for inspection, maintenance, repairs, operations and engineering, as well as access to the HEARS emergency hotline, which enables ship-owners and their crews to contact GTT's experts 24/7 to respond to operational issues.

Philippe Berterottière, Chairman and CEO of GTT SA, said “We are pleased to have the opportunity to support a long

term partner like Exceleerate Energy in the efficient operations of their FSRUs. This agreement is pivotal to develop customised services, ensuring the performance and safety of each FSRU in operation.”

Edward Scott, Chief Operating Officer of Exceleerate Energy adds: “Exceleerate Energy looks forward to continuing a nearly two decades long relationship with GTT in direct support of our mission of providing safe and reliable world-class LNG services to our global customer base.”

For several years, GTT has enlarged its range of services to support the operations of LNGCs, FLNGs, FSRUs and other LNG-related structures in order to shorten dry-dock time, assist crews and assure operational efficiency. The company highlights its Smart shipping solutions development with the support of its specialised subsidiaries Ascenz and Marorka.

GTT has received an order from the Korean shipyard Daewoo Shipbuilding & Marine Engineering (DSME) for the design of a new floating storage and regasification unit (FSRU) on behalf of the Japanese ship-owner Mitsui OSK Lines Ltd (MOL).

The FSRU with a capacity of 263,000 m3 will be fitted with the NO96 membrane cryogenic containment system, a technology developed by GTT. The vessel delivery is scheduled in 2023. It will be located in Wilhelmshaven, Germany.

Philippe Berterottière, Chairman and CEO of GTT, said: “We are delighted to be working with DSME and MOL, two very long-term partners, on this new very large capacity FSRU project.”

## TECHNICAL ASSISTANCE FOR MEMBRANE

In an earlier development, GTT signed a Technical Assistance and License Agreement (TALA) with the Chinese shipyard WISON Offshore & Marine (WOM) for the equipment of Floating Liquefied Natural Gas units (FLNG), Floating Storage and Regasification Units (FSRU), Floating Storage Regasification Power units (FSRP) and LNG Carriers, using GTT membrane solutions.

WOM is a pioneer in floating LNG in China, being the first in the world to deliver barge-based FLNG and FSRU on a turn-key basis. WOM obtained its GTT license after having successfully completed a qualification process, including the construction of Mark III technology Mock-up.

This agreement will enable both partners to further expand their offer to ship-owners, to target new markets, especially focusing on floating based solutions, and to advance the development of LNG in the global supply chain.

Philippe Berterottière, Chairman and CEO of GTT declared: "We are pleased to count WISON among our new-building partners. We are very interested in developing and building together new LNG infrastructures which can provide innovative natural gas value chain solutions."

Mr. An Wenxin, President and Chief Operating Officer of WISON Offshore & Marine, said: "We are very proud to be licensed by GTT for Membrane technologies. This will allow us to offer more actively LNG solutions with GTT's technologies in China, which is what the market is asking for."

An analysis of the competitive landscape of the Global Floating Storage and Regasification Unit (FSRU) indicates the leading manufacturers to be: Excelerate Energy, Hoegh LNG, Golar LNG, BW Gas, Gazprom, FLEX LNG, EXMAR, DSME, OLT, MOL, Bumi Armada, Teekay amongst others. New product launches and continuous technological innovations are the key strategies adopted by the major players.

## TO PARIS WITH LOVE



Photo: BW Group *BW Paris will support the Philippines' ambition to be an LNG hub*

BW Group has entered into a 5-year contract with FGEN LNG Corporation for the charter of BW Paris, a Floating Storage Regasification Unit (FSRU).

BW Paris will play a role in ensuring the Philippines' energy security as part of First Gen's Interim Offshore LNG Terminal

for the First Gen Clean Energy Complex in Batangas City, Philippines.

Besides providing LNG storage and regasification services, BW Paris will support the Philippines' ambition to be an LNG hub through additional services such as the reloading of LNG into trucks and small-scale LNG vessels. This will increase LNG access to nearby industrial areas as well as the rest of the Philippine archipelago.

## BOTAS DELIVERED TO TURKEY



Photo: BOTAS *FSRU Ertuğrul Gazi is undergoing final regasification trials on site before commencing operations.*

The ABS-classed Floating Storage and Regasification Unit (FSRU) for BOTAS Petroleum Pipeline Corporation (BOTAS) has been delivered from South Korea.

Built by Hyundai Heavy Industries in accordance with the ABS Guide for Building and Classing LNG Regasification Vessels, the 295-meter-long Ertuğrul Gazi, which has capacity for 170,000 m3 of LNG, is now undergoing final regasification trials on site before commencing operations.

"As the world's leading provider of classification services in the LNG sector we are proud to support this important project for Turkey," said Vassilios Kroustallis, ABS Vice President, Europe Business Development. "By drawing on ABS' vast in-house experience, we were able to help HHI and BOTAS realise this project with an unwavering focus on safety."

With a daily gasification capacity of 28 million cubic metres (990 million standard cubic feet) per day, the new FSRU ranks among the vessels with the highest send out capacity in the world. Classed as a ship, following the ABS Guide for LNG Regasification Vessels, it is designed with the capability to trade internationally as required.

# OLAV NORTUN ELECTED TO NBAS BOARD OF DIRECTORS



Photo: Thome

Olav Nortun – NBAS

The Norwegian Business Association Singapore (NBAS) has elected Thome Group's CEO Olav Nortun to its board of directors and to its committee for Shipping, Offshore and Energy transition. NBAS is actively involved in promoting trade, investments, finance and industry between Norway and Singapore using the appropriate channels in both countries.

It also provides expert advice and information by staying connected with a variety of Singaporean, Nordic and Norwegian companies, stakeholders, partners, and customers. Close to 200 Norwegian companies are established in Singapore. These companies represent one of the highest concentrations of Norwegian business interests in any city in the world outside Norway.

## THE ‘SOFTWARE’

“The sheer size and scope of the gas-fired power and infrastructure projects that are being proposed, and the number and diversity of investors who have expressed interest, are like nothing the country’s power sector has ever seen”. That perhaps is what energy finance analyst, Thu Vu of the Institute for Energy Economics and Financial Analysis outlines in a report headlined as, “Beyond the Noise: Setting the Right Expectations for Vietnam’s LNG Project Pipeline”.

As a matter of fact, plenty of optimism does indeed flicker in the S-shaped peninsula. Just in 2020, the country’s highest-level policy setting body, Vietnam’s Communist Party Politburo set a strategic goal for Vietnam’s energy sector development with a vision to 2045. The overarching aim is to cap coal production for the rapid development of LNG-to-power capacity. The new policy targets annual imports of about 8 billion cubic meters of LNG by 2030, and about 15 billion cubic meters of LNG by 2045.

Just in the wording of the resolution alone, there is sufficient gravitas in what Vietnam is aiming at. According to leading law firm, Baker & McKenzie, “Resolution No. 55 of the Politburo on the orientation of the National Energy Development Strategy to 2030 with a vision to 2045 provides for the prioritization of fast and sustainable energy development, while aiming to foster favourable conditions for all economic sectors, particularly the private sector, to participate in energy development. The Resolution further aims to eliminate subsidies, monopolies, opaqueness, and unfair competition

in the energy sector. As next steps of implementing these strategies, Vietnam needs further progress on approving the new National Energy Master Plan and the new PDP8, together with a number of specific legal mechanisms and contractual frameworks following the government’s recently approved action program under government’s Resolution No. 140.”.

The elimination of subsidies, monopolies, unfair competition, and opaqueness, lies crucially at engaging the international community of LNG terminal and plant developers.

Work, continues Thu Vu, is already under way with the formulation of the National Energy Master Plan that sets the context for the Power Development Master Plan covering 2021-2030 (PDP8). The latest draft has so far proposed a fourfold increase of the current gas-fired power capacity to 28GW by 2030, or 21% of the system capacity. Most of the new capacity is expected to be fuelled by imported LNG.

Speaking to Fuels and Power, Joel Weiden, director of Corporate

Communications in VinaCapital, said in an email interview, “Vietnam’s draft Power Development Plan 8 identifies LNG for substantial development over the coming years, with 12.6 GW and 32.9GW of combined cycle LNG capacity to be added to the system through 2030 and 2040, respectively. The international project financing needs are substantial – we estimate that USD 30 billion project debt financing will be required to finance the construction of LNG power plants, with additional financing necessary for terminals and pipeline infrastructure”.

In further detail, the draft Power Development Plan 8 proposes that the total installed capacity of gas-to-power projects in Vietnam would reach 28.9-30.1 GW in 2030, generating a total of 126-147 billion kWh (22.7-24.7% of total nation-wide generated electricity). By 2045, Vietnam expects to increase the total installed capacity of gas-to-power projects to 66.5-83.9 GW, generating a total of 269.4-356.5 billion kWh (27.5-29.3% of total nation-wide generated electricity).

The draft Power Development Plan 8 also sets out the orientation to focus on the development of LNG terminals, storages, and import infrastructure at all regions to provide necessary fuel for LNG-to-power projects across the nation. Floating LNG Storages and LNG import storages in the West-southern are also included on the development course. While this draft Power Development Plan 8 is still under review and revision from the government of Vietnam, this stills demonstrates encouraging signals to potential LNG terminal and power plant developers.

Though floating storage regasification units (FSRU) have not specifically been identified by the government as a driver of economic growth, but it obviously plays a part in the development of LNG-to-power. Under Decision No. 60/QD-TTg dated 16 January 2017 of the Prime Minister on gas master plan to 2025 with vision to 2030, among others gas projects, LNG FSRU and related pipelines in Thai Binh are the very first steps of FSRU development in Vietnam. Until now, five LNG-to-power projects in Vietnam plan to use FSRU (e.g. 3,200 MW Bac Lieu LNG-to-power project), he concluded.

The PPP model is much a touted arrangement businesses use as it is effective in helping governments respond to rising demand for infrastructure-related services. According to the Asian Development Bank (ADB) by shifting the burden of capital spending to the private sector, PPPs can help governments do more with less.

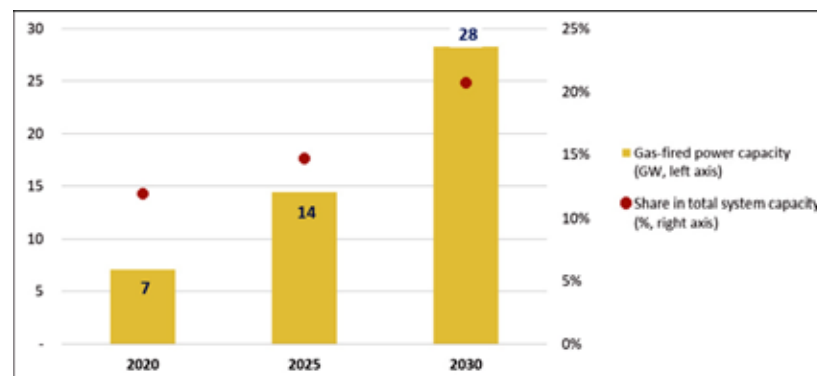
As it appears the nation is not sitting on its laurels. The passage of a new PPP Law called Decree 35/2021/ND-CP on implementation of PPP Law in early 2021 is an example. Under Decree 35/2021/ND-CP, any LNG-to-Power project that meets the minimum investment capital scale of VND 1,500 billion (approx., US\$65 million) may be eligible for electing the PPP investment form in Vietnam to enhance bankability for such large-scale projects.

The new PPP law allows PPP projects to enjoy certain investment incentives under the investment law. The salient features of the new investment law are the “special investment incentives” for certain types of preferential projects, which should cover LNG-to-power projects. The new laws allow the Prime Minister to offer a corporate income tax rate of up to 5% for more than 37 years as a “special investment incentive.” If an LNG-to-power project having an investment capital of at least VND 30,000 billion (US\$1.3 billion) commits to disburse at least VND10,000 billion (US\$433 million) in capital within three years following the project’s in-principle approval, it may be eligible to be considered for this special investment incentive. A draft decision of the Prime Minister has been prepared to provide implementation guidelines on the special investment incentives.

That is not where it ends. An equity transfer in a PPP project between existing shareholders is permitted – provided the lead investor retains at least 30%, and one other investor retains at least 15%. A transfer of equity to outsiders is permitted only after the construction is complete.

What may appear as being written in sand has undoubtedly raised concerns if they may adversely affect the right of lenders to enforce their security over the equity although that the equity transferee and the transferor in a PPP project must have an agreement with lenders as a pre-condition before such equity transfer is conducted.

Figure 1: Vietnam’s Gas Power Capacity To Quadruple by 2030



Source: Draft National Energy Master Plan (December 2020), Ministry of Trade and Industry.



# IEEFA: FINDING THE RIGHT FIT FOR LNG IN VIETNAM'S ENERGY LANDSCAPE

Investors and regulators in search of common ground

By THU VU

The stars appeared to have aligned spectacularly for a rush to create demand for liquefied natural gas (LNG) in Vietnam's growing energy market. The government's determined pivot away from polluting coal, a pressing need to find cleaner baseload-like alternatives, and the perception that gas-fired power systems are the perfect complement to the expanding yet intermittent renewable energy fleet, have helped position imported LNG as Vietnam's future fossil fuel of choice as domestic gas reserves deplete.

Like other countries, advocates have bombarded Vietnamese senior officials with the "clean transition fuel" narrative. Most of the time, these are traditional energy players trying to find a home for their surplus gas by encouraging the development of new LNG markets. Vietnam has responded by putting in place plans to have 18GW of LNG-based power capacity, or 13% of the system, by 2030, according to the draft Power Development Master Plan for 2021-2030 (PDP8). As a result, annual LNG imports are expected to hit 10 million tonnes by 2030, from zero today.

Industry players from across the domestic and global LNG value chain have welcomed the government's initiative with great enthusiasm. At a scale unseen, multi-billion dollar projects have been proposed across Vietnam's coastline, with each project sponsor hoping to secure a spot in the upcoming PDP8. A tight race has emerged among domestic state-owned energy companies, private corporations, and regional utilities from traditional LNG importing markets including Japan, South Korea, and Thailand. Investors from the United States, both global energy majors and some less experienced businesses, have also been prominent in the mix. Taken together, the pipeline of LNG-to-power projects initiated by investors to date has surpassed 100GW in size, outpacing by far the government's plans.

Despite the outpouring of interest, market insiders are conscious of the fact that enabling top-level policies and clear signs of local market backing are only the first, stepping stones to the development of Vietnam's LNG-to-power sector. The slow progress of the more advanced-stage projects is proof that much remains to be done

until project sponsors and Vietnamese regulators can reach an alignment on risk sharing and mitigation.

LNG is an entirely new industry for Vietnam and there is an absence of a clear legal framework and practice regarding LNG import, distribution, and LNG-to-power. Some of the key issues that will influence the project's ability to get off-shore financing are not explicitly permitted under the current legal regime such as fuel cost pass-through mechanism, take-or-pay obligation (for gas, electricity), government guarantees over the obligations of related state-owned enterprises, or having a foreign law as the governing law of contract, among others.

Perhaps the most critical building block for the market will be the agreement on initial gas offtake and power purchase agreements (PPAs). Notably, no maiden LNG-to-power project has yet concluded a PPA with the state utility Electricity of Vietnam (EVN). To date, the financial guarantees demanded by the sponsors to ensure project viability appear out of step with what the government is now willing to offer. On the one hand, almost two decades of successful partnerships with overseas sponsors and credit institutions in a series of coal and gas power projects provide a good track record for Vietnamese regulators to leverage. On the other hand, the rapid build-out of solar and wind power capacity in the past couple of years required very limited government involvement and risk-taking. These factors have reinforced the government's thinking on the minimal role it may take in protecting power projects from standard market risks going forward.

Vietnam's LNG-to-power projects could face years of development ahead. Still, over the next 12-18 months, market analysts and investors would be best served by monitoring progress on the key market building blocks that will define Vietnam's LNG future.

## PDP8 ISSUANCE TO INSTATE MARKET ORDER

Over the past year, the development and delayed passage of PDP8 have effectively extended the project development timeframe for LNG investors eager to scour the country and announce ambitious proposals, resulting in a chaotic picture and an inflated project pipeline. The issuance of PDP8, expected by the end of this year, will end this competition. It will narrow the list of LNG-to-power projects eligible for development in the next ten years and shift the market focus from site selection to the sponsor selection phase. A new era of partnership forging is then likely to commence as investors look for the synergies needed to form the optimal consortia to bid for a limited number of projects.

## RENEWABLE ENERGY AMBITION TO SET THE BOUNDARY FOR LNG

PDP8 issuance will also uncover Vietnam's ambition for renewable energy development in the next decade, which will influence the space left for LNG, and define the future role

of gas power plants in the system (i.e., baseload, mid-merit, or peaking). Vietnam has vast untapped solar rooftop potential and one of the region's best offshore wind resources, which global developers and financiers are equally keen to tap. PDP8's stance on renewable energy and storage solutions will indirectly set the terms for pipeline LNG-to-power projects. As recent data shows, a transition is already underway in Vietnam's generation mix, with incumbent coal and gas-fired power stations registering lower utilization rates as solar power dispatch grows.

## THE REAL PRICE TAG OF LNG

The Vietnamese regulators' work on LNG price discovery is also likely to encourage more realistic negotiations over the next 12-24 months, as more projects advance to the discussion stage with EVN, the single power offtaker. The set of conditions attached to the electricity price will ultimately define affordability and reliability, and the operational and financial flexibility of the new LNG-to-power stations. Disclosures so far by high-profile sponsors such as AES Corporation (in Son My 2 project) and EDF (Son My 1) suggest that in addition to the selling price ranging between USD0.089-0.097/kWh, experienced project sponsors are asking for financial guarantees and high capacity factors. These lock-in requirements, which the big players and their banks prefer, will effectively disable EVN from adapting to more cost-competitive technology options in the pipeline, including innovative new renewables and storage solutions.

## NATURAL GAS POLICIES OF THE MAJOR PARTNERS

In the meantime, politics will remain a factor. Several backers of LNG-to-power projects in Vietnam have leveraged support from former president Donald Trump's administration for the U.S. LNG industry to build credibility for their projects, promising the availability of U.S. public money to finance the projects. President Biden's upcoming new policy guidance on overseas fossil fuel financing is likely to change this dynamic. Analysts do not yet know if the Biden administration will opt for an outright exclusion of natural gas projects or subject them to more stringent eligibility criteria. Either way, project sponsors who were heavily dependent on the backing of the U.S. International Development Finance Corporation and Export-Import Bank to support their financing efforts may struggle to make a case for their projects if they must compete on more commercial terms. Simultaneously, Japan's draft new energy plan, which targets a 50% reduction in LNG-fired power generation by 2030, could incentivize more Japanese investment in Vietnam's import terminals and gas power stations, a demand-creation endeavor for their surplus LNG.

\*Thu Vu is an Energy Finance Analyst at IEEFA. The Institute for Energy Economics and Financial Analysis conducts research and analyses on financial and economic issues related to energy and the environment. The Institute's mission is to accelerate the transition to a diverse, sustainable and profitable energy economy. [www.ieefa.org](http://www.ieefa.org)

# NO GENERIC FSRUS

“ RECENT DEVELOPMENTS IN FSRUS INCLUDE REAL TIME MEMBRANE TANK MAINTENANCE AND CUSTOM-BUILT REGASIFICATION MODULES ”



Photo: Höegh LNG

The FSRU, as part of the LNG value chain and production cycle.

The FSRU (Floating, Storage, Regasification Unit) is an essential part of the LNG (liquefied natural gas) production cycle, value chain and proposition and has become ubiquitous in countries such as Vietnam, The Philippines, and some other Southeast Asian nations. It is vital to acknowledge the fact that the FSRU can be contextually viewed from the perspective of a vessel, as something akin to a standalone offshore floating, production, storage unit, or even as an LNG terminal.

Just where exactly does the FSRU fit, in the LNG value chain and trade cycle? It is an important part of the LNG-to-power model, where at the time of writing, there is a global oversupply situation which makes it an extremely attractive low

priced carbon fuel that can be used as an alternative to power electrical grids. It is also true generally that Southeast Asian Countries such as Vietnam, Singapore, and the Philippines have professed their ambitions to develop their economies into respective LNG trade hubs. It is an exciting time, for the LNG trade, to see numerous innovations that have been borne out of adverse conditions such as the Covid-19 crisis, which has placed tremendous pressures and stresses on crew management and changes in the marine and offshore sectors. For instance, the first instances of LNG ship-to-ship bunkering exercises have reportedly taken place in Singapore and in Japan.

The LNG trade has persisted throughout the better part of 2020, and there has been modest developments in the trade with reports of FSRU projects taking off in locales such as Maharashtra, Senegal and Brazil in Q1, 2021.

Essentially as a vessel, the FSRU can be reconditioned and modified, or repurposed from aging LNG carriers. The sturdy Moss type storage tanks of earlier LNG carriers are amenable to such kind of retrofitting. Latter day membrane type storage tanks have also found their place in LNG carrier newbuilds.

## REAL TIME MEMBRANE TANK MAINTENANCE

GTT has obtained Approval in Principle (AiP) from Bureau Veritas, a world leader in testing, inspection and certification. The Approval is related to the use of a digital solution for sloshing activity assessment in the Framework of Class Survey in order to optimise the LNG membrane tank maintenance frequency. This digital solution is based on GTT's "Sloshing Virtual Sensor" technology, using the tank "digital twin", also designed by GTT, and the real-time operational data of the floating units (FSRU, FLNG and LNGC) to monitor the evolution of critical parameters with regards to the tank integrity. Combined with an appropriate risk analysis, the solution can support Alternative Survey Plans aiming at optimising the tank maintenance while complying with strict safety standards. This will translate into increased operational flexibility and substantial cost saving for the ship-owners.

Philippe Berterottière, Chairman and CEO of GTT, said: "Artificial intelligence combined with the expertise of GTT's teams has made it possible to develop a unique digital solution to optimise the frequency of tank maintenance, while guaranteeing the highest safety standard. With this new cutting-edge digital solution, GTT is putting its innovation

and technological know-how at the service of shipowners, in order to help them adapt to an increasingly demanding commercial environment."

Matthieu de Tugny, Executive Vice President Marine & Offshore at Bureau Veritas, added: "Digitalisation combined with artificial intelligence is a major transformation for the shipping industry bringing new challenges and opportunities. I am proud Bureau Veritas helped GTT to pioneer this digital solution for sloshing activity assessment in the framework of class survey (using sloshing model tests, real-time operational data and machine learning) with the highest safety standards. This demonstrates not only our technical expertise in the fields of sloshing for gas carriers but also our strong competencies in digitalisation and artificial intelligence. Our role remains more than ever to help the industry understand - and address - both risk and opportunity as we look into future technologies."



Photo: Höegh LNG

The FSRU together with a LNG carrier at the terminal.

Other FSRU implementations consist of a 'FSU' vessel or stationary barge, in combination with a separate "regasification" unit 'docked' at the LNG terminal. Regasification units can also be installed on the LNG vessel itself.

Korean shipyard Daewoo Shipbuilding & Marine Engineering (DSME) has given an order to GTT for the tank design of two Floating LNG Storage Units (FSUs), the largest such units ever built, on behalf of the Russian company GTLK. Each FSU will have a capacity of 361,600 m3 and will be fitted with the NO96 GW membrane cryogenic containment system. Their delivery is scheduled for the end of 2022. These two FSUs will be located respectively in the Murmansk region and in the Bay of Kamchatka in the Russian Federation. They will be employed in the Arctic LNG project of the Russian LNG producer Novatek.

The FSRU consists of components such as tanks, unloading arms or hoses, regasification unit and heating medium. While conceptually simple, a FSRU conversion brings to bear complex technical skills and cross disciplinary know-how.

## REGASIFICATION



*The Wärtsilä modules, here being move onto a barge, were delivered from the Cosco yard to arrive in Shanghai in time for the scheduled launch of the vessel. Copyright: Logistic Plus.*

In another development, Wärtsilä has successfully managed and completed delivery of three large-scale regasification modules for China's first new built LNG Floating Storage Regasification Unit (FSRU). The vessel, the 'Transgas Power', was built at the Hudong-Zhonghua shipyard in Shanghai for Greek operator Dynagas. Delivery of the modules was completed on March 28, 2020 and the FSRU was launched two days later.

Wärtsilä designed the modules and sourced the required equipment, including valves and instruments, from suppliers around the world. The contract to fabricate the units was awarded to the Cosco shipyard in Qidong, China in September 2018. The work has been managed and coordinated from Wärtsilä's office in Asker, Norway. The completed products were delivered on time and with high quality.

"Building Regas modules is something of a jigsaw puzzle. However, thanks to detailed planning, excellent teamwork, open communication, and great cooperation we delivered the project to the client's full satisfaction and on schedule. We always aim to be the best possible partner to our customers, which apart from offering technical solutions at the

highest level, involves listening closely to the client, and striving always to fulfil his expectations," says Project Manager Geir Kirkemo, Gas Solutions, Wärtsilä Marine.

The three regasification modules weigh 450, 80, and 240 tonnes. In addition, Wärtsilä also supplied related regasification equipment comprising pumps, heat exchangers, valves, and instrumentation for installation in the engine room. A second FSRU being built at the same yard for Dynagas, also features Wärtsilä regasification modules.

The original contract with Wärtsilä was signed in September 2017. The regasification system supplied is based on the use of seawater and steam as energy sources, and water/glycol as the energy carrier in a combined loop. The plant consists of three trains, each with a capacity of 250 million standard cubic feet per day (mmscfd) or approximately 500 m3/h, and a common suction drum.

Managing FSRU projects has its fair share of complexities and quite frequently merges the technical disciplines. As with other contracts, it requires the timely delivery of system components by suppliers, and it is important to distinguish between the scope of the main contractor that handles the maintenance and operations, the time charterer, regulatory bodies and administration, joint venture partnerships and energy or utilities provider. It takes skill and planning to effect smooth handover or phasing in of respective involvement, at the right time.

## IN A CLASS OF ITS OWN

Bureau Veritas has published its Rules (NR645) in 2017 for the classification of Floating Storage and Regasification Units (FSRUs) in response to industry demand and following close engagement with FSRU stakeholders.

The BV rules enable the classification of all types of floating storage and regasification assets in a comprehensive and pragmatic manner by building on Bureau Veritas' extensive experience in the LNG sector.

The rules set out technical requirements to address the technical and operational issues of FSRUs. These requirements span demand for units that may operate as a floating terminal for one or more decades to FSRUs that may be required for much shorter periods and whose operators may want the option of trading as an LNG carrier.

The rules address this range of needs while applying a unified approach to safety and design challenges and providing clarity in terms of classification requirements by offering two distinct class notations:

## LIQUEFIED GAS CARRIER -FSRU NOTATION

Based on rules for the classification of LNG carriers this enables gas trading in addition to floating storage and regasification terminal operations. The notation provides the possibility for exemptions from the traditional class survey regime - such as five year dry-docking survey requirements - when the vessel is in use as an FSRU.

## FSRU NOTATION

This notation is for units dedicated to pure gas storage and regasification terminal operations and not intending to trade. It provides full optimisation for site conditions and a class survey regime as applicable to permanent units with continuous operation requirements. No dry-docking would be required and some exemptions from IGC Code requirements compared to typical LNG carriers are allowed. For example, no bottom damage stability requirements would be necessary having addressed specific operational circumstances.

Jean-François Segretain, Marine Technical Director, Bureau Veritas, commenting on the new rules said, "FSRUs are a special market with both 'marine' and 'offshore' approaches and requirements involved. So, FSRU projects raise a lot of questions from all stakeholders. These new rules take into account the specific technical, regulatory, operational and environmental requirements of FSRU stakeholders to provide a much higher level of confidence when making significant commercial decisions."

## INDIA'S NATURAL GAS AMBITIONS

Indian Register of Shipping (IRClass), has classed India's first LNG-FSRU (Floating Storage Regasification Unit) marking a milestone in India's energy shift towards natural gas. Constructed at Hyundai Shipyard in Ulsan,

South Korea, the 180,000 cu.m FSRU which is flagged in India, is designed for continuous operations without the need for drydocking over a period of 20 years. The unit is assigned class notation for 20 years extended interval between successive dry-dockings and complies with the requirements of IRClass Rules and Indian Flag for this purpose. The unit is owned by Triumph Offshore Pvt Ltd., a wholly owned subsidiary of Swan Energy Ltd, an India-based listed company.

The vessel can operate in two distinct modes – LNG Carrier Mode and Floating Storage Regasification Unit (FSRU) mode. This allows the utilisation of a FSRU for receiving LNG from LNG carriers, regasification of the LNG and sending it out.

The vessel complies with the recently updated Rules of IRClass applicable for LNG carriers provided with regasification systems and takes into account various risks associated with such systems by appropriate risk control measures. The updated IRClass Main Rules for Seagoing ships, covers the requirements for regasification systems in a separate chapter addressing various aspects such as systems design, fire safety, emergency shutdown arrangements, survey and testing requirements etc. The vessel has also been verified with respect to the requirements of the IGC Code and IRClass Rules for Gas carriers.

With strong government support and improved infrastructure in India, the prospects for natural gas are expected to rise significantly to meet growing energy demands in the country. This is also in line with the Indian government vision to build a gas-based economy and increase the share of natural gas in the primary energy mix to 15% by 2030, up from 6% today. This will also contribute towards IMO's aim of reducing GHG emissions.

"As we anticipate energy demand to soar in India, it is important to move towards the use of clean energy to meet that need. Undertaking this project demonstrates our commitment towards a greener future, and we at IRClass are delighted to play an essential role in meeting that goal." Commented IRClass' Joint Managing Director Vijay Arora.



# BAC LIEU LNG-TO-POWER PROJECT: OFFSHORE ENERGY INFRASTRUCTURE



Photo: Stena

Jetty-Less LNG receiving and regas technology

Stena Power & LNG Solutions has agreed to a Technology License Agreement with Delta Offshore Energy (DOE) to grant utilisation of its proprietary Jetty-Less LNG receiving and regas technology for the offshore LNG to power project located in the Bac Lieu Province in Southern Vietnam.

DOE will employ Stena's Jettyless Floating Terminal (formerly ATS) and Self-installing Regas Platform (SRP) solutions to provide energy to the 3200MW power plant project located at Bac Lieu province in the Mekong Delta.

Svein Hellesmark, Chief Technology Officer, Stena Power & LNG Solutions, said: "We are honoured to play a key part in this important and large-scale energy infrastructure project in Vietnam. This award demonstrates the trust DOE and its partners have in our Jetty-Less LNG technology.

"We have been cooperating closely with DOE on this ground-breaking project for more than two years which has been an extraordinarily interesting and inspiring journey.

"At Stena we offer innovative solutions across the LNG value chain. Our Jetty-Less LNG technology is complemented by considerable LNG competence and experience in new-building project support, ship management and marine engineering."

Bobby Quintos, Managing Director - Engineering, Delta Offshore Energy added: "The metocean and tidal conditions in Bac Lieu are very challenging from a traditional FSRU deployment perspective, so we had to collaborate with Stena to think of 'out of the box solutions' in order to make this work, thus the development of the Jetty-Less solution for our project. The additional benefits of a lower CAPEX and modular design

also fits nicely to the DOE model of innovation and efficiency in our LNG to Power Solutions. We are very pleased to work with Stena to usher in the next technological evolution in offshore LNG re-gas terminals."

## FEEDING ENERGY

Stena Power & LNG Solutions has been awarded a contract by Delta Offshore Energy (DOE) to provide front-end engineering design (FEED) for usage of Stena's jettyless LNG transfer and regasification solutions.

Svein Hellesmark, Chief Technology Officer, Stena Power & LNG Solutions, said: "The FEED agreement is a pivotal milestone in our service provision to Delta Offshore Energy for this important, large-scale energy infrastructure project in Vietnam. "Our Jettyless LNG to Power technology has been created to meet demand for more flexible LNG import and export terminals, such as is required for the hugely exciting Bac Lieu LNG to Power Project.

"At Stena we offer innovative, integrated solutions across the LNG value chain. Our wide-ranging activity in the sector also includes new-building project support, ship management and marine engineering, all underpinned by our ethos that gas should always travel first class."

Bobby Quintos, Managing Director of Delta Offshore Energy added: "The Jettyless Floating Terminal and the Self-Installing Regas Platform are key components of our LNG-to-power solution for Bac Lieu. They allow us to position the LNG receiving terminal offshore, and thereby to minimise the project's impact on land and on the coastline of Bac Lieu. This is a benefit of great value to the province because the coast sustains shrimp farms, mangroves and salt beds, all of which are important to the regional economy and environment. Our ethos at Delta is to provide power for progress, and the JFT and SRP will help us do so in an efficient and economical manner."

The JFT and SRP will be located approximately 40km off the Vietnam shoreline. The FEED will include detailed model testing to ensure optimum performance with the environmental conditions in the Mekong Delta.



Photo: Stena The JFT unit contains all the required equipment, systems and safety features normally installed on a jetty.

## JETTYLESS FLOATING TERMINAL

The Jettyless Floating Terminal (JFT) meets the industry's demand for lower cost and more flexible LNG import and export transfer solutions. The JFT unit contains all the required equipment, systems and safety features normally installed on a jetty. It can be adapted for all LNG carriers from small distribution/bunker vessels to the largest existing LNG carriers. Designed

to cope with wave conditions, the semi-submersible unit ensures high operational regularity, and requires low operational expenditure as no propulsion, additional large machinery or manpower between loading operations is required.

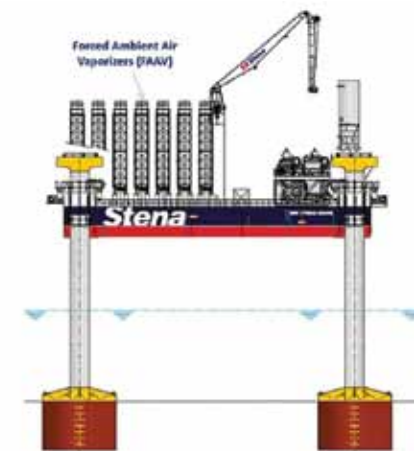


Photo: Stena A cost effective, flexible and robust LNG solution

## SELF-INSTALLING REGAS PLATFORM

The Self-installing Regas Platform (SRP) offers a cost effective, flexible and robust LNG regasification solution, capable of meeting increasing demand for small, mid and conventional size LNG receiving terminals. The SRP solution utilises robust jack-up platform technology combined with an industry proven and trusted LNG regasification system. With the legs rooted to the seabed and the platform situated well above the waterline, the SRP is not exposed to wave loads and motions as is common with traditional LNG regasification barges and FSRU's. This ensures optimum regasification and gas delivery regularity.

Stena Power & LNG Solutions AS is a Stena subsidiary located within Stena's Ship Management and Marine Services entity: Northern Marine Group. Stena Power & LNG Solutions is the owner of innovative Jetty-Less LNG to power solutions including the Jettyless Floating Terminal (JFT), the Self-installing Regas Platform (SRP) and the Self-installing Power Plant (SPP). The solutions are particularly suited for the emerging LNG to power market where there may be limited or no existing infrastructure in place. The Jettyless technology is enabling the possibilities to import LNG and provide power to new markets without the need for any fixed infrastructure (no jetty - no breakwater). The floating solutions are ideal for flexible financing and lease offerings. The entire facilities may also be relocated if the demand or other local conditions should change over time. The Jettyless technology is covered under a US Patent granted by the United States Patent Authorities in 2018.

Delta Offshore Energy PTE LTD ("DOE") is a Singapore registered company focused on project origination and development in clean energy. DOE is the owner of the 3.2 GW Bac Lieu LNG-to-power project ("the Project") which was included in Vietnam's national Power Development Plan 7 revised ("PDP7R"). DOE received the Investment Policy Decision and the Investment Registration Certificate to be the exclusive owner of the Project which is the largest Foreign Direct Investment in Vietnam in 2020. The project is also the first coal-to-gas conversion in Vietnam, the first integrated LNG-to-power project in Vietnam, Vietnam's first approved 100% foreign IPP in thermal power plant as well as the country's first floating LNG terminal.

# CYPRUS LNG PROJECT

## BLUEPRINT FOR THE FUTURE?



Picture: LR The conversion of a 2002-built LNG carrier, Galea, at Cosco Shipping Heavy Industry in Shanghai, could well provide an example for many island communities, and even small countries, which lack energy resources of their own but wish to embark on a decarbonising transition process.

The 137,000 m<sup>3</sup> Galea, originally built for Shell Singapore, is now being converted into a floating storage and regasification unit (FSRU) that will transform the energy backdrop on the island of Cyprus when the unit is deployed later this year, or early next. Work is in progress at Cosco Shipping Heavy Industry in Shanghai.

The ship's conversion is central to a deal, partly funded by the European Union, which should slash the island's cost of electricity, reduce carbon emissions, improve air quality and provide energy security for more than two decades. Ultimately, it could provide the path to a low-carbon or even zero-carbon energy future.

LR has been closely involved in the project since it first became a possibility in 2017. Since then, it has involved bringing together Cygas, the Natural Gas Public Company of Cyprus, China Petroleum Pipeline Engineering – which

will own the FSRU – and the Cyprus Electricity Authority in Vassilikos.

### MAJOR FUNDING SUCCESS

The development is the most expensive infrastructure project ever undertaken by the Cyprus Government. Through the project vehicle, CYnergy, which was established by the Government, LR and a team of consultants including experts from the classification society, a total budget of about €290 million was agreed for the investment, of which the European Union is funding €101 million through its Connecting Europe Facility.

The converted FSRU will be moored alongside a purpose-built jetty at the gas import terminal in Vassilikos. From there, gas will be piped to shoreside LNG infrastructure with links to the country's energy grid until 2046.

Today's very high electricity costs for the island's consumers – both private and industrial – are likely to fall sharply as a result of the energy initiative, with a notable impact on the local economy, the geopolitical stance of the island in the Eastern Mediterranean region and its appeal of the island as a business location. It will also facilitate a new energy hub for industries including shoreside transport, shipping and logistics.

Cygas Chairman, De Symeon Kassianides, commented on the LR's long commitment and support for the project which, he said, was instrumental in raising the necessary finance. "LR's contribution to the CYnergy project proved essential to its success," he said.

"Thanks to their efficient dealing with tight schedules and requirements, the project was instrumental in enabling DEFA [the country's Natural Gas Company] to secure €101 million of EU funding for the subsequent implementation phase."

LR's Global Gas Segment Manager, Panayiotis Mitrou, has been closely involved in the project since the start. He sees a model that could be adopted in many regions which lack indigenous energy resources and are exposed to wide fluctuations in energy prices. He points to the global abundance of gas, rapidly increasing volumes shipped by

sea, a series of new long-haul and small-scale trades, and its low cost.

### TOO MUCH GAS?

He highlights the new LNG trains coming on stream in locations including Australia, Qatar, Russia and the US. Despite the pandemic, more front-end engineering designs get the go-ahead and the number of final investment decisions continues to rise. Ultimately, without more consumers, the world could have too much gas.

"All this gas needs to be channelled to markets," he says. "And we see growing interest in many countries in using FSRUs for LNG imports. The oversupply of gas requires more entry points, and FSRUs provide a quick and cost-effective way of providing the infrastructure that is required. We see a substantial uptake in the FSRU sector."

Mitrou highlights another project in which LR is currently involved in Greece. The country's Copelouzos group has set up the company, Gastrade, to develop and operate a new FSRU at Alexandroupoli in the north. The unit is likely to be built in China.

The Greek gas grid operator, DESFA, has recently become a Gastrade shareholder as well as Bulgaria's Bulgartransgaz, which has taken a 20% stake in exchange for a gas offtake commitment when the newbuild unit is commissioned.

### NOT THE FINAL ANSWER

Although Mitrou is a staunch advocate of LNG as an energy source, he is also well-aware that the fuel is not the final answer to the world's decarbonisation goals because it is still a hydrocarbon. Nevertheless, he insists that it is an essential transition fuel, and has a series of benefits that are available immediately today.

In the longer term, he points out, the fuel has the potential to provide many further carbon-reducing options. Green liquefaction is one example, this involves the liquefaction of gas using renewable electricity but will require the integration of the power generation and LNG sectors, which traditionally work quite separately. It has the potential to

reduce significantly the well-to-wake emissions profile of the LNG that is used today.

Ultimately, as new fuel technologies develop, Mitrou believes that it will become possible to use LNG as a hydrogen carrier by separating the carbon and hydrogen atoms, enabling the use of hydrogen as a carbon-zero fuel. Much of the world's LNG infrastructure which will exist by then, he suggests, can be developed and adapted for hydrogen fuel development.

## LR BLAZES LONG TRAIL IN FLOATING GAS

LR's track record in all aspects of LNG transport by sea, and more recently its production offshore, sets the classification society apart as a safety and assurance pioneer in the field. From the early days of containment system design and the cryogenic technology required to ship LNG at -162°C, to the very latest offshore production facilities to develop gas reserves in ultra-deep waters under the sea, LR has provided constant and reliable support for the sector.

The Brunei LNG plant, the first in the western Pacific, opened for business in 1973. By then, LR was already involved in the design and classification of the first four LNG carriers to service the plant – the so-called G-class of 77,731 m<sup>3</sup> vessels built in France. The ss Gadinia loaded her first cargo there in 1973 and was deployed constantly over her 45-year life in the carriage of LNG from Brunei to Japan. She was only sold for recycling in 2018.

Over that ship's lifetime and in the few years since her passing, the global LNG business has undergone an astonishing transition, enabling gas as a fuel to contribute nearly a quarter of the world's primary energy requirements in 2019, according to the most recent issue of BP's Statistical Review of World Energy.

The Review also notes that LNG exports grew by their largest margin ever in that year, the latest for which comprehensive figures are available. Exports grew by 54 billion cubic metres, equivalent to an increase of 12.7%.

Today, LR has the largest share of LNG carriers in its class, with more than 160 vessels in total and over 50 carriers in the popular 170-180,000 m<sup>3</sup> range, either in service or under construction. The class society has overseen the installation of more than 60 separate reliquefaction systems and has pioneered 20 major gas 'firsts' over the years

LR has developed strong LNG sector links with South Korea where it has been involved in the construction of more than 120 newbuildings. The class society is currently overseeing the construction of 29 new LNG carriers, 24 of them at Hyundai Heavy Industries where it has classed 57 LNG tankers.

The class society's offshore and energy experts have also played an integral risk assessment and assurance role in construction of some of the most prominent LNG projects so far. And it has established an important lead in floating LNG, which is widely seen as a potentially faster and cheaper option to land-based plant in some locations.

LR has provided advisory, assurance and classification services for 11 floating LNG projects so far. They include the world's largest offshore floating plant – the Shell Prelude production facility in Australian waters – and the Browse Basin project, also in Australia, a joint venture between the plant operator, Woodside Energy, Shell Australia, BP Developments Australia, Japan Australia LNG and PetroChina International Investment.

Meanwhile, LR's team in South Korea is closely involved in the assurance and classification of the world's first ultra-deep floating production facility at Samsung Heavy Industries' Geoje Shipyard. ENI's Coral South facility for deployment off the coast of Mozambique will harness gas reserves under the ocean bed in water depths of more than 2,000 metres. The hull was launched at the shipyard in January 2020 and is due to be commissioned in 2022.

Recent developments have meant a new LNG focus for LR – this time in China. The classification society is involved in a project for a new FSRU to be located in northern Greece, as well as the Galea conversion for Cyprus.

# INVENERGY, BW LNG: FINANCING OF FSRU FOR TRANSFORMATIVE LNG-TO-POWER PROJECT

“ BW TATIANA IS  
CENTRAL AMERICA'S FIRST  
FLOATING STORAGE AND  
REGASIFICATION UNIT  
(FSRU), LYNCHPIN OF LIQ-  
UEFIED NATURAL GAS  
(LNG)-TO-POWER PROJECT  
THAT WILL MEET 30% OF  
EL SALVADOR'S ENERGY  
DEMAND ”

Global sustainable energy developer Invenergy and global liquefied natural gas (LNG) solutions provider BW LNG today announced that they recently closed a \$128.3 million financial package with IDB Invest to finance the special-built floating storage and regasification unit (FSRU) component of the Energía del Pacífico (EDP) LNG-to-power project in El Salvador.

The financial package has a 15-year contractual term granted to FSRU Ltda. de CV in El Salvador. The funds provide valuable resources for the purchase and conversion of the BW Tatiana LNG carrier to an FSRU. This is the region's first FSRU, which will be permanently moored at the Port of Acajutla, Sonsonate, El Salvador. Invenergy and BW LNG will jointly commission, operate and maintain the FSRU.

“The close of financing for the FSRU represents a significant step forward in the completion of the transformational EDP project, the foundation for El Salvador's clean energy future,” said Meghan Schultz, Senior Vice President, Finance and Capital Markets at Invenergy. “This landmark, multi-component project is only made possible through the collaboration and support of our incredible partners. We are pleased to partner with BW LNG and IDB Invest as they share our commitment to innovation and excellence, and our vision to provide affordable, reliable energy to the region.”

“BW is grateful for the opportunity to bring clean, affordable energy to the region, with the support of Invenergy and IDB Invest. Besides enhancing this project's competitiveness, we hope this financing encourages the development of many more LNG-to-power projects in the region,” said Jessica Cheung, Vice President, Group Treasury & Corporate Finance, at BW Group.

A key part of the EDP project, the FSRU will have a regasification capacity of 280 million standard cubic feet a day and an LNG storage capacity of 137,000 cubic meters. Regasified LNG will be transported via a subsea pipeline to the onshore 378-megawatt (MW) natural gas-fired power plant. A 44-kilometer, 230 kV electric transmission line will connect the power plant's output to the Central American Electrical Interconnection System (SIEPAC), strengthening the region's electric grid.

Upon its completion in 2022, the EDP project will meet 30 percent of El Salvador's energy demand with cleaner, reliable power through power purchase agreements with seven of the country's distribution companies. EDP's use of natural gas will reduce the country's reliance on imported diesel and heavy fuel oil-fired generation, resulting in significant environmental benefits for the region.



# UNMATCHED EXCELLENCE

“ VIETNAM IS POISED  
FOR A POWER BOOST  
FROM AN LNG-TO-POWER  
PROJECT BEING DEVELOPED  
BY US-BASED ENERGY  
CAPITAL VIETNAM (ECV) ”

For David Lewis, the Chairman and CEO of US-based Energy Capital Vietnam (ECV), the key to successful development of an LNG-to-power project in Vietnam has been an uncompromised pursuit of excellence, especially in the quality of project location.

Since ECV's founding in 2015, Lewis and his team have established deep relationships within the government to prepare for the now imminent opportunity given the forthcoming release of Vietnam's Power Development Plan VIII (PDP8).

Lewis is confident ECV's Mui Ke Ga (MKG) LNG-to-power project will be included in PDP8 because, its superior location in Binh Thuan province represents one of the best in all of southern Vietnam and just a few hours from key manufacturing centres outside Ho Chi Minh City.

“ECV's project location and technical design are the result of years of due diligence and expert research,” Lewis said. “Our design incorporates proven mooring technology and common vessel sizing models, and a site survey conducted by the World Bank/International Finance Corporation (IFC) identified MKG as the ideal location in southern Vietnam for an import terminal to deliver fuel and power at the lowest cost.”

ECV spent 2018, in evaluating possible locations across southern and central regions in concert with continuous diligence discussions among relevant stakeholders

in Vietnam. In subsequent consultation within the Ministry of Information and Trade (MOIT), it became clear that proximity to evacuation points for primary demand would be a key driver given that it also represented less line-loss during electrical transmission.

With the Politburo having designated Binh Thuan province as the future energy hub of the South, and the province already receiving robust infrastructure investment, government support and multiple grid connection access points were readily available. The key priority was to identify which land areas enabled the easiest access to waters, benign and deep enough to facilitate efficient and reliable fuel delivery.

In September 2019, ECV signed an MOU with the People's Committee of Binh Thuan Province to develop a fully private, multi-phase LNG-to-power complex in MKG, which will produce up to 3,600 megawatts (MW) of power using 3 MTPA of LNG. The project will utilise a Floating Storage and Regasification Unit (FSRU), which, bathymetry and extensive metocean studies showed, would provide the most economical solution for importing LNG. The FSRU will connect via subsea pipeline to an onshore power complex.

“MKG represents an ideal project for an FSRU to facilitate efficient and reliable fuel delivery,” Lewis said. “Stable waters with a depth of 20 meters will allow our FSRU solution and connectivity to support maximum project operational capacity onshore.”

In March 2020, ECV delivered a comprehensive pre-FS package for the MKG location, inclusive of Provincial pre-approvals for land and sea rights, to MOIT officials. Pre-FS review and approvals by numerous Ministries resulted in an in-principle approval from the Prime Minister for MKG to be added into PDP8.

The land site agreement provides more than 120 hectares of coastal land and 40 hectares of sea rights, with an ability for expansion as needed. MKG's seawater rights will enable

robust import capacity given the open lanes to deep water shipping. MKG will connect to the grid via 500kV double circuit lines 4xACSR330 near 500kV substation.

ECV has assembled a world-class consortium of partners to develop MKG:

- Deutsche Bank is engaged as structuring bank for debt capital.
- Marathon Capital is engaged to source equity capital.
- Siemens Energy is providing technical and strategic support for FEED preparation.
- Exelon is providing development and operations support for the power plant.
- Black & Veatch is retained as owner's independent engineer.
- Gunvor and ECV are forming a trading joint venture to source LNG supply.
- Mauis is engaged to advise on capital structure and risk mitigation via insurers and financiers.
- KPMG is providing tax guidance.

ECV's position – being in the right place at the right time – has Lewis confident that bright days are ahead, for the company and for Vietnam.

“Vietnam has proven itself attractive for foreign investment with consistent GDP growth above 6%, low inflation, and a stable currency,” Lewis said. “Vietnam also represents an untapped market for LNG as the country shifts away from coal and hydro for baseload supply while experiencing annual growth in electricity consumption nearing 10 percent. ECV saw this coming and has been on the ground since 2015 preparing for this energy transition opportunity.

# NEXT GENERATION CRYO-POWERED REGAS SYSTEM FOR FSRU

In recent years, environmental awareness has been on the rise, and liquefied natural gas (LNG) has been attracting attention worldwide, as a clean energy source. Demand for it is expected to increase in the future. However, construction of onshore LNG receiving facilities requires huge amounts of initial investment and a long construction period. Therefore, Floating Storage and Regasification Unit (FSRU) is attracting attention, especially in countries new to importing LNG. FSRU is a facility that not only receives LNG, but also stores and regasifies LNG, as its name suggests. This article gives an introduction to the technical specifications of MOL FSRU CHALLENGER (Fig.1) - the world's largest FSRU owned and operated by MOL- and the Cryo-Powered Regas System - a new generation FSRU system that MOL has newly developed in collaboration with Daewoo Shipbuilding & Marine Engineering (DSME) which will reduce fuel usage and environmental impact of FSRU operations.



Fig.1 MOL FSRU CHALLENGER

## MOL FSRU CHALLENGER

The main specifications of the Vessel are as follows.

- It is the world's largest FSRU with 5 Cargo tanks and a volume of 263,000 m<sup>3</sup>.
- Nominal send out rate of high pressure natural gas (NG) is 540 MMSCFD (540 million ft<sup>3</sup>/day).
- For low send out demand, the system's high pressure compressor can boost the boil-off gas (BOG) in the tank for sending out to the onshore receiving facility.
- The vessel's power generation and propulsion system is powered by dual-fuel diesel power generation + electric propulsion system (DFDE, Dual Fuel Diesel Electric Propulsion).

## BASIC OUTLINE OF REGASIFICATION FACILITIES

One of the FSRU's main aspects is the regasification facility, a plant for regasification of LNG. This section describes the overall flow of the regasification facility. Fig. 2 shows the layout of regasification equipment on the Vessel, and Fig. 3 shows the regasification flow.



Fig.2 Arrangement of regasification related equipment

- (1) Submerged pumps in cargo tank  
FSRU has three types of pumps in each cargo tank. The cargo pump is used for the transfer of LNG between tanks. The stripping/spray pumps are used for tank cooling and dredging of liquid remaining in tanks. The medium-capacity regas feed pump, is used to deliver LNG to the regasification facility.
- (2) Recondenser/Suction Drum  
The Recondenser/Suction Drum is located between the cargo tank and the High Pressure/Small High Pressure pump in the LNG supply flow and serves as a buffer tank for safe operation of the pump. It also serves to re-liquefy part of the BOG generated in the tank.

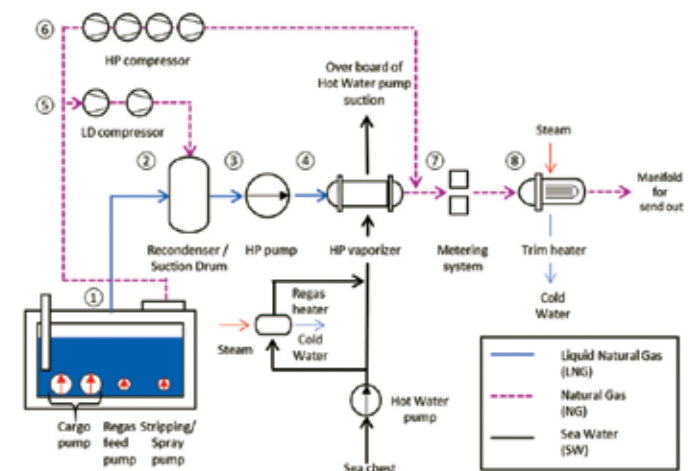


Fig.3. Regasification Flow

- (3) High Pressure (HP)/Small High Pressure (SHP) pump  
The HP/SHP pump increases the pressure of LNG from 4 bar to about 120 bar to meet the pressure required by the onshore NG receiving facility.
- (4) HP vaporiser  
The HP vaporiser plays a role in regasification of LNG to NG and is the most important equipment for regasification. MOL FSRU CHALLENGER uses a Shell and Tube type heat exchanger as shown in Fig. 4. Sea water is sent to the Shell Side as a heating medium, and the LNG passing through the Tube is heated and regasified to NG. The seawater used in this system is cooled when the LNG is regasified and discharged into the sea (Open Loop Mode).

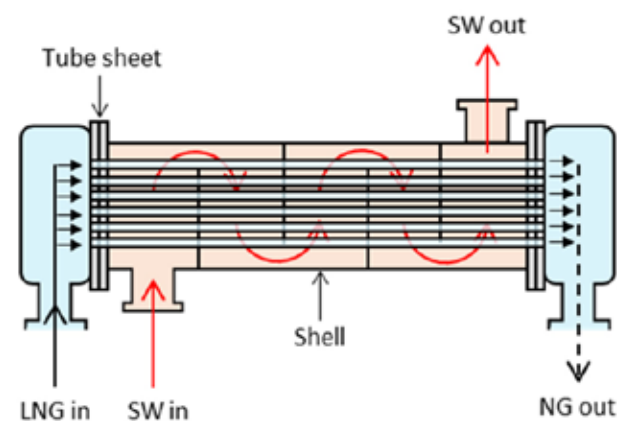


Fig.4 Shell and Tube Type Heat Exchanger Schematic

#### - (5) Low Duty (LD) compressor

The LD compressor supplies BOG from the cargo tank to the DFDE and boiler as fuel. It also supplies BOG to the Recondenser.

#### - (6) High Pressure (HP) compressor

The HP compressor increases the pressure of the BOG generated in the cargo tank and sends it out to the land as high-pressure NG. This operation is performed during demand off-season when a minimum amount of NG is required from the receiving facility. By sending out BOG, the accumulated pressure in the tank can be adjusted.

#### - (7) Metering unit

The metering unit measures the gas flow with an ultrasonic flow meter and samples the gas components using gas chromatography.

#### - (8) Trim water

The trim heater is responsible for heating the NG to the specified temperature, which can be heated by steam if the temperature of the NG is lower than that required by the project.

## NON-DRYDOCK FOR 20 YEARS

In the design stage of this vessel, MOL worked hard to achieve 20 years of non-docking and specifications to achieve an

annual availability over 98.5%. While regular vessels are regularly docked in the shipyard for repair work, the vessel is designed so that maintenance can be carried out at site. Some of these are introduced here.

- The equipment and cargo pipe system are separated so that the regasification operation and maintenance of a specific cargo tank can be performed simultaneously.
- Because the vessel is basically designed to be moored at all times without sailing, the bottom paint for preventing growth of marine organisms is kept to a minimum. On the other hand, extra rust preventive paint is applied since the vessel will not be entering dry-dock for repainting.

## CRYO - POWERED REGAS SYSTEM

MOL FSRU CHALLENGER adopts a direct seawater regasification system (Fig. 5) in which LNG is regasified from LNG to NG by direct heat exchange with seawater. In this system the cold heat of LNG is not utilised.

The new technology Cryo-Powered Regas System (Fig. 6), co-developed by DSME and MOL, recovers the cold heat of LNG to generate power by incorporating an Organic Rankin Cycle (ORC) into the conventional regasification process. Since power is generated during the regasification process, the fuel consumption amount and the CO2 emissions of an operating FSRU can be reduced by up to 55%.

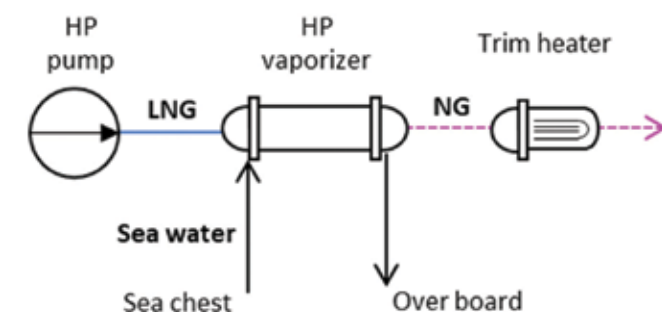


Fig.5 Schematic of direct seawater regasification system

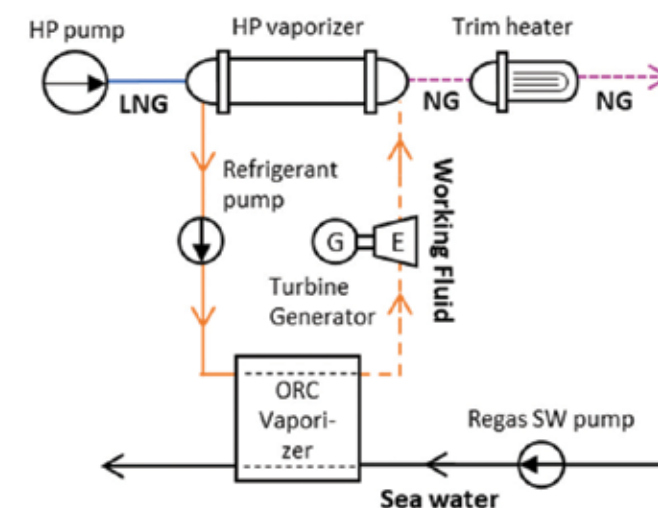


Fig.6 Schematic of Cryo-Powered Regas System

This technology has secured the official approval of the classification society (Fig. 7) and the Cryo-Powered Regas System is ready to be introduced to the market with confidence.

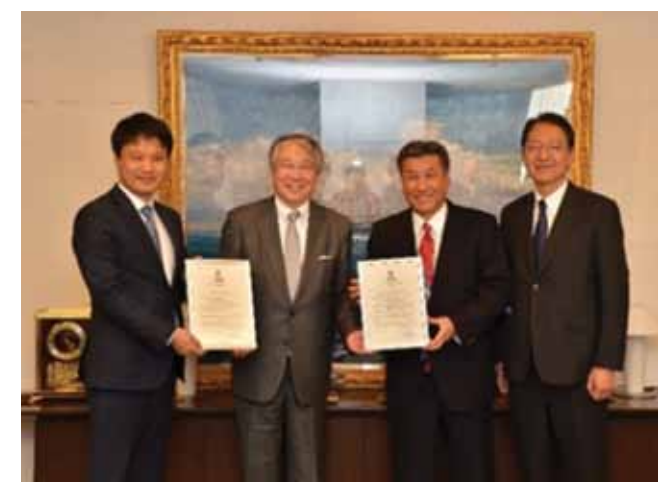


Fig.7 "Approval in Principle (AIP)" certificate acquisition from classification society

In the ORC, by using an organic heat medium with a low evaporation temperature as the working heat medium, it is possible to generate power efficiently through the regasification process.

As shown in Fig. 6, the organic heat medium vaporised by the ORC Vaporiser is used in turbine generators as a working fluid to drive turbines. The higher the temperature of the seawater, the more, turbine inlet pressure can be increased. This improves the efficiency of the ORC and enables the system to obtain greater power. Thus, this technology is best fit for projects in tropical and subtropical regions where the temperature of the seawater is high.

The Cryo-Powered Regas System is believed to be a promising technology, in regions where demand for LNG-to-power projects and environmental awareness are increasing.

## SUMMARY

This article gives an outline and description of the FSRU, and its future technology based on knowledge attained through the operation of MOL FSRU CHALLENGER.

The key takeaways are as follows:

- The regasification process for an FSRU.
- MOL FSRU CHALLENGER is designed so that 20 years non-dry docking is possible.
- MOL has developed the Cryo-Powered Regas System for regasification. It has a higher energy efficiency and less environmental impact, forming a basis for market leading, next generation FSRU specification. MOL intends to contribute to the preservation of global environment through eco-friendly technologies.

This article is an editorial contribution by Yuta Morimoto in FSRU Project Team, Offshore Technical Division and Kyohei Oka and Junko Baba in FSRU Team(A), Offshore Gas Project Division, MITSUI O.S.K LINES, LTD. with the cooperation of Daewoo Shipbuilding & Marine Engineering Co., Ltd. Petromin Fuels & Power wishes to express its sincere thanks to its authors.



# DIGITAL TECHNOLOGIES ENABLE METHANE REDUCTION EFFORTS

“DIGITAL INNOVATION  
IS A KEY ECONOMIC,  
ENVIRONMENTAL  
OPPORTUNITY FOR THE  
OIL AND GAS SECTOR”

The deployment and adoption of digital technologies across the oil and gas value chain could help scale the impact of industry’s methane reduction efforts, finds a report by Environmental Defense Fund, in collaboration with Accenture Strategy. While early adopters are using digitalisation to gain a competitive advantage operationally, few of the world’s major oil and gas companies are using these solutions to reduce emissions of methane, a potent greenhouse gas.

The paper, Fueling a Digital Methane Future, examines how innovations such as automated asset management, predictive maintenance and industrial internet of things (IIoT) can help prevent the annual loss of \$34 billion a year in leaked, vented and flared methane, the primary component of natural gas.

“The oil and gas industry has embarked on an exciting digital transformation that will make operations more efficient and reduce waste across the board,” said Isabel Mogstad, a methane mitigation expert with EDF+Business and former management consultant at Schlumberger. “Leaving methane mitigation out of this evolution would be a major oversight and a tremendous missed opportunity to improve operations and address stakeholder concerns.”

According to the research, digital innovations have the potential to unlock more than \$1.5 trillion in economic, environmental and societal value across oil and gas operations. As more operators set methane targets or begin their methane management journey, digital innovations can support the realisation of company goals.

“As the oil and gas industry seeks to deliver affordable and sustainable energy in a disruptive and low carbon context, managing methane emissions intentionally and effectively needs to be a priority,” said Muqsit Ashraf, senior managing director, Accenture Strategy, Energy. “Digital technologies can accelerate methane reduction; delivering significant economic, environmental and societal gains that will boost the industry’s trust quotient and competitive agility.”

The analysis defines four stages of digital methane maturity—ranging from having no methane mitigation strategy to using advanced capabilities such as big data analytics, machine learning and advanced sensors to

enable prediction and prevention of leaks before they even occur. After a company diagnoses its position on the methane maturity continuum, the authors recommend opportunities for digital projects at every stage.

The paper also identifies three ways companies can incorporate methane management into their existing digital architecture:

- Predictive asset management: shifting from time to condition-based management using historical and real-time data
- Ecosystem convergence: integrating digital platforms between vendors and customers to improve accountability, reduce costs and provide operational transparency
- End-to-end network management: optimising gas systems through automated interventions and pattern analysis to minimise leak-inducing events

“Momentum to reduce methane emissions is building through industry commitments, a growing market of cost-effective solutions and sensible regulations,” added Mogstad. “But it’s not enough to solve one of the oil and gas sector’s biggest challenges. For companies to stay competitive in a decarbonising world, they need to integrate methane solutions now, while they are deploying or scaling their broader digital initiatives—not after their digital agendas are set.”

# GAZPROM NEFT: DIGITAL REFINING-PROCESS CONTROL

Gazprom Neft's Omsk Refinery is improving the efficiency of its catalytic reforming\* complex (under a project developed by Gazprom Neft industrial-automation subsidiary Avtomatika-Servis) using digital production management. This move towards new management standards forms part of the plant's modernisation of its catalytic reforming complex, designed to allow the company to respond more flexibly to market demand.



Photo: Gazprom Neft

System makes it possible to collect and process information on all parameters governing the operation of a complex.

Using more than 4,000 sensors, the new system makes it possible to collect and process information on all parameters governing the operation of the complex automatically, track changes, and prevent emergencies. The system is equipped with a "smart" safety module, as well as the most advanced emergency protection equipment currently available.

"We are utilising the best solutions — including digital — in modernising the Omsk Refinery. Oil-refining industry technologies have, today, reached the highest level, so developing a digital environment for accumulating data on technological process-flows in a single, cohesive system means we can align production management in a way that is efficient and effective, increasing plant reliability as well as facilities' industrial and environmental safety," says Oleg Belyavsky, Director General, Gazprom Neft Omsk Refinery.



Photo: Gazprom Neft

Oleg Belyavsky, Director General, Gazprom Neft Omsk Refinery

"The work of the Omsk Refinery's technological facilities today involves hundreds of complex engineering systems, IT solutions and automation tools. All of these operate consistently and reliably thanks to control system that ensures the safety and efficiency of every single technological process. Gazprom Neft is always working on developing these systems, developing a single, inclusive production-control environment, step-by-step," says Rustem Mufteev, Director General, Avtomatika-Servis.



Photo: Gazprom Neft

Rustem Mufteev, Director General, Avtomatika-Servis

Avtomatika-Servis is a Gazprom Neft engineering-service subsidiary, specialising in the design and deployment of digital and automated systems for the company's logistics and refining facilities. Avtomatika-Servis' key areas of activity include control and instrumentation equipment, APCS, integrated manufacturing execution systems (MES), and high-tech digital solutions. The company's service facilities include more than 250,000 pieces of specialist equipment. The first ever Technopark beyond the Urals operates from within Avtomatika-Servis, offering a unique forum for the development and testing of industrial automation solutions.

Gazprom Neft is currently implementing a full-scale modernisation programme at its Omsk and Moscow refineries, involving cumulative investment of more than RUB550 billion. The first stage of modernisation involved the full transition to the exclusive production of Euro-5 fuels. The implementation of the second phase of the modernisation programme is ongoing, as a result of which the conversion rate and the production of light petroleum products will increase to match the highest international standards.

\* Reforming is an industrial process for refining gasoline and naphtha oil fractions to obtain high-octane gasoline components, resulting in the octane number increasing from 60 to 95.

# MAKING THE ENERGY TRANSITION



“ SANDY GWEE IS PRINCIPAL CONSULTANT (ENERGY AND SMART CITIES) AT NRI SINGAPORE. SHE IS BASED IN SINGAPORE AND REPORTS TO KAZAUKI OHARA, PRESIDENT OF NRI SINGAPORE AND HEAD OF CONSULTING. IN AN EXCLUSIVE INTERVIEW WITH PETROMIN FUELS & POWER, SANDY GWEE SHARES HER INSIGHTS ON THE ENERGY TRANSITION AND CARBON NEUTRALITY, AS IT AFFECTS THE SHIPPING INDUSTRY. ” GOH TZ'EN LONG REPORTS.

It is our understanding that Singapore aims to be an LNG hub, but is also looking at supporting the development and needs of alternative fuels such as liquefied ammonia and hydrogen. It aims to adopt a holistic approach...

- What are your views on this? How do you feel about a holistic approach to achieving zero carbon emissions? When looking at the fuels, which type of fuel should ship designs be based on? LNG, ammonia or hydrogen, or other types of biofuels?

o Firstly, it is important to note that IMO regulations have not been aligned to the Paris Agreement. Secondly, this energy transition will consist of a myriad of energy solutions and diversification as no prevailing technologies or fuels have emerged as the only few sources to power the world economy reliably and sustainably. The race towards net-zero will also mean that many innovative technologies are being developed and competing to be the most efficient and scalable – and many policy makers and adopters have yet to make final decisions.

o Climate change is a global crisis and Singapore is likewise not free from the challenges and impact that other countries face as well. As the world transitions to a carbon neutral future, Singapore must balance between challenges, such as decarbonising all sectors, and ensuring that it has a reliable and affordable energy supply without unwanted inflationary pressures impacting to livelihoods. To sustain its competitiveness on a long-term basis as one of the global maritime and bunkering hubs, Singapore has to build readiness to serve the increasingly diversified fuel preferences, including emerging low-carbon technologies such as hydrogen. By considering future fuels scenarios, Singapore will be able to maintain the long-term security and sustainability of its own energy supply that is geared towards its aspiration of establishing a greener economy as mapped out in the 2030 green plan. This is because low-carbon technologies such as

hydrogen produces water as the only by-product when it is being used to generate energy. As a clean-burning form of energy resource that exists alongside with fossil fuels in Singapore, this is one way that will allow Singapore to gradually shift away from carbon-intensive sources of energy. Further, this also provides an opportunity for Singapore to play a key role in supporting energy transition on a regional and global basis.

o A holistic approach to transitioning towards a clean energy shipping sector, will require a significant shift from fossil fuel-powered transport to energy-efficient designs and renewable-energy powered technologies. The contribution of renewable fuel sources to the energy mix of the shipping sector, however, is limited in the near and medium timeframes even under the most optimistic scenarios, and this is largely due to high technology cost, fuel switching cost and supply-chain constraints including infrastructural readiness on a global basis. For instance, the development of renewable energy solutions for the shipping industry in Singapore has been hampered by a few factors, such as the availability and suitability of ship-board technologies like fuel storage and supply systems, as well as energy converters.

o Since the carbon emission produced by Liquefied Natural Gas (LNG) is lower than fossil fuels, ships should adopt hybrid solutions that include both LNG and alternative fuels as their energy source. Overall, if we were to choose amongst different fuel-types to be used for ship-designs, it would have to be based on economic and other non-economic considerations such as the potential for technological improvement, safety and environmental aspects, the range (nautical miles travelled by ships), ease and availability of refuelling and maintenance. Given the more foreseeable scenarios in the medium term, LNG and biofuels remain more viable as transport fuels for large-scale deployment, as compared to hydrogen and ammonia due to technological cost and policy uncertainties. The scaling challenges of such advanced fuels should eventually resolve on a longer-term basis as observed in the maturing phase of solar and wind power development. In a recent IEA report on net-zero roadmap, it has proposed shipping as one of the leading sectors for hydrogen and ammonia application in a net-zero scenario.

As a short to intermediate term measure, ship designers have opted for “hybridised” engine solutions where it is possible to run both LNG and diesel, for example...

- What are your views on hybrid engine solutions as a means to reduce emissions?

o Given that LNG refuelling network development is at its infancy stage, the deployment of cleaner engines could be hampered. Therefore, hybrid engine solutions will be the best interim solution to encourage ship owners and operators to begin decarbonisation now, particularly to serve a growing need from corporates that are combining low-carbon or net-zero emission plans. As technology for ships are advancing towards utilising clean

fuels such as hydrogen, ammonia and electrification of ships, there is still uncertainty in terms of technical and commercial viability, including policies around the adoption and usage of such fuels and technologies. Having the flexible fuel option removes the technical constraints, allowing the deployment of cleaner fuel choices that could further encourage LNG supply points and increase the speed of displacing diesel in ports. Having the choice of LNG means that the ship will emit less carbon when compared to a ship that is fully operated by diesel, as LNG has a more complete combustion, thereby releasing lesser by-products.

- With regards to the ship designs of the future, do you think there should be more development along the lines of ‘electrification’, which could result in hybridised fuel cell vessels for ‘short sea’ trips, for example?

o There should be more development along the lines of ‘electrification’ as that will allow cleaner and/or green energy to be utilised for hybridised fuel cell vessels. Other merits can be derived from electrification; according to one technology provider, the electrification of hybridised fuel cell vessels will also mean that systems can be better optimised and ensure efficient energy usage through analysis powered by AI. Therefore, the ‘green electrification’ of vessels is definitely beneficial in reducing the carbon footprint and should be strongly encouraged for vessels conducting ‘short sea’ trips.

o Green electrification of ships should be made affordable as such demand will arise from environmental-conscious end-users and corporates that have made net-zero goals, thereby seeking to decarbonise their supply chains. Decarbonisation of ‘short sea’ trips will also be crucial given more frequent trips from shore to shore. The shorter range would also ease refuelling challenges faced in a ‘long haul’ trip.

Among the low carbon and alternative fuels, LNG is one of the most widely adopted, and has arguably the most stable and developed supply chains... although it is still being called out for shortcomings such as methane ‘slippage’. We note that countries such as Thailand, and Vietnam have invested heavily in LNG based solutions to their intermediate and long-range energy needs...

- Do you feel this is a good strategy? What kind of strategy should shipping adopt in relation to low carbon and alternative fuels, or even zero carbon fuels...?

o In achieving low-carbon economic development, it is imperative that both Thailand and Vietnam have invested heavily in adopting LNG as a cleaner fuel to displace coal and oil for power generation and industrial use. While there is an increase in methane slippage reported in marine transport use, there is merit in LNG bunkering which further enhances the business case for affordable LNG to displace coal and diesel power generation, and other uses across the economies.

o For shipping, given the present fuel options, LNG and biofuels seem to be the most viable solutions in the interim



until hydrogen and ammonia development matures and become cost-competitive fuels. Shipping should commence decarbonisation now; adopt a pragmatic approach to engage stakeholders regionally and globally in this energy transition, where not only common goals are set, and also agree on the adoption of cleaner fuel choices and time frame for net-zero goals. For instance, the International Advisory Panel (IAP) recently formed during the Singapore maritime week, could set some guidance on what could be deployed within reasonable costs to produce the least possible carbon emissions. The industry should be open to switching to clean energy sources as economically and structurally viable.

**Given that there are vessels still running ‘diesel’ even as we speak about issues such as ballast water treatment and ‘scrubber’ systems and the need to meet low sulphur emission standards, etc.**

- **What is a realistic strategy for shipping to adopt to achieve zero carbon in the shortest period of time?**

- o The path towards net-zero for the shipping industry will require shared goals and plans aligned with key stakeholders:

Firstly, IMO could work closely with governments on aligning net-zero goals and energy transition plans, particularly to reflect the Paris Agreement. Governments will need to implement effective carbon taxes and carbon markets to account for emissions in the near term, and support companies in accelerating green technology innovation and adoption. Related to this, government can explore public private partnerships to accelerate technology development, targeting the high cost of new energies such as advanced biofuels, hydrogen, fuel cells capacity and battery technology. Secondly, for shipping companies to explore the fast expansion of electrification and hybridisation of ships which enable advanced sensors and AI systems for seamless energy efficiency optimisation, and emission reductions. Thirdly, energy producers should ensure the accessibility (affordability, availability and adequacy) of low-carbon fuels such as liquefied natural gas, biofuels, hydrogen, and ammonia. As such, the path to net-zero in the maritime industry hinges on conscious efforts required by different stakeholders in the ecosystem to strive for a common goal of carbon neutrality.

**“The future of shipping will rely heavily on sustainable solutions to meet environmental and profitability goals.”**

- **Would you like to share your thoughts on this statement?**

- o With the shipping sector looking for more sustainable options, it is expected that there would be a growth in low carbon energies such as hydrogen and renewable energy. LNG will continue to play an important role as a transitional cleaner fuel for many years to come, until alternative green energies are commercially viable to support a decarbonised world. As the maritime industry seeks to fulfil its goal of low to zero emissions, it will require innovation of efficient energy storage technology

fit for long-haul ships. Furthermore, the current production cost of advanced biofuels, hydrogen and ammonia are prohibitive as a transport fuel, and engine adaptation and innovation will also take time to mature. Until such a time, carbon offsets can be applied to support decarbonisation efforts and enabling corporations to begin decarbonising their supply-chains.

- o There have also been steps taken internationally to drive the shift towards sustainability. The International Maritime Organisation (IMO) has initiated a few initiatives to ensure sustainable energy for all, such as the Global Maritime Energy Efficiency Partnership, which encourages interaction between global, regional and national partners in order to increase maritime energy efficiency. IMO has also established the Global Industry Alliance to support low carbon shipping, as well as the Global MTCC Network project, which provides technical assistance and capacity building for countries to effectively implement energy efficient measures.

- o Locally, as Singapore is exploring to make the energy transition towards hydrogen as its main source of fuel, it needs to take into account the various safety measures that will allow for safe transportation and storage of hydrogen. These measures include pipeline protection, leak detection features, and routine inspections of the pipeline. Thus, the transition to sustainable solutions is likely to be costly in the short term, but it will allow the shipping industry to retain its attractiveness and competitiveness as a sector in the long run given the world’s shift to carbon neutrality.

**According to SPGlobal, Maersk shipping has recently proposed a carbon tax on ship fuel of at least \$450 per ton fuel (\$150 per ton CO2), a levy to bridge the gap between the fossil fuels consumed by vessels today and greener alternatives that are currently more expensive.**

- **What do you think of this proposal and do you think it will work?**

- o When priced optimally, a carbon tax will effectively account for the negative externalities that comes along with carbon emissions from shipping. The tax collected will be helpful in a few aspects; firstly, to provide the necessary funding to mature green technology development and scale the deployment to improve the cost and economics as seen in the solar power deployment. Secondly, the carbon taxation levels the playing field for shipping companies that adopt cleaner energy sources and technology with those that maintain the status quo. It is also worth noting that maritime leaders such as Maersk are taking the leadership role in transforming the industry and energy transition to carbon neutrality, and other leading companies will likely follow suit particularly when the demand for carbon-neutral supply chain continues to forge forwards globally. Therefore, a proposed carbon tax is helpful in spurring other companies to make the green or lower-carbon transition, but it will need to be priced correctly to encourage energy transition and taking into consideration inflationary effects from fuel switching.

## LEGAL WATCH

# M.V. EVER GIVEN: A POSTSCRIPT

*By Dr. (Capt) Vivek Jain*

## Introduction

In March, the MV Ever Given, a 200,000 MT container ship, capable of carrying 20,000 TEUs ran aground in a part of the Suez Canal. The ‘mishap’ was enough to cause considerable hand wringing. The Suez Canal – that vital waterway connecting East/West trade routes – was closed for around six days. In an ancillary the grounding blocked some 10-12% of global trade.

The vessel was finally salvaged using mud excavators with the assistance of powerful tugs. The salvage operation needed to lighten the vessel by offloading 20,000 containers from the vessel.

After the salvage operations, the vessel was awaiting inspections at Great Bitter Lake (a lake in between Northern and Southern part of the Suez Canal) for signs of any damage to hull, and for collating evidence that could assist the investigators to find the cause of the grounding.

The vessel was enroute to Rotterdam after loading in China in the month of March 2021. Such types of vessels usually carry the cargo/finished products/spares for consumers in Europe/US for Easter Holidays and other industries. Such type of trade takes advantage of supply chain and costs in China and carry the goods/spares following ‘just in time’ concept to Europe/US, where they purchasing power is relatively higher.

This incident raises some intriguing issues in maritime law, particularly of salvage, marine insurance and claim from the Suez Canal Authority (SCA). The vessel

was detained for over 3 months by the SCA until a settlement was reached. It seems settlement was reached at an amount way below the SCA’s initial demand and yet the vessel was detained for months at stretch. In addition, there are commercial issues that need the attention of global managers, and such issues pertain to supply chain for businesses and the need to diversify them from one country, or one region.

SALVAGE

Salvage is payable provided it is proved that the property of ship (valued at about 100 million) and cargo (about 500 million) was at danger. If only the vessel MV Ever Given was exposed to danger and not its cargo, then the cargo owners and their insurers would not be liable to pay for any salvage. It will be a matter that will require extensive nautical analysis.

Most salvage claims will be paid by the Hull and Machinery Insurers and the salvage remuneration payable to multiple salvors will depend on the duration of salvage operations and to some extent the costs involved in carrying out those salvage operations. The other salvage remuneration must be paid by the cargo insurers or cargo owners (if they are self- insured). There are no issues of pollution that arise after this maritime incident. However, for the sake of completeness, the 1989 Salvage Convention created a right to special compensation for salvors in respect of salvage efforts that served to prevent or minimise environmental damage.

In this case, the subject matter of salvage was the vessel itself. The other is property of bunkers. Cargo that was on board the vessel, and even if any freight at risk at the time of the accident. For the sake of completeness, freight paid in advance is not the subject matter of the salvage. The master and crew on board the vessel were not on risk, so likelihood of the issues of life salvage was negligible. From news reports, it seemed the salvage was successful and the SCA had ordered special excavators and powerful tugs from abroad.

The pertinent issues for analysing the issue of salvage are:

- The vessel was stuck between the two ends of the channel and was grounded. Therefore, there was a

real danger to the vessel and/or clear case of future or contingent danger. The elements of salvage were present and any party that has rendered the services of salvage nature to the vessel can in theory claim salvage remuneration.

- In theory, the master and crew had contributed to the salvage operations and accordingly, may be due for some remuneration. The rights of Master and crew to claim salvage remuneration exists even if they were initially at fault for causing the maritime incident or even if they were under any obligations to assist the salvors.
- It is quite possible that even if the Egyptian government authority’s assets were used in the salvage operation, and if they had provided services far and above the duties expected of them, then they too can in theory claim salvage remuneration.
- Even the owners of any tugs or assets provided by SCA that were merely standing by until the salvage was completed too can claim salvage remuneration. Local authorities such as the Suez Canal Authorities or the Egyptian Navy that provided assets even just for standing by could in principle claim salvage.

While professional salvors that came from Europe will likely claim salvage under ‘No Cure No Pay’ under Lloyd’s Open Form (‘LOF’), or BIMCO forms, the Egyptian salvage providers would have likely provided salvage services pursuant to the Egyptian Law. The author cannot comment whether the settlement with the SCA included this element of remuneration or not. However, this will be a factor for future salvage arbitration/litigation with non-Egyptian salvors. How the salvage remuneration would be calculated is likely to be a complicated exercise and the author believes that it could involve protracted litigation in various jurisdictions.

Any successful remuneration is only possible if the services rendered were successful. The factors for assessing the salvage award are likely to be decided pursuant to Article 13(1) of 1989 Salvage Convention. Such factors will include – value salvaged, skills and efforts in preventing and minimizing environment damage, measure of success, salvors’ skills,

time, and expenses/losses incurred by salvors, the risk of liability and other risks undertaken by the salvors, the promptness of services rendered, the availability and use of the vessels and state of readiness and efficiency of salvors’ equipment and the value thereof. Additionally, the salvage arbitrators or courts could consider the different degree of danger that the hull and cargo were exposed. For example, if some cargo that could have perished was saved, then, the contribution by them could proportionally be more from the salvage fund made up of ship’s value, cargo value, value of containers, value of bunkers, value of outstanding freight. Immediately after the successful salvage operation, the vessel was detained by the Egyptian Authorities.

Important nautical issues relevant to most legal issues

For many other issues, following nautical facts would have to be analysed deeply to arrive at the legal conclusions:

- I. Was there a failure of steering gear on the vessel?
- II. Was there a sudden black-out on the vessel due to failure of machinery on board the vessel?
- III. Was there a sudden gust of wind creating a “sail effect” due to containers that were stacked very high on the vessel?
- IV. Were the Master and crew unable to deal with sudden emergency?
- V. Was there a breakdown in communication between the pilot &/or the SCA authorities and the Master on the vessel?
- VI. Were the crew and the Master selected appropriately by the ship management company that oversaw crewing and technical management of the vessel and/or lack of shore management responsible for such a state on board the vessel?

VII. Was there a possibility of suction effect due to width of the vessel as compared the width of the channel?

VIII. Were there sufficient systems and gears available within SCA to deal with such emergencies?

IX. Were the Master and crew incompetent and/or lacked certifications and/or lacked proper briefing?

X. Was the vessel unseaworthy?

XI. Were there any demands made by the pilots from the vessel as has been observed customarily in many ports and even in Suez Canal?

This author’s initial analysis of location of the maritime accident reveals that vessel was not inside the Suez Canal for a long time, and if the weather was supposed to be not suitable for such kinds of vessels, the Suez Canal pilot’s or authorities should not have allowed the transit for the vessel. This issue is ripe for lots of lengthy arguments for maritime lawyers from both sides. Also, it was noted that powerful tugs were called from abroad to assist in the salvage operation as the magnitude of the operation was quite vast.

Seafarers’ issues

Lastly, it is hoped the seafarers on board MV Ever Given are treated as innocent until proven guilty. Seafarers are already suffering mentally and physically due to Covid-19 and their detention for bargaining inflated claims after detention had put immense stress on their well-being. There are clearly human rights issues involved, while the focus of powerful stakeholders has been on claims, what went wrong, the effects of the incident on the stakeholders, while the same stakeholders have completely ignored the human rights issues not only on this incident but in other similar incidents as well.

# LIGHTS OUT, VIETNAM!

The Vietnamese are known to be a friendly, helpful, and kind. But that is only up to a point, until you find out why and how they laid land mines and punji sticks to entrap unsuspecting US forces during the War that ended in 1975. But then that was war, and one is not expected to be nice during war. One must be mean and tough, like in the drinking of snake wine. So, Vietnam cannot be a nation for animal lovers. They may be kind but for an ordinary dog in the street, it is a dog's life!

It is a downright 'difficult' place peopled, oddly, by easy-going inhabitants.

But the thing about the S-shaped peninsula is that it has industrious people. They are not of the Calypso-type of rum, reggae and dancing their future away as is seen in some parts of the world. That is beyond them. They are serious about what they do, and serious about giving a thumping reply to anyone trying to tweak their noses.

Some 98% of their population is literate making it easy for visitors.

As may be for a nation of close to 100million they almost now seem powerless on how to have electric power, in a nation where blackouts can happen even in the middle of a conference, dinner or even during childbirth. That is the other oddity apart from hunting for snakes in the wild or asking personal questions.

So much for a communist revolution that after gaining victory on the altar of huge sacrifices they are back to being in the dark all over again. There is now, as it seems, an earnest quest to crawl out of that self-inflicted darkness and show the world that Hanoi too, is a global citizen of sorts.

LNG providers and vendors from East and West are making a beeline like never; save even of the bees being swallowed.

But what the pandemic had done is the kind of favours the nation does not need. Pending projects have been pushed back as far as they could be. Some have even been cancelled. To everyone's despair there is not a single FSRU yet at the time of writing. Plans are only beginning now and that too, is mired in complexities because of the sheer difficulty of getting the 'software' off the ground for nothing more than that FSRUs involve plenty of stages of development, from upstream, midstream, downstream, intra-stream etc.

Yet the problem for Vietnam is that even if the pandemic ends now as you read, the absence of foreigners armed with the knowledge, expertise, finance, and experience will only mean a delayed timeline for LNG receiving terminals and gas-to-power infrastructure.

Simply put, it will be a season of blackouts, and more blackouts. The future of a nation should be brightly lit. And not appear in the dimmest and remotest way possible.

The Vietnamese cannot be faulted for not doing anything to fix the problem. They are doing something. But they just seem to be in the dark over it.

Turn on the Lights, Vietnam. Everybody wants to see clearly ahead, and a vision is needed in every sense of the word.

# NOMENCLATURE

**BOG:** Boil-off gas

**FSRU:** Floating, Storage and Regasification unit

**HP:** High Pressure

**IFV:** Intermediate Fluid Vaporiser

**K.O:** Knock out LNG liquefied natural gas

**LP:** Low Pressure

**MTPA:** Million tonnes per annum

**ORV:** Open Rack Vaporiser

**PFD:** Process Flow Diagram

**RAM:** Reliability, Availability and Maintainability

**STV:** Shell and Tube Vapour

**BCFD:** Billion cubic feet per day. A flowrate or production output of typically natural gas commonly used in North America.

**BCMA:** Billion cubic metres per annum. A flowrate or production output of natural gas commonly used internationally.

**CLOSED LOOP:** Circulation of heating medium (typically glycol/water) for LNG regasification in heat exchangers.

**HOSES:** Cryogenic hoses used to transfer LNG at ca. minus1620C). Used mainly for ship-to-ship transfer as an alternative to more expensive mechanical arms.

**FEED:** Front End Engineering Design.

**FID: Final Investment Decision** – Typically made by the investors in an LNG project when all necessary sales contracts and other government and regulatory approvals are in place.

**FLNG:** Floating LNG liquefaction vessel.

**FSRU:** Floating storage and regasification vessel.

**FSU:** Floating Storage Unit

*Data retrieved from <http://www.iso.org> and the Oxford Institute for Energy Studies.*



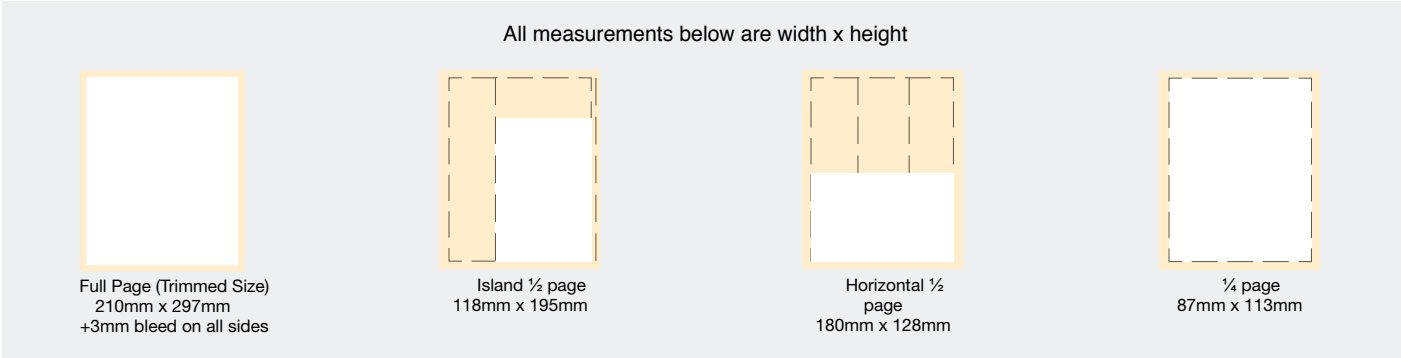
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TYPES	PAGES	ONE ISSUES (SGD)	SIX ISSUES (SGD)	TWELVE ISSUES (SGD)
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Inside Front Cover	1	\$2,000	\$1,800 each	\$1,600 each
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REST OF BOOK				
Full Page	1	\$1,800	\$1,600 each	\$1,400 each
Half Page Island	½	\$1,100	900 each	700 each
Half Page	½	\$1,100	900 each	700 each
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MAGAZINE SIZE MEASUREMENT IN MM (W X H)

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COMMENTING ALOUD

YOUR FEEDBACK  
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Unless if you are living in an autocracy or dictatorship where your opinions do not matter the least bit, you can ignore this page.

But please do not ignore, even as there may not be the midnight knock on your door, as had always been the case in places and nations which do not respect the right of free speech, opinions and comments meant to elevate our sense of collective responsibility, and how the dissemination of alternative viewpoints are all about raising collective and responsible debate.

So, ‘Yes’, with a big capital Y. We welcome your views; wholly, substantially, and not incrementally. Those views must generate a deeper understanding of the issues at play such that debate, knowledge and wisdom is concurrently, elevated.

It is that key differential separating the world of free choice from the world of no choice. It is choice that a learned citizenry continually needs such that it never stops learning, never stops informing and is always informed in the best possible way possible that its learning continues the journey of discovery upon discoveries.

Even so, let us also not forget that Free Speech is forever *Free!* It has never been and never will be because as always has been the case, being free comes with a measured degree of responsibilities that sometimes can rightly or wrongly, manifest as societal disapproval, a legal injunction or worse still, even as both.

Neither of that is desirable, meaning societal disapproval and legal injunctions. For all too often, what would count as innocuous opinions may not just receive the same rendering in a wholly different setting. It becomes fodder for open debate. And debate is what this column of our publication is all about.

It is for you to agree, disagree, agree to disagree, disagree about agreements, argue, counter argue, posit a thesis, posit an antithesis, posit a synthesis, and love to hate what some would keep loving. So, this is for you. A page and a place for you to air views and opinions and agree or disagree with us on what you feel about the articles that you read or wish to read.

All you need to do is drop me a line at [editor@mediacomz.com](mailto:editor@mediacomz.com) and I will be so very morally obliged.

## CALENDAR OF EVENTS

### SEPTEMBER 2021

#### Philippines Marine 2021

1 – 3 September, 2021

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Email: [Abigael@asiafireworks.com](mailto:Abigael@asiafireworks.com)

Tel: +639178198830

Website: [www.philmarine.com](http://www.philmarine.com)

#### Oil & Gas Philippines 2021

1 – 3 September, 2021

Contact: Abigael Lamparas

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Tel: +639178198830

Website: [www.oilgasphil.com](http://www.oilgasphil.com)

### DECEMBER 2021

#### Oil and Gas Asia (OGA) 2021

7 – 9 December 2021

Kuala Lumpur Convention Centre  
(KLCC), Malaysia

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#### Green Shipping 2021

#### Ammonia & Hydrogen 2021

#### 2<sup>nd</sup> Marine & Offshore Congress 2021

#### 6<sup>th</sup> LNG & Clean Marine Fuel Forum

#### 10<sup>th</sup> Dynamic Positioning Asia Conference & Exhibitions 2021

#### 12<sup>th</sup> RAMPS 2021

#### 4<sup>th</sup> Tank Terminal Tech Asia 2021

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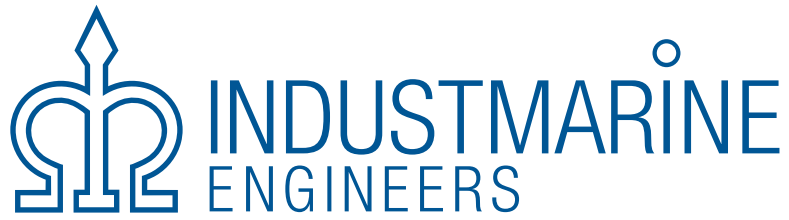
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