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Canadian energy company fuels future of North American transportation with LNG

FortisBC builds out trucking and bunkering services from small-scale plants in British Columbia

FortisBC, an energy provider and utility in the Canadian province of British Columbia, is making significant headway in using liquefied natural gas for transportation.

The utility serves around 1.1 million customers in 135 communities in BC. In addition to providing traditional piped natural gas to residential, commercial, and industrial customers, the firm is also expanding the use of LNG.

Innovation

FortisBC is the owner and operator of the only LNG production facilities in the province of BC - the Tilbury Island facility in Delta in operation since 1971 and the Mt. Hayes facility near Ladysmith on Vancouver Island, operating since 2011.

Both facilities are strategically located near ports, water channels and the Pacific Ocean, and are the only operating LNG facilities on the west coast of North America.

Since 1995, LNG from Tilbury has been safely used as an energy source for remote communities in the province and neighboring provinces and territories.

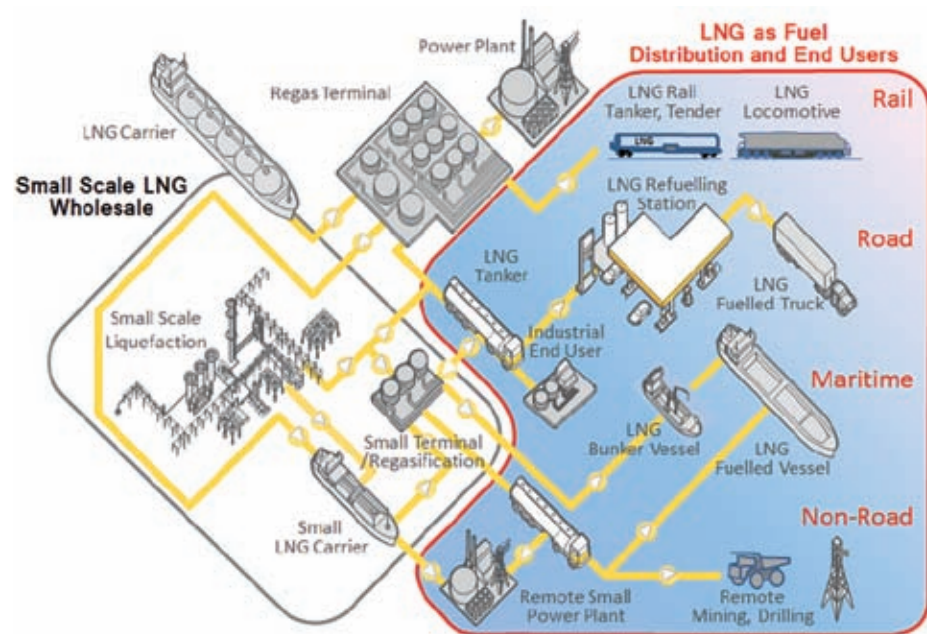
In 2009, FortisBC identified an opportunity to support the BC transportation sector in adopting natural gas as a motive fuel. Fleets that adopted natural gas as a fuel lowered operational costs and lowered environmental greenhouse gas (GHG) emissions.

The company first worked with Vedder Transport, a local transportation company, to construct Western Canada's first large-scale LNG fuelling station on Vedder's premises.

With the innovative fuelling services provided by FortisBC, Vedder was able to safely and economically refuel their new fleet of 50 LNG-powered trucks on their own premises.

Vehicles

Since their operation began, Vedder has added an additional 15 LNG-powered



How LNG is seen spread across transport and power sectors

tractors to its fleet. The use of natural gas has helped the company to reduce its GHG emissions by over 3,500 tonnes of CO₂e per year.

Emissions from the transportation sector represents more than one-third of BC's total GHG emissions. Using LNG fuel in long-haul trucking was, therefore, an important step towards a better environmental profile for the transport industry.

"We live in an ever-changing world with evolving energy needs. As an energy provider we need to anticipate and adapt, to ensure our customers have innovative solutions," said Doug Stout, Vice-President of Market Development and External Relations at FortisBC.

To further support the growing market for natural gas, in the fall of 2014, FortisBC broke ground on a C\$400 million (US\$298M) expansion project of its Tilbury LNG facility to meet growing market demand, most notably from BC's transportation sector.

At that time, BC had more than 400 natural gas vehicles, using either LNG or compressed natural gas (CNG), which was more than any other province in Canada.

"The expanded facility will serve the

growing need for natural gas for transportation," said Stout. "The project itself has led to substantial job creation and benefits to the local economy," he added.

The original Tilbury facility can liquefy 5,000 gigajoules (GJ) of gas per day, and has a storage capacity of 600,000 GJ.

The expanded Tilbury facility will be able to liquefy an additional 34,000 GJ of natural gas per day and will add 1.1 million GJ of additional storage capacity. There will also be dedicated loading facilities to allow for the loading of LNG tankers.

"The additional capacity will also help meet the growing LNG demands of the transportation sector, remote communities and industry in BC," said Stout. "We anticipate it will be fully operational by mid-2017."

Maritime

With the infrastructure in place to service land-based fleets, FortisBC identified an opportunity for expansion of the use of LNG to the marine sector.

In 2014, a commitment was made of two LNG-fuelled vessels for Seaspan Ferries, a prominent marine transportation company operating along the West Coast of North America.

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Maritime Content Ltd

1st Floor, 30 Warner Street
London EC1R 5EX
United Kingdom
www.**LNGjournal.com**
+44 (0)20 7253 2700

Publisher

Stuart Fryer

Editor

John McKay
editor@lngjournal.com

Advertising

David Jeffries
Only Media Ltd
Tel: +44 (0) 208 150 5293
djeffries@lngjournal.com

Subscriptions Sales Manager

Elena Fuentes
Tel: + 44 (0) 7017 3416
elena@lngjournal.com

Production

Vivian Chee
Tel: +44 (0) 20 8995 5540
chee@btconnect.com

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See website for more details
www.lngjournal.com
elena@lngjournal.com
hotline +44 (0)20 7017 3416

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Shortly after, BC Ferries, one of the largest and most sophisticated ferry transportation systems in the world, become an early adopter of LNG as a marine fuel with the commitment of three vessels fuelled by LNG from FortisBC. These were some of the first marine vessels of their kind in Canada.

In 2016, BC Ferries decided to convert two of their largest vessels in their fleet, the “Spirit of Vancouver Island” and “Spirit of British Columbia” to LNG. This will bring the number of vessels operating on LNG in British Columbia to a total of seven by 2020.

Once fully operational, the five vessels from BC Ferries are expected to reduce GHG emissions by over 14,500 metric tonnes of CO₂e per year of operation, or the equivalent of removing over 3,000 passenger vehicles from the road.

“FortisBC plays a significant role in supplying LNG to ship operators who choose to convert from higher emitting fuels,” said Sarah Smith, Director of Natural Gas for Transportation and Regional LNG at FortisBC.

“For those in the marine industry, LNG provides a cost-effective, environmentally minded choice,” she added.

Bunkering

FortisBC provides LNG marine bunkering services to BC-based LNG-fuelled ships. In fact, it is the first company in the world to offer onboard truck-to-ship LNG bunkering. This was possible through the collaborative approach with FortisBC and its customers, BC Ferries and Seaspan.

Both marine customers required an onboard bunkering solution for their new LNG ferries, similar to their existing diesel re-fuelling.

To meet this requirement, FortisBC consulted with its customers and their shipbuilders in creating a custom-made solution.

To ensure safe and efficient implementation of this new approach to fuelling, FortisBC develops and delivers the training and certification materials required of third-party drivers who operate the LNG marine tanker trailers during the truck-to-ship bunkering operation.

“Our LNG provider, FortisBC has been a great partner for us to have a secure source of LNG and a great bunkering solution,” said Harly Penner, Port Engineer for Seaspan Ferries.

The success of these early LNG adopters shows there is a strong market demand for LNG supply in BC.



FortisBC truck-to-ship re-fueling for a vessel in Vancouver

Shipping companies now face higher standards for emission controls under the International Marine Organization’s global sulphur limit which will come into force in 2020.

One option for compliance is using lower-carbon fuels like LNG. As a result, FortisBC anticipates increased interest in using LNG for marine fleet operators on the West Coast of North America.

Creating demand

At present, most of the Trans-Pacific vessels calling into the Port of Vancouver fuel in Asia. Conventional fuel prices on the west coast are higher than that of many international ports, which results in many shipping companies avoiding Canadian ports for fuel if there are other lower priced options.

However, with supply of LNG from FortisBC available at prices that are competitive with petroleum marine fuels, there is an opportunity for Vancouver to develop an LNG bunkering hub domestically.

A recent study by Monitor Deloitte identified Vancouver as one of the top five international maritime centres becoming increasingly important for future investment decisions by ship owners and operators.

“The city of Vancouver is considered a global maritime business hub and LNG plays a big part in that,” explained Smith.

“The close proximity our facilities have to the water gives us an advantage; we can transport and bunker LNG for marine vessels anywhere along the coastline of western North America,” she added.

The price for LNG freight on board (FOB) at FortisBC’s LNG plant at Tilbury is US\$267/metric tonne of LNG marine gas oil equivalent for the month of April 2017. In other terms, the April 2017 price of FOB from our Tilbury facility is C\$7.66 per gigajoule (GJ), or US\$6.04 per million British thermal units.

LNG is available from FortisBC through a regulated public, open access tariff. More

information on the detailed rate, service and supply information of FortisBC’s LNG capability is available online.

Support

In addition to LNG supply and delivery capabilities, FortisBC has financial incentives to help offset the incremental cost of LNG vessels for eligible marine operators.

“Customers are asking for innovative solutions now,” said Arvind Ramakrishnan, Senior Manager of Business Growth at FortisBC.

“The decision to shift to natural gas is about more than fuel savings and environmental benefits. It is also about total cost of ownership, from the vehicles, the tanks and the engines to financing options, incentives, maintenance and retrofitting shops,” added Ramakrishnan.

FortisBC is a leader in driving the adoption of natural gas as a transportation fuel in BC and provides a wide range of services, from planning and economic analysis to fuelling station installations to technical training and support.

“We can provide a complete solution so you can remain focused on your business,” stated Ramakrishnan.

Incentives

The introduction of the Government of BC’s GHG Reduction (Clean Energy) Regulation enabled FortisBC to develop an incentive funding program in 2012 to assist heavy duty fleet operators with purchasing natural gas vehicles and marine vessels.

The current incentive program allows FortisBC to:

- Offer capital incentives to transportation fleets that use natural gas as a fuel in place of diesel (or other higher carbon emitting fuels) such as marine vessels, heavy duty trucks, locomotives, mine haul trucks, busses, or natural gas used to produce power for remote industrial applications

- Allowable capital spending to provide LNG marine bunkering infrastructure such as shoreside fuelling assets for the marine market
- Build, own and operate CNG and LNG
- Provide grants to meet safety guidelines for operating and maintaining natural gas vehicles

"We are committed to providing the certainty to our customers that we have the supply today to meet the demands of tomorrow and the certainty to provide more incentives through our government's Greenhouse Gas Reduction Regulation," explained Ramakrishnan.

Since its inception, the incentive program has converted a number of vehicles and vessels to natural gas in BC. To date, the program has resulted in commitments for more than 600 natural gas vehicles and vessels that have displaced about 67.5 million litres of diesel fuel and reduced GHG emissions by more than 74,000 tonnes.

Investment

In 2017, the provincial government announced increasing the use of LNG and

renewable natural gas (RNG) made from waste in transportation, marine and other sectors.

"It was a welcome investment to an already growing area," says Stout.

FortisBC now has C\$107.9M in financial incentives available to reduce capital costs for the conversion of natural gas-powered vehicles, marine vessels and other industrial applications.

In addition, expenditures were also approved for the following:

- C\$70 million to provide incentives toward the capital cost of conversion or purchase of LNG-powered ocean-going marine vessels
- C\$25 million incremental infrastructure spending allowance for LNG fuelling infrastructure intended

to support LNG fuelling for the marine sector

- C\$40 million incremental incentives for vehicle and marine vessel operators that adopt 100 per cent RNG for their fleets

Conclusions

In BC, the transportation industry is responsible for the largest share of provincial GHG emissions. According to the provincial government, converting just one deep sea vessel to LNG could reduce GHG emissions by 93,500 tonnes of CO₂e per year.

With its infrastructure strategically located near main waterways, FortisBC's vision for the future is to continue expanding into new markets.

For the maritime sector these options include coastal freight vessels transiting the west coast of North America as well as Trans-Pacific vessels, such as car carriers and container vessels, transiting between North America and Asia.

FortisBC has a highly skilled and dedicated team committed to expanding the market for LNG and developing solutions that meet the needs of its customers.

The team focuses on several areas including research and analysis, regulatory standards, safety and business growth through sales and innovation.

"FortisBC can cater to new markets because we have supply available today, an attractive incentive program as well as competitive rates on an open tariff," stated Smith. ■

LNG executives at FortisBC



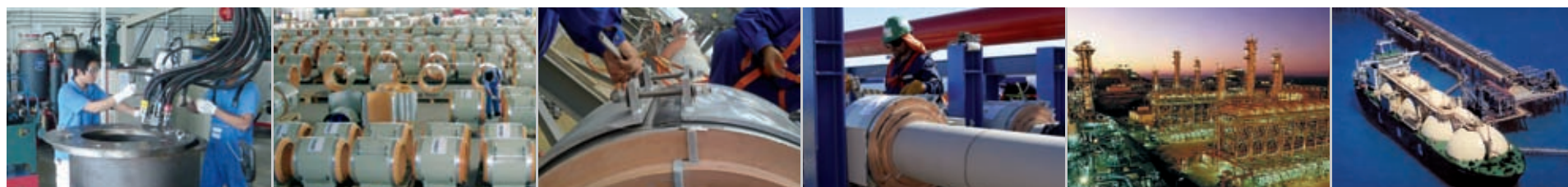
Sarah Smith,
Director of
Natural Gas for
Transportation
and Regional
LNG



**Arvind
Ramakrishnan,**
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Key bankability considerations for LNG FSRU deals for independent power producer plants

Richard Nelson and Nick Kouvaritakis of law firm King & Spalding LLP

The growth of the use of regasified liquefied natural gas as a feedstock fuel for power generation, is largely attributable to a combination of economic, political and technical factors.

The growth of FSRUs as a leading solution for LNG import projects has been growing over the past few years.

Of the four countries that began importing LNG in 2015, three of them - Pakistan, Jordan, and Egypt - opted to do so using FSRUs rather than building full-scale onshore regasification facilities.

Factors

The factors for the increase in FSRUs to supply gas-fired power plants are broadly categorised as follows:

- Growth in electricity demand and consumption, leading to development of new power generation facilities, particularly independent power producer plants (IPPs);
- Climate-change and air-quality policies favouring natural gas over less environmentally friendly fuels for electricity production (for example, new OECD rules which have recently come into effect limit the circumstances under which certain financial institutions can provide funding for new coal-fired power plants);
- Plentiful global supplies of LNG and favourable natural gas pricing relative to other fuel sources; and
- Rapid commercialisation of marine LNG regasification solutions, including floating storage units (FSUs) and FSRUs, allowing the development of flexible small and mid-scale LNG regasification infrastructure with lower capital costs and shorter lead times than traditional land-based terminals.

Integrated

Importantly, a number of integrated LNG-to-power projects under development are opting to utilise FSU or FSRU technology.

As depicted in the graphic, many more FSRU-to-power projects are currently envisaged. In this paper, we will examine some of the critical issues to consider in

structuring power projects utilising a marine-based LNG FSRU or FSU.

Financing structure: Integrated vs separate financing models? A crucial ingredient for the success of integrated LNG-to-power projects is the alignment of multiple components from fundamentally different industries: long-term LNG supply, offshore regasification vessels, midstream transportation/pipelines (and in the case of FSUs, onshore regasification facilities), power plants and associated transmission infrastructure.

It is essential that the risks associated with each component part of the value chain are fully understood and allocated appropriately between the various stakeholders: the host government, the project developers, the suppliers and contractors, and the project lenders.

In most cases, project finance lenders will require detailed assurances from project sponsors that all technical and operational interface issues between the various project components have been addressed: for example, synchronising (i) completion, testing, commissioning and acceptance of the FSRU with the power facility and interconnecting infrastructure; and (ii) FSRU maintenance/dry-docking with scheduled power plant maintenance to minimise any potential delay or outage penalties under the power purchase agreement.

Bankability issue

The treatment of the FSRU is a critical bankability issue that has fundamental implications for any project financing structure.

The approach to the FSRU needs to be fully considered, as conventional FSRU project financing differs significantly from a traditional IPP project finance model.

Invariably the FSRU is essential to the viability of the overall LNG-to-power project, as such projects are often located in areas where no alternative gas/fuel supply is available and the costs of a land-based regasification terminal are deemed prohibitive.

To address this interdependency, the equity and financing interests should ideally be as aligned as possible, meaning that the same or similar equity

Country	Site	Project Lead	Power Gen (MW)	MWh/y	LNG required (t/y)*	Potential FSRU capacity		Start-Up	FSRU	FSU
						750 MMcf/d	500 MMcf/d			
South Africa	Richards Bay	Out for tender	2,000	18,000,000		65%	100%		FSRU	
South Africa	Cooga	Out for tender	1,000	9,000,000	1,796,407	33%	50%		FSRU	
Ivory Coast	Abidjan	Total, Shell, Endeavor Energy, Socar, Petroci, CI-Energies, Golar LNG	375	3,375,000	673,653	12%	19%	2018	Golar FSRU	
Malta	Marsaxlokk Bay	Electrogas Malta (GEM Holdings, Siemens, Socar)	215	1,935,000	386,228	7%	11%	4Q16		Armada LNG Meditterrana
Ghana	Port of Tema	West Africa Gas Pipeline Ltd. (Nigerian National Petroleum Corp., Sahara Energy Resource), Golar LNG	750	6,750,000	1,347,305	24%	37%	2017	Golar Tundra	
Brazil	Sergipe	Golar Power (Golar LNG, Stonepeak)	1,516	13,644,000	2,723,353	50%	76%	2020	Golar Nanook	
Jamaica	Montego bay	New Fortress Energy, Jamaica Public Service, Golar LNG	120	1,080,000	215,569	4%	6%	4Q16		Golar Arctic
Colombia	Cartagena	Sociedad Portuaria El Cayao, Termobarranquilla, Termocandelaria, Zona Franca Celsia, Hoegh LNG	1,500	13,500,000	2,694,611	49%	75%	4Q16	Haegh Grace	
Bangladesh	Maheshkhali Island	Reliance Power	750	6,750,000	1,347,305	24%	37%	2018-2019	FSRU	
Bangladesh	Maheshkhali Island	Summit Group	600	5,400,000	1,077,844	20%	30%	2018	FSRU	
Chile	Penco Lirquén	Cheniere Energy, Biobionera, Central El Campesino, Hoegh LNG	640	5,760,000	1,149,701	21%	32%	2Q18	Haegh FSRU	
Indonesia	Benoa	Jaya Samudra Karunia, Humpuss, Gas Entex	200	1,800,000	359,281	7%	10%	2017		Newbuild FSU
Morocco	Jorf Lasfar	Consultation Stage	2,000	18,000,000	3,592,814	65%	100%	2021	FSRU	
Namibia	Walvis Bay	NamPower	200	1,800,000	359,281	7%	10%		Excelerate FSRU	
Senegal		Senelec, MOL, Nebras Power	400	3,600,000	718,563	13%	20%		FSRU	
Kenya ⁽¹⁾	Mombasa	Consultation Stage	300	2,700,000	538,922	10%	15%	TBC	FSRU	
El Salvador ⁽²⁾	Acajutla	Quantum Energy, Invenery	355	3,195,000	637,724	12%	18%	2021-2022	FSRU	
Sri Lanka ⁽¹⁾⁽³⁾		Petronet LNG	600	5,400,000	1,077,844	20%	30%	TBC	FSRU	

*Based on certain assumptions on gas required for power generation and plant efficiency

Leading FSRU-to-power project opportunities on the horizon

(shareholders) and debt providers (lenders) are involved in the FSRU and the power generation owning entities, which in most cases are project special purpose vehicles (SPVs).

In this way, IPP sponsors and IPP lenders derive the control they require over the FSRU to prevent gas supply interruptions and preserve downstream (PPA) revenue flows.

Structures

Principally we have seen two distinct project finance structures emerge.

First, the “fully integrated” financing structure whereby the FSRU and power

plant are financed by the same group of lenders.

This can be achieved either through a “co-borrower” model (IPP SPV and FSRU SPV both take out loans from the same group of lenders), or an “on-lending” structure whereby IPP SPV borrows the entire amount of the debt for the power plant and the FSRU from a single lending group and then subsequently on-lends a portion of that debt to the FSRU SPV to finance the FSRU.

Under both structures, a single group of lenders would seek to take security over both the FSRU and the power project assets, which is essential for the

bankability of the integrated project.

An example of such integration is the 1.5 GW Sergipe power project in Brazil in which Golar (as FSRU sponsor) recently invested directly as a shareholder. The project represents the first time an FSRU sponsor has taken a direct equity investment in the downstream power project.

Sponsors

In contrast, FSRU sponsors typically favour the second structure, a “non-integrated” financing structure which envisages IPP sponsors obtaining financing for the power plant and FSRU sponsors separately raising financing for the FSRU.

The fundamental disadvantage of this structure is the lack of integration between the power plant and the FSRU, which in turn is likely to create inter-creditor issues between the two sets of lenders.

Typically, the lenders to the IPP (if different) will seek preferential step-in rights and some form of security over the FSRU, which may not necessarily be compatible with the terms of the financing to the FSRU.

Also, each lending group will most likely seek quiet enjoyment rights over their respective project (i.e., the power plant or the FSRU).

This friction between two sets of lenders can cause significant delays to achieving financial close for the project.

The project involving the Penco Lirquén LNG terminal and the Central El Campesino power plant in Chile is an example of a “non-integrated” structure which envisages separate groups of lenders for the FSRU and the power plant.

Electricity dispatch:
LNG procurement and FSRU inventory

management considerations: The dispatch merit order and profile of the power plant to which regasified LNG is supplied (i.e., peak, mid-tier or baseload),

is likely to have significant ramifications with respect to the LNG procurement and inventory management strategy for IPP sponsors.

Power plants dispatched on a peaking basis (often based on daily or seasonal demand fluctuations) create a degree of uncertainty as to the level of LNG



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demand and consequentially the required level of inventory to be maintained on-board the FSRU.

Understanding

Careful consideration of the power purchase agreement is required to understand precisely how the power plant is dispatched (i.e., whether on a firm or non-binding basis and whether daily, monthly or yearly).

However, in many cases, a “peaker” PPA may not be prescriptive in terms of how the offtaker may dispatch the plant (or individual units) or what level of gas may be nominated in a given period.

The challenge, therefore, is modelling sufficient LNG volumes to meet electricity demand/dispatch requirements throughout the year: in other words, what baseload (LNG) volume is required and how will any shortfall or surplus (of LNG) be addressed.

There are various ways for IPP sponsors to mitigate against fluctuations in dispatch levels via their LNG sale and purchase agreements, including annual contract quantity (“ACQ”) reductions/increases, downward and upward quantities tolerances, call options for additional quantities, cargo cancellation rights, cargo deferment rights, diversions and variations to LNG ship sizes.

The ability to procure spot cargoes is also an important mitigant to address a shortfall scenario (where the baseload LNG volumes are insufficient).

Procurement

This calls for a highly specialized LNG procurement strategy and a bespoke LNG SPA or SPAs which fit the specific demand profile and requirements of the power facility in question.

However, it is important to note that not all LNG sellers will be willing to accommodate a high level of LNG supply flexibility.

LNG portfolio suppliers are generally better placed to meet a more flexible procurement profile than a point-to-point/project seller. It should also be noted that LNG sellers are more likely to price in any increase in purchasing flexibility.

Peaking power plants present significant challenges in relation to the inventory management of the FSRU.

Modern-day FSRUs have limited storage capacity: new-build FSRUs typically have a capacity of between 170,000 cubic metres capacity and

180,000 cubic metres capacity, although Japan’s Mitsui OSK Lines through its unit, Lakler S.A., is set to take delivery of a 263,000 cubic metres capacity FSRU later this year.

The use of a single floating solution (FSU or FSRU) for a peaking power plant presents IPP sponsors with material inventory constraints, which can prove especially challenging to manage if the power purchase agreement permits short-term (intra-day) fluctuations in dispatch levels.

LNG deliveries

The IPP sponsor will need to ensure that sufficient LNG quantities are scheduled and available for delivery to meet short-term demand peaks and also that the FSRU owner is able to vary the regasification nominations at short notice.

Typically FSRU owners will be able to meet these short-term variations, but in return they may require relief from certain performance warranties under the time charter party (TCP) or bareboat charter (BBC), such as the fuel usage warranty (depending on the extent of the regasification nomination fluctuations).

Alternative mitigation strategies include: (i) utilising the FSU/FSRU in LNG carrier mode to help manage the potential scheduling and inventory management constraints and (ii) developing supplemental storage capacity, either via an additional FSU facility offshore or onshore storage tank(s).

In the case of (i), in order to mitigate against LNG supply-related failures (or, as the case may be, force majeure events) the FSRU could potentially be deployed as an LNG carrier and utilised to receive cargoes on a free-on-board basis.

Further, if there are predictable periods where short-term downstream demand is zero, the FSRU could switch to operate in LNG carrier mode so as to sell any surplus LNG to a third-party buyer.

Ship switch

From an operational standpoint, the switch from FSRU mode to LNG carrier mode (and subsequent demobilisation) is manageable, with the mobilisation/demobilisation process typically taking between 24 and 30 hours, based on a conventional mooring system.

However, from a contractual standpoint there are a number of issues that need to be considered, namely that the FSRU sponsor would usually seek to be held harmless by the IPP sponsor

(as charterer) in respect of any

will in most cases seek to limit its liability to events

LNG portfolio suppliers are generally better placed to meet a more flexible procurement profile than a point-to-point/project seller

incremental costs arising as a result of the operation of the FSRU in LNG carrier mode (i.e., taxes, port charges, etc.).

The FSRU sponsor and IPP sponsor would in most cases agree on a separate charter party agreement that relates to the operation of the FSRU in LNG carrier mode, which would contain a number of market-standard concepts including:

- (i) a procedure for the mobilisation/demobilisation of the vessel as an FSRU;
- (ii) an acknowledgement that the regasification/boil-off warranties that apply to the FSRU in regasification mode would not apply to the use of the vessel in LNG carrier mode; and
- (iii) dispensation from the permitted maintenance/dry-docking regime (i.e., the requirements for a vessel operating in dual-usage mode may not be the same as for a vessel operating solely in FSRU mode).

Project-on-project liabilities? A fundamental issue for IPP sponsors to consider is the disproportionate nature of the contractual liabilities faced by IPP sponsors (under the PPA) and the FSRU sponsors (under the TCP or BBC).

The scale of penalties and damages potentially payable under a PPA are of a much higher order of magnitude than those payable under a TCP or BBC.

Whilst IPP sponsors will need to assess how to allocate liability for the failure of multiple parties (LNG supplier(s), FSRU owner(s), EPC and O&M Contractor(s), or electricity offtaker(s), the FSRU owner

caused by its own failure; that is to say, performance of the FSRU.

Problem

The problem that IPP sponsors face is that a performance failure of the FSRU (for example, a failure to regasify LNG at the rate nominated by the IPP sponsor) can lead to IPP sponsors incurring significant liabilities under their upstream (LNG SPA) and downstream (PPA) contractual arrangements.

However, the liability of the FSRU owner(s) under the TCP or BBC will almost always be capped at a percentage of the total hire amount payable, meaning that the IPP sponsors are unlikely to have recourse against the FSRU owner(s) for the full amount of the liabilities that they are exposed to under the LNG SPAs and/or the PPA.

In the pre-operational phase, a failure of the FSRU supplier to successfully commission the FSRU by the required commercial start date can potentially expose IPP sponsors to take-or-pay liabilities under their LNG sale and purchase agreement (subject to mitigation measures such as a diversion, rescheduling of the cargo/cancellation, etc.) and delay liquidated damages (LDs) under their power purchase agreement.

In the operational phase, a performance failure of the FSRU vessel could result in IPP sponsors incurring outage penalties under their power purchase agreement if the IPP sponsors are unable to meet the dispatch requests of the electricity buyer.

Historically, FSRU owners have been reluctant to accept LDs for performance failures that exceed the daily rate of hire (i.e., capital costs plus operating costs).

Mind-set

This mind-set is largely derived from LNG shipping market practice whereby the risks that the vessel owner is willing to take on should be commensurate with the return that it receives under the charter party.

Generally, this mind-set is slowly changing as there are more instances, particularly in the context of integrated LNG-to-power projects, of FSRU owners agreeing to assume some (but only some) responsibility for liabilities incurred by IPP sponsors resulting directly from FSRU-related performance failure.

Notwithstanding this shift towards a more favourable liability regime under the charter party agreement, IPP sponsors are often left with significant residual liabilities, some of which they may be able to mitigate via insurance, such as delay-in-start up insurance (pre-operational phase) and business interruption insurance (operational phase), but it is unlikely that such insurances will fully cover such residual liabilities as the policies will contain various deductible periods, sub-limits and exclusions.

Project finance lenders may require that IPP sponsors themselves cover any remaining residual liabilities that cannot be covered by the FSRU owner or insurance.

Payment in advance vs payment in arrears: A further challenge for IPP sponsors is to align the payment mechanism under its power purchase agreement(s) with its payment obligations under the FSRU charter agreement (i.e., to ensure that IPP sponsor receives payment from the power purchaser prior to hire payments being due under the FSRU charter agreement).

In advance

In the FSRU industry this is often referred to as a “pay-when-paid” regime. FSRU owners typically require payment of hire in advance to ensure that the FSRU owner has sufficient available cash to cover all operating expenses (including payments to be made to third-party service providers).

In an integrated project context, the IPP sponsors will be using revenues received under the PPA to make those hire payments to the FSRU owner

(subject to the relevant payment waterfall).

Project finance lenders will typically prefer that the IPP sponsor first put in funds provided by the power purchaser before it is obliged to make payments to the FSRU sponsor, or, if this is not achievable, that the payment terms (i.e., periods) are aligned and/or that the IPP sponsor maintains a working capital/hire reserve account to ensure that it is able to meet its hire payment obligations to the FSRU sponsor.

Also, to the extent that the underlying payment obligations under the PPA are supported by credit instruments such as standby letters of credit (SBLCs) or sovereign/government guarantees, lenders would prefer that the IPP SPV borrower retains the ability to call on such credit instrument(s) before becoming liable to pay the hire instalments, subject to a requirement to pay the FSRU owner any amounts recovered under those instruments.

Evolution

The FSRU-to-power market is still evolving in this regard, and from our experience FSRU sponsors are moving towards a broader “pay-when-paid” regime subject to the IPP sponsor agreeing to certain conditions with respect to the credit support/guarantee arrangements, such as posting a SBLC in respect of the required months of hire and agreeing to claim against and to pass through the benefits of any credit support provided by the power off-taker.

Emergence of a multi-user terminal model? A further notable development is the advent of “multi-user” FSRU-IPPs (i.e., where the FSRU is intended to be utilised by the IPP and also by other downstream customers).

This could be as a result of mandatory or regulated third party access requirements under the laws of the jurisdiction in which the project is being developed.

Multi-user FSRUs present a number of technical and operational challenges, particularly given the size and storage constraints of FSRU vessels.

From a credit perspective, the FSRU owner would likely prefer that a single (creditworthy) charterer stands behind the hire payment obligations, as opposed to multiple charterers with separate hire payment obligations (although, in the final analysis this will depend on the creditworthiness of the proposed charterers).

Multi-user FSRU terminals also give

rise to complicated storage and send-out capacity allocation issues, as between the various users, as well as LNG quality and contamination issues in the context of potential commingling of LNG supplies in a single storage tank.

In structuring multi-user FSRUs, a robust terminal use agreement is imperative to the bankability of the project.

Considerations

This may follow the form of onshore RGT terminal use agreements, although particular consideration will need to be given to the specification and configuration of the individual FSRU facility.

However, despite the notable challenges, multi-user FSRUs may be

favoured in geographically remote locations (for example, the archipelagos in Indonesia and Philippines) where a “storage and reload” model to deliver to multiple plants utilising small or smaller scale LNG ships is preferable.

Despite the multitude of technical, legal, financial and commercial challenges facing integrated LNG-to-power projects and the tension between the conventional business model of the FSRU owners on the one hand and the IPP sponsors (and project finance lenders) on the other, we expect that, assuming the fundamental economics remain viable, the number of these projects will grow exponentially over the next few years.

We have set out below a brief snapshot of select FSRU-to-power project opportunities currently in the market. ■

The Authors



Nick Kouvaritakis

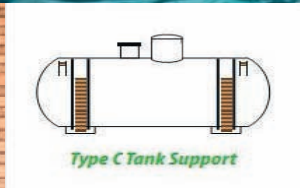


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For the Record

ABS, the American Bureau of Shipping, has signed an agreement with the South Korean shipyard, Daewoo Shipbuilding and Marine Engineering, to support safety in the development of a conceptual floating liquefied natural gas design. The Korean design project for an LNG production vessel is planned to start at the end of May and will last for a year. DSME built the world's first FLNG hull to enter operations, the "PFLNG Satu", at its Okpo yard. The FLNG hull is owned by Malaysian energy company Petronas and deployed offshore Sarawak where it is producing LNG. ABS said it would review the conceptual design for this new project to the applicable class requirements and provide guidance to support safety during development. "We are pleased to sign this agreement and work with DSME to support new innovations and technology advancements in the offshore industry," said ABS Executive Vice President of Global Offshore Ken Richardson. "As gas continues to play an increasingly important role in the global energy mix and industry looks to develop new resources, ABS remain committed to its mission of advancing safety," added Richardson. DSME's Chief Operating Officer for its Offshore business, Jang-Jin Kim, said that by partnering with ABS his company is able to apply best-in-class standards. "Successful construction of the world's first FLNG vessel 'Satu' in 2016 is further proof of DSME's technological excellence," he said. "Working with ABS as our advisor, we will be able to develop an effective design with robust safety and enhance the LNG value chain," Kim added. ABS pointed out that it launched its Global Gas Solutions team in 2013 to support industry in developing gas-related projects, recognizing the changing landscape and increased industry focus on gas. "A pioneer in classification for the safe transport and handling of gas, ABS classed the world's first LNG carrier conversion, the 'Methane Pioneer' in 1959, as well as the first newbuild LNG carrier, the 'Methane Princess' in 1964," the US class society noted.

AES Dominicana, a subsidiary of AES Corp. of the US, has signed an agreement

to supply liquefied natural gas to the Barbados National Oil Company from its AES Andres LNG terminal in the Dominican Republic. "The agreement represents an important milestone for the country's positioning as the Caribbean's most geographically strategic distribution center," said Edwin De los Santos, President of AES Dominicana. In addition to distributing LNG via ISO containers, AES will also transport LNG via small bulk carriers following the successful modifications at the AES Andres LNG terminal in January 2017. AES has operated the Punta Caucedo regasification terminal in the Dominican Republic since 2003 and the facility has recently undergone modifications. "The LNG will be loaded at the LNG truck-loading facility and transported via ISO containers," said George Nemeth, Director of LNG Marketing for AES Dominicana. At the beginning of 2017, AES Dominicana completed construction of the new AES Andres Marine Facility at the import terminal at a cost of US\$9 million. This included infrastructure changes to the regasification terminal to allow the re-loading of cargoes for export on ships as small as 10,000 cubic metres capacity. "For smaller scale customers, AES will load LNG into ISO tanks at the liquefied natural gas truck terminal so that fuel can be delivered by container ships to neighboring countries," said AES. Barbados is already an importer of LNG in ISO containers from the US state of Florida. Latest US Department of Energy figures show that about four cargoes of US LNG per month are exported in ISO container tanks from the Hialeah facility near Medley in Florida, via the port of Miami, to Barbados. Each of the US ISO container shipments to Barbados is priced at \$10 per million British thermal units and the exporter is American LNG Marketing.

ARCTIC COUNCIL delegates meeting in the Alaskan town of Fairbanks had former ExxonMobil Chief Executive Rex Tillerson, the US Secretary of State, saying the US had not formulated its final greenhouse-gas policy, though he had overseen plans to produce Alaskan LNG to ship to Asia as a clean fuel. Russian Foreign Minister Sergey Lavrov was also at the meeting in Alaska and said his nation's agenda for the region was peace. Tillerson's former company ExxonMobil has taken the lead in introducing LNG to the world from large-scale production in Qatar and other projects, including in Alaska where it holds the resources for a

planned LNG project to send clean fuel to Asia. The LNG project has three major components: a gas treatment plant located at Prudhoe Bay where the huge feed-gas resources are located, an 800-mile pipeline to southcentral Alaska with up to five offtake points for in-state use and a natural gas liquefaction plant in Nikiski to produce and export the LNG. The Arctic Council, which is currently chaired by Finland from 2017-2019, is a forum comprising the indigenous people of the Arctic and eight member countries of the region with sovereignty over Arctic Circle land, the US, Russia, Denmark, Finland, Iceland, Norway, Sweden and Canada. "And I want to thank again the tribal leaders of the aboriginal groups for their greeting this morning and their very meaningful message to all of us," said Tillerson in his speech. "The United States had been privileged to lead the Arctic Council at a time when the Arctic region has been facing unprecedented change and challenges," he said as the US handed over its Council leadership to Finland. "In the United States, we are currently reviewing several important policies, including how the Trump administration will approach the issue of climate change," said Tillerson. "We are appreciative that each of you has an important point of view, and you should know that we are taking the time to understand your concerns. We're not going to rush to make a decision. We're going to work to make the right decision for the United States," stated Tillerson.

ANADARKO Petroleum Corp., the US company with plans to develop LNG projects in the southeast African nation of Mozambique, has made executive changes to its US and international operations team leadership as it moves forward after the Colorado accident that led to a temporary shutdown of 3,000 wells in the state. The company said Daniel E. Brown had been named Executive Vice President for International and Deepwater Operations and Bradley J. Holly will be Executive Vice President for US Onshore Exploration and Production. Darrell E. Hollek, formerly Executive Vice President for Operations, will serve as a senior adviser until his retirement later this year. Anadarko only appointed Hollek to the operations post in August 2016 ahead of his impending retirement. He had replaced the retiring Bob Daniels, who was Anadarko Vice President of Worldwide Exploration when the Mozambique natural gas discoveries were

made between 2010 and 2013, opening the way for LNG project development. The US company's main foreign asset is its licence for Offshore Area 1 in Mozambique in which it still holds a 26.5 percent participating interest. The company said earlier in 2017 it was progressing with three elements that will position the LNG project for future execution and delivery, including the legal framework of the onshore liquefaction plant, project finance and long-term LNG sales contracts. "We owe Darrell our gratitude for his many contributions over the last 37 years," said Anadarko Chairman, President and Chief Executive Al Walker. "He was instrumental in leading many areas of the company over the years, as well as helping to build the deep opportunity our portfolio offers today. We will continue to benefit from his insight over the next several months in his advisory role and wish him all the best in retirement," added Walker. The CEO said the two executives who would share the split operations role, Brown and Holly, have each been with Anadarko for the last two decades, and have demonstrated outstanding leadership abilities during their careers. Brown began his career with the company in 1998. Most recently, Brown served as Senior Vice President, International and Deepwater Operations since August 2016. Holly began his career in 1994 with Amoco and joined Anadarko in 1997. He most recently served as Senior Vice President, US Onshore Exploration and Production. Holly is a past Chairman of the Colorado Oil & Gas Association and Colorado Governor John Hickenlooper appointed Holly to the Task Force on State and Local Regulation of Oil and Gas Operations in 2014. Colorado was the scene of the recent accident that led Anadarko to shutdown 3,000 producing wells in the state. The shutdowns were ordered by Anadarko as a precaution following an explosion and fire at a house in the town of Firestone on April 17, which was later shown to be caused by a gas leak from a pipeline. Two men were killed in the incident and it is currently being investigated by the Colorado Oil & Gas Commission. Anadarko's portfolio includes US onshore assets covering most producing states, including the Marcellus and other key shale basins as well as offshore operations in the Gulf of Mexico. In addition to its Mozambique natural gas discoveries and LNG production plans, Anadarko is also active overseas in Algeria, Ghana, Colombia and the Ivory Coast as well as other countries.

AWILCO LNG, the small Norwegian LNG shipping player, reported a falling short-term LNG carrier charter market as the gas price spread and arbitrage possibilities diminished at the end of the first quarter. The company said the year started encouragingly with few available vessels and rates reported at \$52,000 per day in the Atlantic and \$38,000 per day East of Suez. "Along with reduced gas price arbitrage opportunities and lower seasonal demand the activity eased off substantially in both basins, resulting in increased vessel availability combined with a sharp decline in rates," explained Awilco. "The quarter ended with day rates at \$30,000 and \$28,500 West and East of Suez respectively, coupled with low activity," the company said. Awilco made its comments as it reported a first-quarter drop in its freight income to \$2.5 million compared with \$9.1M in the previous three months and \$6M in the first quarter of 2016 because of low activity and weak spot market rates. The company's two vessels, the "WilForce" and the "WilPride", operated in the spot market during the first quarter. "Due to the difficult current spot market conditions negatively impacting liquidity, the Group is in the process of evaluating its capital structure, and is in positive discussions with its main creditor Teekay LNG Partners," Awilco said. The Norwegian firm stated that even though LNG trade has increased steadily over the last nine months, the vessel overcapacity has not been fully absorbed, resulting in a continued weak and volatile shipping market. "Nine vessels were delivered during the first quarter of 2017 and a further 35 vessels are scheduled for delivery in the remainder of

2017, although some delays are likely to occur," said Awilco. The company cited shipbrokers as saying that the orderbook at the end of the first quarter for LNG

vessels above 100,000 cubic metres capacity, both conventional carriers and floating storage and regasification units, was 104 vessels, of which only 10 are

available for contract. "The volatility and seasonality is expected to continue, but as additional LNG production comes on stream the current overcapacity is

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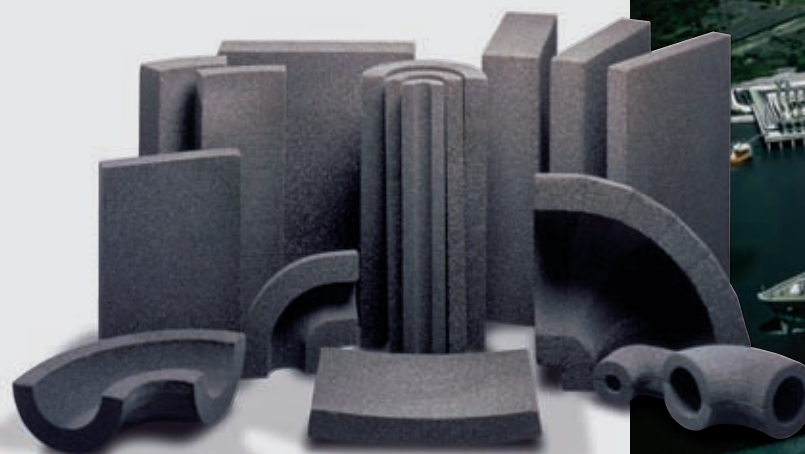
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expected to gradually be reduced, resulting in an improvement in the market going forward,” Awilco said in its outlook. “The long-term outlook for LNG shipping remains promising because of scheduled LNG production capacity coming on stream over the next couple of years,” it said.

BP, the UK major, and its US project joint venture partner for offshore Senegal and Mauritania announced a large natural gas discovery to further enhance the resources offshore West Africa and providing the foundation for a second liquefied natural gas hub. The latest successful well for BP and Dallas-based Kosmos Energy came from the Yakaar-1 drilling by the “Atwood Achiever” drillship to a total depth of around 4,700 meters in nearly 2,550 metres of water in the Cayar Offshore Profond block. Formerly known as Teranga West, Yakaar-1 is located in waters 95 kilometres northwest of the Senegalese capital Dakar. BP and Kosmos said the Yakaar discovery, coupled with the earlier Teranga discovery, underpinned the prospects for a further LNG production system in the basin. The UK and US companies said they would be stem testing the Tortue discovery in mid-2017 and would now drill three additional exploration wells over the next 12 months offshore Senegal and Mauritania. The Tortue field is estimated to contain more than 15 trillion cubic feet of discovered gas resources. BP said the Yakaar-1 well intersected a gross hydrocarbon column of 120 metres in three pools within the primary objective and encountered 45m of net pay. BP only entered the Mauritania and Senegal LNG project area of Kosmos with an agreement finalized in December 2016. “Kosmos has a 100 percent success rate in the basin with six consecutive successful exploration and appraisal wells drilled to date, confirming that our geologic model and geophysical tools are well calibrated,” said Andrew G. Inglis, Chairman and Chief Executive of Kosmos. “Together with the Teranga-1 discovery made last year, we believe this resource will support a second cost-competitive LNG hub. The result also confirms our view of the potential scale of the petroleum system offshore Mauritania and Senegal, in particular the basin floor fan systems which have now been further de-risked, with the well demonstrating that reservoir and trap both work in these previously untested fairways,” stated Inglis, a former BP executive. In April 2017, the UK company agreed to deepen its investment

in Senegal by acquiring the full 30 percent minority participating interests that Timis Corp. held in the Saint-Louis Profond and Cayar Profond blocks offshore Senegal. “Yakaar-1 follows the earlier exploration success that led to the Tortue discovery and further confirms our belief that offshore Senegal and Mauritania is a world-class hydrocarbon basin,” said Bernard Looney, BP Upstream Chief Executive. “This discovery marks an important further step in building BP’s new business in Mauritania and Senegal,” he added. “We look forward to results from the additional exploration wells planned for 2017,” stated Looney. BP in April agreed to deepen its investment in Senegal by acquiring the full 30% minority participating interests that Timis Corporation held in the Saint-Louis Profond and Cayar Profond blocks offshore Senegal. “The Saint-Louis Offshore Profond block includes the Senegalese sector of the cross-border Tortue (Ahmeyim-Guembuel) field and significant future prospectivity,” said BP. Participating interests in the Senegal blocks are similar to the aligned partnership in Mauritania, with BP holding participating and effective working interests of close to 60 percent, Kosmos close to 30 percent and Societe des Petroles du Senegal (Petrosen) 10 percent.

BP announced improvements in its Trinidad LNG production assets and advances in its joint venture plans offshore Mauritania and Senegal in West Africa to develop floating liquefaction projects. “Following completion of BP’s entry into Mauritania and Senegal, exploration drilling in Senegal has begun,” said BP in regarded to the upstream activities linked to two floating LNG projects being entered into with US company Kosmo Energy of Dallas, Texas. BP gave details of the projects as it posted an improved replacement cost profit for the first quarter of \$1.51 billion versus the \$532 million logged in the same three months of 2016. First-quarter operating cash flow, excluding payments related to the Gulf of Mexico oil spill, amounted to \$4.4Bln and not counting these disaster payments operating cash flow was \$2.1Bln. “Our year has started well. BP is focused on the disciplined delivery of our plans. First quarter earnings and cash flow were robust,” said Group Chief Executive Bob Dudley. “We have shown continued operational momentum - it was another strong quarter for the Downstream and the first of our seven

new Upstream major projects has started up, with a further three near completion,” added the CEO. Two projects meant to increase LNG output in Trinidad advanced. “The Trinidad onshore compression project, the first of seven major projects scheduled to start up in 2017, began operation in April,” said BP. It added that the Juniper venture for additional feed-gas in Trinidad was also nearing completion. BP noted that a third gas discovery in the North Damietta Offshore Concession in the East Nile Delta of Egypt was announced in the quarter. The UK company additionally completed the purchase in February 2017 of a 10 percent interest from Italy’s Eni in the Shorouk concession offshore Egypt, which contains the huge Zohr gas field. BP’s natural gas production edged lower to 5,791 million cubic feet per day from 5,846 (mmcf/d). The company does not release LNG figures, nor quarterly volumes, in its earnings. The BP average natural gas price in the US, Europe and the rest of the world rose in the first quarter to \$3.61 per million British thermal units compared with \$2.93 per MMBtu in the first three months of 2016. Looking ahead to the next three months, the company is forecasting little change in current production levels. “We expect second-quarter 2017 reported production to be broadly flat with the first quarter, with the continued ramp-up of major projects offset by seasonal turnaround and maintenance activities,” BP said.

CB&I, the US energy and liquefied natural gas engineering company, reported a 77 percent drop in first-quarter net income and revenue also fell, though the company sensed a rebound in opportunities in China and the Middle East. CB&I said its first-quarter net income came to \$25 million compared with \$107M in the same three months of 2016 amid a full US book of LNG contracts. Revenue for the quarter was \$2.4 billion compared with \$2.7Bln in the year-ago period. New awards amounted to \$3.3Bln versus \$1.2Bln for the first quarter of 2016. CB&I’s backlog at the end of the first quarter of 2017 was \$19.3Bln. The Houston-based company is currently working on two large-scale LNG export projects on the US Gulf Coast. These are the Freeport LNG plant on Quintana Island in Texas, led by energy entrepreneur Michael Smith and the Cameron liquefaction project in Louisiana being developed by California-based Sempra Energy and European and

Japanese utilities. However, CB&I has not mentioned any new LNG contract wins so far in 2017. Its last LNG contract award was in November 2016 and worth more than \$200M. This was from Puget Sound Energy for the engineering, procurement and construction of an LNG storage and fuel terminal in Tacoma port in Washington state. The scope of that work includes a 30,000 cubic metres full containment storage tank, which is a CB&I speciality. The facility will provide peak shaving, marine bunkering and truck loading. “Each of our operating groups reported solid earnings for the quarter except Engineering & Construction, which was negatively impacted by underperformance on two union construction projects,” said Philip K. Asherman, CB&I’s President and Chief Executive. “Overall, new awards exceeded our expectations, indicating the rebound of opportunities in our end markets, specifically in the United States, Middle East and China,” added Asherman. “I’m especially proud of our outstanding safety record, having performed more than 51 million work hours with zero lost-time incidents in the past six months,” he stated. New awards for the quarter include an engineering, procurement and construction contract valued at \$1.3 billion with Total Petrochemicals & Refining USA for an ethane cracker project in Texas, CB&I’s fourth new ethane construction project on the US Gulf Coast. The company also secured a \$600M contract by a leading integrated energy company for the engineering, procurement, construction and commissioning of a combined-cycle power plant in the southern United States. There were also “multiple multi-technology and licensing awards” in China.

CHENIERE ENERGY said first-quarter liquefied natural gas revenue from the Sabine Pass liquefaction and export plant in Louisiana, the first on the US Gulf coast, topped \$1 billion. Houston-based Cheniere said its income amounted to \$1.14Bln at the end of March 2017, a year after the facility came on stream. Cheniere said it shipped 43 LNG cargoes from the Sabine Pass facility during the first three months of the year to customers in Asia, Europe and South America. However, net profits came in at just \$54 million compared with a loss of \$321M in the same quarter of 2016 because of continuing high debt costs and other expenses. Cheniere has completed four LNG production Trains at the Sabine Pass plant, located on the Sabine-Neches Waterway less than four

miles from the Gulf Coast. The first three Trains have started commercial operations while Train 4 is undergoing commissioning to be completed by the start of June. "I am pleased to announce strong first-quarter 2017 earnings, which are underpinned by excellent execution by our Cheniere professionals and LNG sales under our long-term customer contracts," said Jack Fusco, Cheniere's President and Chief Executive. "As we look forward toward the rest of 2017, our top priorities are achieving operational excellence, completing and placing into service Train 4," added Fusco. Each Train of the six that are planned has nameplate capacity of 4.5 million tonnes, giving Cheniere 18 million tonnes of output currently on line. Train 5 is already under construction and Train 6 is being developed and has all necessary regulatory approvals in place. "We are developing and constructing a second natural gas liquefaction and export facility at the Corpus Christi (Texas) LNG terminal, which is on nearly 2,000 acres of land," Cheniere noted. Net profit was low because of debt repayments and Cheniere said total operating costs and expenses increased by \$675M during the three months compared with the same 2016 quarter. During the quarter, Cheniere said it had also finalized organizational changes to simplify its corporate structure and improving operational efficiencies. "As a result of these efforts, we revised the way we manage our business, which resulted in a change to our reportable segments. We previously had two reportable segments: LNG terminal segment and LNG and natural gas marketing segment. We have now determined that we operate

as a single operating and reportable segment," the company added.

CHEVRON CORP., the operator of

the Gorgon LNG plant on Barrow Island in Western Australia, said one of its three Trains has been shut until mid-June because of a technical fault as its newest

Wheatstone venture continues with its commissioning process. Gorgon is Australia's newest liquefaction and export plant and has been shipping



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cargoes for just over a year, while another Chevron-run facility, Wheatstone LNG, will be coming on stream in a matter of weeks and taking Australia closer to the position of the world's No.1 LNG exporter. Chevron said the processing Train 1 at Gorgon would be closed for about four weeks due to a problem with a “flow measurement device” at the plant where nameplate production is 15.6 million tonnes per annum. It is the second time in six months that Train 1 has been closed for engineering investigations. Production stopped in November 2016 to “address some performance variations” and was restarted in January. The Gorgon plant Train 3 only started up in March 2017 and that landmark coincided with a scheduled temporary shutdown of Train 2 for planned work to improve its reliability. Most LNG production plants suffer output stoppages in the first 18 months or so and are often temporarily shut as part of the medium-term ramp-up process to make sure operations are running smoothly and safely. “Train 1 is expected to be down approximately one month and we will take this opportunity to perform other routine maintenance. Trains 2 and 3 are running normally and we are continuing to ship cargoes,” said Chevron.

CHIYODA CORP. the Japanese energy engineering company working on liquefaction projects such as Yamal LNG in Russia and Cameron LNG in Louisiana, recorded an annual loss of more than \$360 million as it installed a new management team to recover from problems at a subsea market subsidiary. The Yokohama-based company posted a loss of 41.1 billion yen (\$361.4 million) versus a profit of 3.4Bln yen (\$30.7 million) for the fiscal year ended in March 2017. Annual revenues held up amid the subsea losses, though came in 1.3 percent lower than the previous fiscal year at 603.7Bln yen (\$5.30Bln). “Although demand for energy grows steadily in the mid-term to the long-term with rising populations, economic development etc., the business environment in the next fiscal year will be still tough due to over-supply of LNG in the short term and a delay in the oil price recovery,” said Chiyoda. Chiyoda is currently working on LNG production projects in the expansion at Tangguh in Indonesia, the Yamal plant in Russia and two export ventures in the US, as well as Ichthys LNG in Australia. It is also carried out pre-construction work for LNG in the southeast African nation of Mozambique. “We will concentrate on our five on-going projects and to pursue

favorable projects in the US, Russia and East Africa, with the anticipated launch after 2019 of new emerging business fields in the gas value chain such as FLNG and small-scale LNG,” stated Chiyoda. Chiyoda said it received new orders worth 351.8 billion yen (\$3.09Bln), down 12 percent on the 406.3Bln yen (\$3.57Bln) of orders won in the previous year. Orders in the LNG and gas related industry amounted to 197.1Bln yen versus 166.6Bln in 2016. Chiyoda said most of these contracts related to a rise in domestic Japanese orders and the new liquefaction Train at the Tangguh LNG plant, operated by BP of the UK. The company blamed its losses on the problems at Emas Chiyoda Subsea. The venture was established in late 2015 as a procurement and construction service provider in the form of a 50-50 joint venture between Singapore-based Ezra Holdings, the offshore contractor, and Chiyoda. Having thoroughly re-valued the subsea business, the Chiyoda group recorded non-operating expenses and extraordinary losses of \$355M in the fiscal third-quarter. This then led to a management overhaul. Under the changes Senior Executive Vice President Masaji Santo was named as President and Chief Executive and Katsuo Nagasaka, a director and Senior Vice President, has been named executive Chairman. Senior Vice President Hirotsugu Hayashi was also appointed as the new Chief Financial Officer. Chiyoda said nominees would be subject to final confirmation in their posts at the annual general meeting of shareholders at the end of June. “The new medium-term management plan will focus on not only the business development strategy looking at 2025-2030, but the reinforcement plan for risk management and operations for group companies,” said Chiyoda.

CROWLEY MARITIME Corp. said its liquefied natural gas services group has been awarded a multi-year contract to supply additional volumes of containerized LNG shipped from Florida to pharmaceutical manufacturing plants in Puerto Rico. The contract, executed through Crowley’s Carib Energy, extends a 2014 contract awarded to Crowley for LNG supply for the facilities by expanding the service to additional plants. “It includes the fuel supply and transportation of LNG, which helps the customer yield substantially lowered emissions and provides an alternative to their current fuel source, diesel,” said Crowley. Crowley’s domestic logistics

operation will manage the transportation of the LNG in 40-foot intermodal containers from US liquefaction plants to the Port of Jacksonville in Florida. The ISO tanks are authorized by the US Department of Transportation to each carry approximately 10,000 gallons of LNG. Once in Puerto Rico, the LNG will be regasified into pipeline natural gas for boiler consumption at the pharmaceutical plants. Puerto Rico is the fifth-largest area in the world for pharmaceutical manufacturing with more than 80 plants in the US territory, including some of the largest such as AstraZeneca and Bristol Myers Squibb. Crowley entered the LNG market in 2015 by acquiring Florida-based Carib Energy. Founded in 2011, the Crowley company was the first to receive a small-scale, 25-year LNG export licence from the Energy Department for LNG transport from the United States. “We are thrilled to enhance our relationship by growing our LNG services and volumes with this critical customer in Puerto Rico,” said Greg Buffington, Crowley Vice President. “Crowley will continue to provide an uninterrupted supply chain of natural gas to the customer’s site, just as we have done since 2014, helping them utilize a safe, reliable and environmentally friendly fuel for their operations,” added Buffington.

DELEK GROUP of Israel said the financing from two international banks of the Leviathan natural gas project in the East Mediterranean to supply LNG buyer Jordan among others has been finalized and the first payments are being made. The first payment of the first phase amount of \$1.75 billion is being paid to the venture comprising two Delek subsidiaries Avner Oil Exploration and Delek Drilling as well as Leviathan field operator, Noble Energy of the US. The partnership has raised the funds from UK-based HSBC Bank and US investment bank JP Morgan. “The first withdrawal of funds shall be used, inter alia, for the payment demands issued by the operator to the partners in the Leviathan project, as well as for the financing of part of the costs of the loan,” said Delek. A second Israeli pipeline to Jordan is being built in the Beit Shean area and is scheduled to supply gas by 2019 from the Leviathan project to Jordanian National Electric Power Co. (NEPCO) plants in the Arab Kingdom. The Leviathan partners signed a letter of intent to supply 45 Bcm of gas to NEPCO over 15 years. The value of that contract

is estimated at more than \$15 billion. The Jordanian economy is still suffering from the loss of Egyptian natural gas since 2011 when political unrest and sabotage of the pipeline running through the Sinai Peninsula caused supplies to stop. Jordan has partially replaced some Egyptian supplies since 2015 with its LNG import terminal at the port of Aqaba, though LNG requirements are expected to drop after the larger Israeli pipeline opens in 2019. Noble said recently that it had begun exporting natural gas from Israel for the first time to industrial customers in Jordan as part of a ramp-up of pipeline supplies in the region. The first pipeline to Jordan belonging to Israel Natural Gas Lines passes via the Sdom area by the Dead Sea to supply two Jordanian private companies from the East Med Tamar natural gas field, also jointly owned by Noble and Delek and which has been on stream since 2015. Noble and Delek signed an agreement in February 2014 to supply the two Jordanian companies, Jordan's Arab Potash Company and Jordan Bromine. The two companies are believed to be paying \$5.50 per million British thermal units in a price linked to North Sea Brent crude oil. They will receive 1.8 Bcm of natural gas over 10 years at a cost of around \$500 million.

DEVON ENERGY, the US independent exploration and production company, said it planned to sell upstream shale-gas assets worth around \$1 billion, mostly in the Barnett shale area and which could be attractive to European and Asian LNG liquefaction tolling agreement holders. The Oklahoma City-based company reported its intention as it posted net earnings of \$565 million in the first-quarter of 2017. On the sale of upstream shale assets, Devon said it planned to offload the Barnett shale resources over the next 12-18 months. “The non-core assets identified for monetization include select portions of the Barnett Shale focused primarily around Johnson County and other properties,” the company said. Devon said total Barnett natural gas production in the first quarter of 2017 amounted to 683 million cubic feet per day. LNG export projects currently at an advanced stage of construction include Freeport LNG in Quintana Island in Texas, while a dozen others are planned on the Texas-Louisiana coastline. Freeport has 20-year Liquefaction Tolling Agreements with Asian companies under which they provide their own feed-gas. The accords are with some of the largest Asian

LNG buyers such as Osaka Gas and Chubu Electric as well as the major global player, BP of the UK. The Barnett shale region for oil and natural gas deposits is in North Texas and stretches from the west and south of the city of Dallas and covers 13,000 square kilometres and around 20 counties. The US company said it preferred to concentrate its oil-led activities in the Stack region of Oklahoma and the Delaware sub-region of the Permian Basin in Texas and New Mexico. Devon became a major player in the Barnett shale when it acquired Mitchell Energy, which was credited with launching the boom from hydraulic fracturing in the Barnett area, with more than 5,000 wells drilled. “After acquiring a substantial position in 2002, Devon was the first to apply horizontal drilling techniques in the Barnett, further enhancing production and transforming the Fort Worth Basin into one of the top producing gas fields in North America,” it explained. “Devon has acquired the largest and arguably the best acreage position in the play,” it said, with 169 thousand barrels of oil equivalent per day (27 percent liquids) and reserves estimated at 895 million barrels of oil equivalent (25 percent liquids). In focusing on oil, Devon said it was firmly on track to deliver on its previously announced US oil production growth targets of 13 percent to 17 percent in 2017. “Looking ahead to 2018, the operational momentum created by accelerated drilling activity in the Stack and Delaware Basin is expected to expand light-oil production in the US by approximately 20 percent compared to 2017,” said Devon in explaining its strategy. The company said it ended the first quarter with \$2.1Bn of cash on hand. Having made \$2.5Bn of debt repayments in 2016, Devon added that it had no significant debt maturing until mid-2021.

ENI, the Italian energy company, will supply LNG to Pakistan under a long-term contract to a new floating storage and regasification unit to be moored at Port Qasim. It will be the Italian company’s largest ever tender win for LNG and will be supplied on a monthly basis to a Pakistan state-owned firm. The total amounts to 180 cargoes over the period, corresponding to 11 million tonnes of LNG. “The LNG quantities that Eni will supply every year correspond to 25 percent of Pakistan LNG imports in 2016,” the company said. Pakistan’s first LNG import facility, the FSRU “Exquisite”, began operations in April 2015 at Port Qasim, located on a channel

of the Indus River east of Karachi. Two other FSRUs will be deployed during 2018 to meet the country’s growing natural gas needs in the absence of pipeline imports. One will be supplied by Excelerate Energy of the US at Port Qasim from around mid-2018 as the second Pakistani import facility, while a third FSRU will be deployed by Hoegh LNG near the same location at the end of 2018. “A significant part of the LNG volumes will be sourced from Indonesia, where the Eni’s operated Jangkrik field (supplying also the Chinese market) will come on stream in the next couple of months,” Eni explained. “Pakistan is nowadays one of the fastest growing LNG markets worldwide,” said Eni. “This LNG contract will contribute to satisfying the increasing energy needs of Pakistan and will allow Eni to further consolidate its presence in the country, where Eni is already leader for domestic gas production,” added the Italian company. Eni recently signed an agreement with BP for the sale over more than 20 years of the LNG volumes produced by the floating liquefaction facility to be placed offshore Mozambique and known as the Coral South project.

GASLOG, the LNG fleet owner, said shipping companies are expecting an increase in activity from the summer cooling season in the Middle East and Asia and from Southern Hemisphere winter demand. The Monaco-based company with a fleet consisting of 27 LNG carriers as outlined its view in its first-quarter earnings report. “While the recovery in charter rates and utilization in the LNG shipping market is taking longer than we had anticipated, we are seeing some initial signs of increased short-term and long-term activity, and we continue to believe that the longer-term fundamentals point to a strengthening market in 2017 and beyond,” said GasLog. Its first-quarter revenues amounted to \$128.3 million compared with \$104.4M in the year-ago quarter. Net profits of \$23.4M were recorded versus a loss of \$5.3M in the same three months of 2016. The company, much of whose long-term charters were first struck with BG Group of the UK before its takeover by Shell, said profit was due to an increase in the number of operating days for its ships to 2,070 in the quarter compared with 1,643 operating days for the year-ago period. The increase in operating days resulted mainly from the deliveries of four new ships, the “GasLog Greece”, the “GasLog

Glasgow”, the “GasLog Geneva” and the “GasLog Gibraltar”. GasLog’s contracted charter revenues are estimated to increase from \$444.5M for the fiscal year 2016 to \$486.5M for the fiscal year 2019, based on contracts in effect as of March 31, 2017. At the end of the first quarter the total future firm contracted revenue stood at \$3.5 billion, including the vessels owned by GasLog Partners but excluding the vessels operating in the spot market. GasLog noted that in addition to the larger projects coming on stream in Australia such as Gorgon LNG, there was a significant increase in demand from a number of new markets such as Pakistan, Poland, Lithuania and Jordan as well as major energy growth markets such as China and India. “This trend has continued into the first quarter of 2017 with further strong increases in demand from China,” the company added. Chinese imports were up 23 percent year-on-year and shipments were higher to the large traditional markets such as Japan, with 13 percent more LNG imported and South Korea, up 18 percent compared with 2016. GasLog also forecasts a surge in imports linked to the deployment of more floating storage and regasification unit (FSRU) import terminals. “Many countries with growing power demand, such as Ivory Coast, South Africa, Bangladesh and Myanmar, are looking at FSRUs as a quick-to-market, cost-effective solution to import LNG. Other countries with FSRUs already in place are looking at expanding their use of FSRUs due to the successful commissioning and effective operations of the existing units,” it added. Among quarterly highlights, GasLog mentioned its February investment the privately-held company Gastrade, which is proposing to import LNG to northern Greece and Bulgaria by using an FSRU. GasLog closed the acquisition of a 20 percent shareholding in Gastrade. The company is aiming to develop an independent natural gas system offshore Alexandroupolis in Northern Greece using an FSRU along with other fixed infrastructure. GasLog, as well as being a shareholder, will provide operations and maintenance services for the FSRU through a formal agreement. “Gastrade is currently in discussions with additional potential investors, including DEPA, the Greek state-owned gas company, Bulgarian Energy Holding, the holding company of the Bulgarian Ministry of Energy and major gas suppliers in Bulgaria,” it stated. A final investment

decision is expected on the Greece-Bulgaria import project later in 2017 and with the FSRU scheduled to be operational by the end of 2019.

GOLAR LNG, the Norwegian fleet owner and project developer, has signed agreements for conversion of the 126,000 cubic metres capacity carrier “Gandria” to a floating liquefaction facility to be deployed for the Fortuna project offshore Equatorial Guinea, led by UK company Ophir Energy. The primary contract for the “FLNG Gandria” was entered into with Singapore’s Keppel Shipyard, while the liquefaction technology will be provided by Black & Veatch of the US. This contract leaves just three issues outstanding as Fortuna FLNG proceeds to its final investment decision. The “Gandria” vessel will be acquired by the Fortuna Joint Operating Company upon reaching the planned FID within several weeks. The Republic of Equatorial Guinea, as a partner in the venture, has the right to acquire up to 30 percent of the FLNG vessel. Ophir said that the award of the midstream ship conversion and engineering contracts completed another import phase leading up to the FID. “At this point three external milestones remain,” explained Ophir. The UK company listed the outstanding issues as the award of the upstream Engineering, Procurement, Construction, Installation and Commissioning (EPCIC) contracts, the completion of the debt facility and the allocation of LNG offtake. Ophir said that as regards progress, the EPCIC contract was on schedule, term sheets have been agreed with a consortium of China-based banks and the project financing was at the final documentation stage. In relation to offtake agreements, Ophir said: “The Fortuna partners will determine in May the structure and amount of the expected 2.5 million tonnes per annum to place under contract at FID. An award of offtake will be made from the shortlist of attractive proposals from high-quality counterparties.” Nick Cooper, Chief Executive of Ophir commented: “The award of the midstream construction completes another milestone as we approach FID. We remain firmly on schedule for the FID of Africa’s first deepwater FLNG Project in mid-2017.” Parties to the Fortuna project had earlier signed a full legal and fiscal framework agreement. The accord was signed by Ophir, the government, the joint venture company OneLNG, comprising Golar and oil services company Schlumberger, and

state energy firm Compania Nacional De Petroleos De Guinea Ecuatorial (GEPetrol). Ophir said it confirmed the participation rights of GEPetrol as partners for 20 percent of the upstream portion of the project, as well as a 30 percent ownership of the “FLNG Gandria”. Equatorial Guinea already has an onshore LNG plant on Bioko Island, operated by US company Marathon Oil and on stream since 2007. Ophir has a joint venture agreement to develop the Fortuna FLNG project with Golar and oil services firm Schlumberger to produce free-on-board cargoes priced at around \$6 per million British thermal units.

INPEX Chief Executive Toshiaki Kitamura acknowledged that the Japanese company’s Ichthys liquefied natural gas project near Darwin in Australia’s Northern Territory was behind schedule by several months and the shipping of the first LNG cargo could take place by the end of 2017 or early 2018. Kitamura also said in an address to analysts that Ichthys LNG, being developed with French energy company Total, was likely to be expanded using additional liquefaction Trains constructed near the Bladin Point site. The latest delays have been caused by several issues, including age disputes involving a local construction company working on the project which led to delays in building storage tanks and power facilities. Delays in the completion of the natural gas fields offshore northwest Australia also added to the schedule slippage, as did the later completion by Daewoo Shipbuilding & Marine Engineering of the Central Processing Facility (CPF) that is still being towed to the site over the Ichthys field. The CPF, named the “Ichthys Explorer”, left the Daewoo shipyard on April 28 and was being towed to the Ichthys Field over a period of six weeks after which it is scheduled to undergo hook-up. The Ichthys venture is noted for having the largest offshore facilities in the industry and an 890 kilometres pipeline linking the feed-gas to the onshore liquefaction plant. Inpex aims to bring liquefaction equipment on stream later this year and further delays could add to the final costs, currently running at \$37 billion. “LNG tanks are also reaching the final stages of construction,” said Kitamura. “We will continue with our work, mainly focusing on commissioning work for onshore and offshore facilities,” he added. When completed by the main contractors, the JKC consortium comprising Japanese

engineering groups JGC and Chiyoda and US engineering company KBR, the liquefaction facility will have two Trains with nameplate output of just short of 9 million tonnes per annum. “Thereafter, the Ichthys LNG project will begin production of condensate, LNG and LPG in sequence during the current fiscal year,” said the Inpex CEO without giving a specific date in the fiscal-year window between now and early 2018. Kitamura also focused on the plans by Inpex to expand Ichthys LNG from resources in gas fields adjoining the Ichthys resources and acquired over recent years in an Inpex buy-up campaign. “We have participating interests held in 14 exploration blocks in the vicinity of the Ichthys Field. Gas structures include the Crown, Lasseater, Mimi and Burnside discoveries,” said the Inpex CEO. “The discovered gas structures extend across at least six of the 14 exploration blocks in the vicinity of Ichthys and there is a site for additional LNG trains that has already been secured. These discovered gas structures still need to be appraised, so some time will be needed for this appraisal before we commercialize them,” said Kitamura. “We can expect there to be a considerable amount of synergies between Ichthys and the surrounding gas development project,” stated the CEO. Kitamura is confident he can place additional LNG resources from an Ichthys project expansion with Japanese utilities. The Ichthys joint venture has long-term contracts to supply LNG shipments to the Japanese utilities Tokyo Gas, Osaka Gas, Kansai Electric Power, Toho Gas and Jera Co. Inc., the joint procurement venture between Tokyo Electric Power and Chubu Electric.

JAPANESE government figures show that the average delivered price of spot liquefied natural gas shipments arriving in Japan was higher at \$5.90 per million British thermal units in April compared with \$5.80 per MMBtu in April 2016. The preliminary average April 2017 contract-based price was also up compared with a year ago at \$5.70 per MMBtu versus \$4.20 per MMBtu in April 2016. However, compared with the previous month the spot cargo prices were down. The March 2017 spot price contracted but not yet delivered had been \$6.20 per MMBtu versus \$8.50 MMBtu the previous month. The spot cargo numbers come from the commerce division of the Japanese Ministry of Economy, Trade and Industry and are only issued if a minimum number of two trades are recorded. The ministry

emphasizes that “spot LNG” refers to fuel traded on a cargo-to-cargo basis and does not mean shipments under contracts on a short-term, medium-term or long-term basis. The statistical accounting of the spot prices started in March 2014. “Subjects of these statistics are companies which are end-consumers of spot LNG. In order to avoid double counting, companies that mediate transactions (for example trading companies) are excluded from subjects of these statistics,” the Ministry noted. Overall shipments to Japan, last given for the month of March, amounted to 8.14 million tonnes, the same as in the March 2016. The shipments were underpinned by Australian shipments and spot and short-term contract volumes. While year-on-year LNG cargo volumes were unchanged, imports of thermal coal for power generation, a competitor to LNG, rose 5.6 percent to 9.64MT. Japan’s LNG imports had amounted to 7.79MT in February compared with 7.43MT in February 2016. The March 2017 LNG imports cost Japan 367.85 billion yen (\$3.37Bln), a price rise of 6.5 percent compared with the 345.49Bln yen paid in March 2016.

KONGSBERG, the Norwegian maritime technology company, has signed a contract with the German shipbuilder Fassmer for the delivery of equipment for the world’s first government-owned LNG-powered research vessel ordered by Germany. Kongsberg, listed on the Oslo stock exchange, said the equipment would be installed in the German Federal “Maritime and Hydrographic Agency (BSH) research vessel “Atair II”. “The ‘Atair II’ will have Kongsberg’s Integrated Research Vessel Concept, uniting operational hydrographic and energy functions on board, facilitating seamless information sharing and enhanced efficiency and long-term life cycle benefits,” said Kongsberg. Kongsberg Maritime delivers products and systems for positioning, navigation and automation to merchant vessels and offshore installations, as well as products and systems for surveying and monitoring. The “Atair II” will be 74 metres in length and 16.8m wide and will be Germany’s most modern research vessel when it starts operating in the North Sea, Baltic and North Atlantic. The dual-fuel ship is scheduled to go into service out of Hamburg in the first quarter of 2020 as the biggest vessel in the BSH fleet. Kongsberg said its system will deliver a fully integrated operator environment, equipped with high-level

acoustic data acquisition, propulsion control as well as navigation and vessel automation. “The concepts are a brand-new approach to vessel design and building that leverages the power of integration between disparate systems to produce gains in operational efficiency while reducing life-cycle costs,” said Brynjar Standal, Vice President of Marketing at Kongsberg Maritime. “With concepts designed for specific ship types, our Integrated Vessel Concepts portfolio represents the cutting-edge of marine technology and engineering,” added Standal. The “Atair II” will have a dual-fuel propulsion system from Finnish engine-maker Wartsila, providing a trial speed of 13 knots. There will also be two dual-fuel generators and an emergency diesel generator using high-quality gas-oil as well as a 130 cubic metres capacity LNG tank for 10 days of operations with LNG fuel. The German newbuild will have a crew of 18 and room for 15 other people. It will boast two independent on-board tenders, laboratory facilities and free deck space of 200 square metres.

MAGNOLIA LNG, the US export project in Louisiana said it had received a Notice to Proceed (NTP) from the Federal Energy Regulatory Commission, opening the way for preparation work to begin on the site for the liquefaction plant on the Calcasieu Shipping Channel near the Port of Lake Charles. Magnolia is being developed by Australian company LNG Ltd and is planning a facility with 8 million tonnes per annum of production. “We are appreciative to FERC for the issuance of the NTP on our request for authorization to commence initial site preparation activities,” said John Baguley, Chief Operating Officer for Magnolia LNG. “FERC’s comprehensive review of our submittals and concurrence that we have complied with conditions for these initial activities demonstrates the project’s readiness,” added Baguley. Greg Vesey, Chief Executive of LNG Ltd., said the project was now in a “shovel ready” state. “Nevertheless, the pacing item for our Final Investment Decision (FID) and initiation of construction for Magnolia remains the finalization of our LNG offtake agreements, and our team remains fully engaged in advancing this activity,” stated Vesey. In addition to developing the Magnolia venture, LNG Ltd owns the Bear Head project in the Canadian province of Nova Scotia. It also holds a site lease agreement for the proposed Queensland coal-seam-gas-to-LNG project in Australia

and has its own patented liquefaction processing technology called the optimized single mixed refrigerant (OSMR) system. The Magnolia project in January 2017 signed a Heads of Agreement with Vessel Gasification Solutions Inc. (VGS) in relation to shipping cargoes to India. The accord, if it becomes a full Supply and Purchase Agreement (SPA), would see Magnolia supply LNG to the East Coast of India for the first time as all the Asian nation's four existing terminals are on the West Coast. Indian group VGS describes itself as an Indo-American company. VGS has apparently ordered a floating storage and regasification vessel from the Nantong shipyard of China-based Wison Offshore & Marine to be deployed as an import facility. A mooring site has been found at Kakinada Deepwater Port and the project will supply natural gas to the eastern Indian states of Andhra Pradesh and Orissa. The non-binding HOA between Magnolia and VGS provides for a future free-on-board (FOB) Sale and Purchase Agreement over 20 years of up to 4 million tonnes per annum, half of the planned initial capacity at the Louisiana plant.

MONADELPHOUS, the Australian engineering and construction company said it was awarded the long-term offshore maintenance services contract for the Ichthys LNG project being developed by Japanese energy company Inpex near Darwin in the Northern Territory. Monadelphous said the contract was for an initial period of six years with a further two two-year extension options and is in the Browse Basin offshore northwest Australia. Inpex is developing the Ichthys project at a cost of US\$37 billion with French joint venture partner Total and the liquefaction plant at Bladin Point is on schedule to begin LNG production before the end of 2017. Monadelphous has been engaged to deliver operational, campaign and shutdown maintenance services for the offshore feed-gas facilities. Its work is specifically focused on project implementation associated with the Ichthys Central Processing Facility, the "Ichthys Explorer" and the Floating Production Storage and Offloading (FPSO) facility, the "Ichthys Venturer". The "Ichthys Explorer" is the world's largest semi-submersible central processing facility. When completed by the main contractors, the JKC consortium comprising Japanese engineering groups JGC and Chiyoda and US engineering company KBR, the liquefaction facility

will have two Trains with nameplate output of just short of 9 million tonnes per annum. Ichthys has long-term contracts to supply LNG shipments to the Japanese utilities Tokyo Gas, Osaka Gas, Kansai Electric Power, Toho Gas and Jera Co. Inc., the joint procurement venture between Tokyo Electric Power and Chubu Electric. "We are delighted to be awarded such a significant maintenance contract by Inpex operations for the world-class Ichthys LNG project," said Monadelphous Managing Director Rob Velletri. "The contract continues to strengthen our position as a major service provider of offshore maintenance services," he added. "We look forward to further strengthening our relationship with Inpex and working together to create sustainable economic and social development opportunities for local people, businesses and communities," said Velletri.

NEXTDECADE, the US LNG export project developer, has appointed French bank Societe Generale and Australia's Macquarie Capital to act as joint financial advisors for the debt and equity financing of the Rio Grande project at the Texan port of Brownsville. The Rio Grande export venture, which is advancing through the Federal Energy Regulatory Commission permitting process, will produce 27 million tonnes per annum of LNG when completed. NextDecade is led by Kathleen Eisbrenner, a former senior LNG executive at Royal Dutch Shell. The Houston-based Eisbrenner company recently competed a reverse merger transaction to obtain a stock listing on the Nasdaq global exchange to make it easier to raise finance for the liquefaction plant and its affiliated pipeline. Societe Generale and Macquarie Capital have each played extensive roles in advising and participating in debt and equity financing for large-scale infrastructure and LNG projects. NextDecade pointed out that the French bank has worked on more than 45 transactions in the LNG sector. NextDecade Chief Financial Officer Ben Atkins commented: "Societe Generale and Macquarie Capital's combined experience and collaborative approach will help ensure that NextDecade optimizes its cost of capital and minimizes its execution risk." Macquarie also has extensive experience in the infrastructure advisory role and in LNG projects in particular, including raising more than \$3 billion of financing for the Freeport LNG plant currently under construction on Quintana Island in

Texas. "We are pleased to bring our expertise to NextDecade as they move towards their final investment decision," said Brent Wahl, Senior Managing Director at Macquarie Capital. "NextDecade's commitment to proven technology along with their strong industry and commercial relationships make Rio Grande an attractive LNG project," added Wahl. NextDecade submitted its formal application for the Rio Grande venture to the FERC in May 2016 and its six liquefaction Trains will be among the leading projects in the second wave of the US export build-out.

NOBLE ENERGY of US, the main production company in the East Mediterranean, said it began exporting natural gas from Israel for the first time to industrial customers in Jordan as part of a ramp-up of pipeline supplies in the region that may displace LNG shipments. The Israel Natural Gas Lines link passes via the Sdom area by the Dead Sea to supply the Jordanian companies from the Tamar natural gas field, jointly owned by Noble and subsidiaries of the Israeli Delek Group. Noble and Delek first signed an agreement in February 2014 to supply the companies, Jordan's Arab Potash Company and Jordan Bromine. The two companies are believed to be paying \$5.50 per million British thermal units in a price linked to North Sea Brent crude oil. They will receive 1.8 Bcm of natural gas over 10 years at a cost of around \$500 million. A second Israeli pipeline to Jordan is also being built in the Beit Shean area and is scheduled to supply gas by 2019 from the Noble-led Leviathan project in the East Med to Jordanian National Electric Power Co. (NEPCO) plants in the Arab Kingdom. The Leviathan partners signed a letter of intent to supply 45 Bcm of gas to NEPCO over 15 years. The value of that contract is estimated at more than \$15 billion. The Jordanian economy is still suffering from the loss of Egyptian natural gas since 2011 when political unrest and sabotage of the pipeline running through the Sinai Peninsula caused supplies to stop. Jordan has partially replaced some Egyptian supplies since 2015 with its LNG import terminal at the port of Aqaba, though LNG requirements are expected to drop after the larger Israeli pipeline opens in 2019. Noble said in its first-quarter earnings just published that the company averaged 274 million cubic feet equivalent per day in sales volumes from its Israel assets within the first three

months of 2017. "Gross field sales of 956 MMcf/d reflected an increase of over 12 percent from the first quarter of 2016," Noble said. "The company began exporting natural gas from Israel for the first time to industrial customers in Jordan," it added, in reference to the pipeline start-up in January 2017. "During the first quarter, the company completed the Tamar 8 development well, further supporting long-term field deliverability. The Tamar 8 well began producing in early April and is performing as expected," said Noble. Noble noted in its earnings report that the company and Delek sanctioned the initial phase of the Leviathan development project. "Development activities and project spend have commenced, with drilling underway on two production wells (four production wells capable of 1.2 Bcf/d are included in the first phase of Leviathan). Initial Leviathan proved reserves are anticipated to be recorded in 2017 at approximately 3.3 trillion cubic feet (550 MMBoe) net," it stated. In addition to the East Med, Houston-based Noble has extensive US assets, including in the Eagle Ford and Marcellus shale plays, the DJ and Delaware basins and in the Gulf of Mexico. "Noble Energy is off to a great start in 2017, with strong operational and financial performance and importantly, numerous recent strategic accomplishments," said David L. Stover, Noble Energy's Chairman, President and Chief Executive. "Our top-tier US onshore assets and execution are delivering ahead of plan as a result of drilling advancements in all basins and continued industry-leading well performance. Offshore, we are maximizing the cash flow from our existing assets, while progressing the recently-sanctioned Leviathan major project," added Stover.

NORTON ROSE Fulbright, the International law firm has hired LNG and shipping experts Jonathan Siu and Sung Hwan Choi for its shipping and offshore oil and gas team in its Singapore office. Siu has joined Norton Rose Fulbright as senior associate from Allen & Overy in Perth, Western Australia. "He has extensive experience on a broad range of international transactions focusing primarily in the shipping, offshore and oil and gas sectors and has acted on numerous award winning deals including the Ichthys LNG and Nghi Son Refinery projects," said Norton Rose Fulbright. Sung Hwan Choi, known as "SD", joined

the firm as counsel from Campbell Johnston Clark in Singapore, having previously been at Kim & Chang in Seoul, South Korea. “SD brings a wealth of knowledge, advising Korean and multinational clients in all aspects of shipping and offshore finance matters,” his new employers said. “He has acted for a variety of banks, lenders, investment funds and ship owners and is qualified to practice in England and Wales, the Marshall Islands, New York, and the District of Colombia,” said Norton Rose. Ben Rose, head of shipping for Asia at Norton Rose Fulbright, said that in a recovering market these “two significant hires” will help further cement our leading position in the shipping, offshore and oil and gas markets and continue to strengthen our practice. “Singapore is an important hub for the global shipping and offshore markets and the links of ‘SD’ and Jonathan’s into Korea, Australia, Malaysia and Japan will be of enormous benefit to our clients throughout the Asia-Pacific,” said Rose. Harry Theochari, global head of transport at the firm, commented: “These hires, together with the announcement of our upcoming combination with Chadbourne & Parke, and our recent office openings in Vancouver, Monaco and Papua New Guinea, illustrate our continued commitment to the shipping and offshore industry, which we have served for over 215 years.”

OPHIR Energy of the UK, the licence holder for the Fortuna floating LNG project in Equatorial Guinea, said a full legal and fiscal framework agreement has been signed by all parties, signalling the go-ahead for the venture offshore West Africa with Chinese-sourced loans. The accord was signed by Ophir, the government, the joint venture company OneLNG and state energy firm Compania Nacional De Petroleos De Guinea Ecuatorial (GEPetrol). Ophir said it confirmed the participation rights of GEPetrol as partners for 20 percent of the upstream portion of the project, as well as a future potential participation of up to 30 percent ownership of the midstream FLNG vessel for the government or a designated state company. “These participations create alignment with the EG Government throughout the project value chain from upstream through to LNG marketing,” said Ophir. The UK company said signing the accord was one of the key milestones to be delivered ahead of the final investment decision. The Fortuna FLNG Project FID is on

schedule for mid-2017 with first gas expected in mid-2020. Ophir has a joint venture agreement to develop the Fortuna FLNG project with Norwegian shipping and project company Golar and oil services firm Schlumberger to produce free-on-board cargoes priced at around \$6 per million British thermal units. Ophir signed an accord in November 2016 with a joint subsidiary of Golar and Schlumberger called OneLNG. The shareholders agreement established a joint operating company to develop the Fortuna FLNG project from feed-gas resources in Block R offshore Equatorial Guinea using Golar’s production hull technology. “The impending award of construction contracts is well progressed and on schedule,” said Ophir. It added that “term sheets have been agreed with a consortium of China-based lenders” and the counter-parties to the financing had entered into the final documentation stage. “The Fortuna partners will decide in the coming weeks the amount of the expected 2.5 MTPA to put under contract at FID from the several offtake options available,” said Ophir. “As previously announced the expected total capital expenditure for the integrated project is approximately \$2 billion to reach first gas. Approximately \$1.2 billion is expected to be debt financed, with full drawdown by the start of commercial operations,” the UK company added. Nick Cooper, Chief Executive of Ophir, said the latest agreement formalized the value chain economics for the government and the project participants. “We welcome the introduction of Equatorial Guinea’s national companies as project partners and the alignment of interests that this brings,” said Cooper. “The remaining milestones of the construction contract awards, the finalisation of debt and the LNG offtake are as advanced as we had wanted them to be at this stage,” added Cooper. According to Jeff Goodrich, CEO of the OneLNG joint venture, the agreement was a landmark and an innovative way of doing business. “It brings alignment throughout the entire value chain to all of the project stakeholders and provides clear line of sight to FID for the project,” said Goodrich. “The Fortuna project remains on track to become Africa’s first deepwater FLNG project,” he added. Equatorial Guinea’s Minister of Mines and Hydrocarbons, Gabriel Mbagha Obiang Lima, said the parties were one crucial step closer to realizing the “historic” Fortuna FLNG project. “This

agreement is in line with the government’s objective to deliver important projects that monetizes our gas, promotes local content and brings world-class petroleum technology to Equatorial Guinea,” said the minister.

PETRONAS, the Malaysian energy company, said it expected to proceed with a second floating liquefied natural gas project involving a US company after the successful start-up of “PFLNG Satu”, the world’s first production hull deployed over the stranded Kanowit gas field offshore Sarawak. “Our first cargo went to India, and the vessel will sit on the Kanowit gas field for five years, after which our development people will be looking at the next field,” said Petronas Upstream Vice-President Adnan Zainol Abidin in a statement issued in Kuala Lumpur. Abidin said the operating FLNG venture with output of around 1.2 million tonnes per annum would increase Malaysia’s total LNG production to over 30 MTPA, most of it coming from the seven Trains at the onshore Bintulu production plant in Sarawak. The Kanowit FLNG hull was constructed at the Daewoo Shipbuilding and Marine Engineering shipyard in South Korea. “Next, we want to stabilise our operation on the first facility and in 2020, our second vessel, ‘PFLNG Dua’ is scheduled to be released,” explained the Petronas executive. The “PFLNG Dua” will be designed to produce 1.5 MTPA and it, like the first vessel, would be designed to operate for 20 years without drydocking. The second FLNG venture was originally scheduled to be started up in 2018 and to be deployed over the deepwater Rotan gas field, about 80 miles offshore of Sabah, the Malaysian state occupying the northern part of the island of Borneo. The Rotan gas well was discovered by Murphy Oil Corp. of the US in in 2007 in the Block H licence in Malaysian waters of the South China Sea and both companies had previously sanctioned first FLNG output by 2018. However, Petronas said in March 2016 that “PFLNG Dua” had been postponed as part of cost-cutting measures amid much lower revenues because of the oil slump. The US company, based in Arkansas, still holds about 50 percent of the Block H licence for the Rotan gas field. Murphy said in April 2017 that it was planning to monetize the Block H FLNG project with Petronas with first production possible by 2020.

PIERIDAE Energy of Canada is planning a reverse takeover and a listing on the Toronto Stock Exchange as it

follows the lead of US LNG developers before the start of financing and construction of its Goldboro LNG plant in the Atlantic province of Nova Scotia. Calgary-based Pieridae is currently a privately-held company and it has now announced it is merging with Petrolia Inc. of Quebec, whose shares trade on the exchange and whose oil and natural gas properties in Canada are only in the exploration stage. However, by taking over the listing of Petrolia, the Calgary company will more easily be able to raise capital on financial markets for its project which already counts German utility Uniper as its foundation customer. US LNG projects such as Cheniere’s Sabine Pass, Tellurian Inc’s Driftwood LNG and NextDecade’s Rio Grande LNG have all opted for the advantages of being public companies to raise the billions of dollars required to complete their liquefaction and export ventures. Under the terms of the transaction, Pieridae has committed to raise \$50 million through subscription receipts before the deal closes, with Petrolia expected to end up with 14.75 percent of the combined company. Pieridae Chief Executive Alfred Sorensen said the deal would help raise money in a challenging environment as it looks to secure the C\$5.5 billion (US\$4.03Bln) needed for one processing Train and an additional C\$2Bln for the second train. “Pieridea’s Goldboro LNG facility project, combined with the resource potential held by Petrolia, constitutes an opportunity for investors to participate in the evolution and growth of Canada’s only integrated LNG facility holding key permits and approvals for its current stage of development,” he said. The Pieridae CEO explained that while the supply agreement with Uniper allowed it to borrow debt at a much lower rate, there is a need to start construction by the end of the year or early 2018 to have enough time to finish and to start supplying the Germans by the end of 2021 as part of the offtake accord. “It all very much revolves around the German offtake and loan guarantee, which kind of makes us more credible when it comes to getting to the finish line,” said Sorensen. “There’s no doubt that Pieridae is punching way above its weight class,” he added. The combined Pieridae- Petrolia company will take the new name Amalco when the merger is completed. “It is expected that the combined expertise and diversification of the two companies will provide Amalco with the potential of an effective and sustainable long-term growth plan,” the companies said. Amalco will

maintain offices in Calgary, Quebec City and Halifax, Nova Scotia. Pieridae recently ratified labour agreements to secure tradesmen for the building of the Goldboro plant to produce 10 million tonnes per annum of LNG. The labour pact is with the Nova Scotia Construction Labour Relations Association and would be expected to settle payment levels in advance and to avoid disputes. “The agreement provides Pieridae with a higher degree of cost certainty for the construction phase, and reduces the overall risk for Pieridae in planning the final construction of the Goldboro LNG facility,” it explained. Pieridae’s deal with Uniper is for 50 percent of Goldboro’s initial capacity pursuant to a 20-year, take-or-pay contract. The Goldboro facility is located at the Goldboro Industrial Park after the company earlier acquired 265 acres of land from the municipality of the District of Guysborough. Another LNG export project in Nova Scotia is the Bear Head venture being developed by LNG Ltd. of Australia.

PO VALLEY Energy, the Australian natural gas producer, whose subsidiary owns three onshore Italian gas fields near the cities of Milan and Bologna, has reached a provisional agreement with United Oil and Gas, holder of assets in the UK Wessex Basin, to sell it a stake in a fourth Italian field located in the Emilia Romagna region. Po Valley Energy’s London-listed unit recently started production at the Bezzecca gas field near Milan in northern Italy in a small-scale domestic resource challenge to LNG and pipeline gas imported from North Africa. The company has now reached a conditional agreement for United Oil & Gas to earn a 20 percent stake into Po Valley’s Podere Gallina licence in Emilia Romagna. The Podere Gallina permit area includes the Selva gas field, which produced 83 billion cubic feet of natural gas from 15 wells over a 35-year period. “We are delighted to welcome United Oil & Gas as a strategic partner in Selva which was previously one of ENI’s largest onshore natural gas production fields,” said the Chairman of Po Valley, Michael Masterman. “Our successful drilling of Podere Maiar-1 is a strategic priority and has the potential to add more significant gas production for Po Valley following development. Civil works are already underway and drilling is planned for the December quarter 2017,” said Masterman. Po Valley Energy, already listed on the Australian Securities

Exchange in Sydney, sold part of its holdings in three other Italian gas fields in an initial public offering in London of its subsidiary, Saffron Energy. The Saffron unit is the holding company for the Bezzecca, Sillaro and Sant’Alberto fields located near Milan and Bologna. The Podere Gallina licence measures 330 square kilometres and it is situated in the eastern part of the Po Plain in the Ferrara and Bologna provinces of Emilia Romagna. The licence was awarded in 2008. The Australian company said conditions for full commitment by United to the deal are expected to be completed by July 2017 and drilling is planned for the December quarter. The strategy of companies like Dublin, Ireland-based United is to acquire non-core oil and gas licences from mid-caps firms or majors where they can unlock previously untapped value. United had previously acquired First Oil’s stake in the PL090 licences, onshore the UK in 2016. These licences include an existing onshore UK field and access to significant exploration opportunities. The PL090 licences are situated in the Wessex Basin, a long-established productive area that contains Wytch Farm, the largest oil field in onshore Europe.

RAS LAFFAN Liquefied Natural Gas Co. (RasGas), the Qatari producer currently finalizing its merger with Qatargas, has successfully loaded and delivered its 2,000th cargo to Korea Gas Corp., one of the world’s largest importers. The cargo was lifted by the Kogas vessel, the 138,000 cubic metres capacity “SK Summit”, which also carried the first cargo of LNG supplied by RasGas to Korea in August 1999. “We are deeply proud of our long-standing partnership with Kogas, which has been maintained for more than two decades,” said RasGas Chief Executive Hamad Mubarak Al-Muhannadi. The Korean natural gas company is the largest long-term contract holder with RasGas as well as being its first customer as it began the process of building liquefaction Trains for around 32 million tonnes per annum of LNG. “We are honoured by the trust they have placed in RasGas over the years to safely and reliably deliver LNG to meet Korea’s energy needs from Qatar,” added Al-Muhannadi. Kogas CEO Lee Seung Hoon said his company appreciated its long and reliable energy link with Qatar. “Over the last few decades, RasGas and Kogas have been proving the power of a harmonious partnership between seller and buyer,” said the Kogas CEO. RasGas

had signed its first-ever long-term sales and purchase agreement with Kogas back in October 1995. The two companies subsequently entered into two further long-term SPAs and RasGas is currently contracted to deliver more than 9MTPA of LNG to Kogas. Qatar Petroleum, owner of both RasGas and Qatargas, announced in December 2016 it was merging its two production companies and consolidating all activities under the Qatargas banner to make operations more efficient. Qatargas and RasGas have 14 liquefaction Trains in operation at the Ras Laffan production complex, including six of the world’s largest Trains, enabling Qatar to produce more than 77 MTPA of LNG.

SANTOS, the Australian company, a stakeholder in three Asia-Pacific liquefied natural gas production plants, said it received further positive results from the Muruk 1 gas exploration well being drilled in the Papua New Guinea Highlands to help underpin PNG LNG plant expansion. “Well logs and pressure data have confirmed that the entire Toro reservoir section is gas saturated,” stated Santos. The company explained that the Toro Sandstone interval in the Muruk side-track is similar to the “excellent, high-quality reservoir” penetrated in the original wellbore. The Muruk 1 gas discovery was first announced in December 2016 and an additional sidetrack has been successfully drilled through the Toro reservoir objective to the southwest of the gas discovery. In addition to its stake in the PNG LNG plant, operated by ExxonMobil, Santos is operator of the Gladstone coal-seam-gas-to-LNG plant in the eastern state of Queensland. Its partners are the French company Total, Petronas of Malaysia and Korea Gas Corp. Santos also has a stake in the ConocoPhillips-operated Darwin plant in Australia’s Northern Territory. “After cementing the 7-inch liner at 3,921 metres, Muruk side-track penetrated the top Toro at 3,968 metres and was drilled to a depth of 4,025 metres. Two cores were cut and the well was then deepened to 4,130 metres, to enable a full suite of logs and pressure data to be acquired,” added Santos. “The data acquired from logging, cores and pressure samples is now being evaluated. Subject to Joint Venture approval, a production test will be undertaken, to assess the deliverability and potential flow rates from the Toro,” said Santos. “The Muruk drilling programme confirms the discovery of a potentially significant new gas field, 21

kilometres north west of the Hides production facilities,” it added. “The data from the Muruk drilling program will be evaluated to assist in the definition of forward appraisal options,” the company stated. The Muruk licence participants along with Santos are ExxonMobil and Oil Search Ltd. The existing two Trains at the PNG LNG plant, located northwest of the capital Port Moresby, produced at an average rate of 7.9 million tonnes per annum during 2016 compared with their combined nameplate capacity of 6.9 MTPA. An independent gas certification of the Elk-Antelope fields, which would provide additional LNG production for PNG, recently took place. Together with existing resources and the upgrade in PNG LNG reserves, the certification supported the view that there are sufficient gas resources available to support further expansion of PNG LNG production as well as two new PNG LNG-sized Trains.

SHELL sold 3.2 percent more liquefied natural gas in the first quarter, helped by higher output from the Gorgon LNG plant in Western Australia as income for the Integrated Gas division more than doubled. Shell sold 15.84 million tonnes of LNG in the first three months of the year compared with 15.34MT in the fourth quarter of 2016. The total was 29 percent more than the 12.29MT of LNG volumes sold in the same three months a year ago before the BG Group merger had fully kicked in. Income in the Shell Integrated Gas division, including profits from LNG, more than doubled to \$1.82Bln versus \$905M in the same quarter of 2016. Overall quarterly net income, including other areas such as oil and refining, amounted to \$3.86Bln in the first three months compared with \$1.83Bln in the year-ago period. “Integrated Gas earnings, excluding identified items, benefited from higher realized oil, gas, and LNG prices, higher LNG volumes and increased contributions from trading,” said Shell. “LNG liquefaction volumes mainly reflected the start-up of Gorgon in Australia and the contribution of BG assets for an additional month,” it added. “LNG sales volumes reflected increased trading of third-party volumes and higher liquefaction volumes compared with the same quarter a year ago,” said the Anglo-Dutch company. “New field start-ups and the continuing ramp-up of existing fields, in particular Gorgon in Australia, contributed some 62 thousand barrels of oil equivalent per day to production

compared with the first quarter 2016,” it explained. The full-year 2016 LNG sales volumes had been 57.11MT compared with 39.24MT in 2015, an increase of over 45 percent. Among quarterly events, Shell highlighted the sale of its interest in the Bongkot field in Thailand as it continued to offload non-core assets. It also mentioned the April signing of an agreement with Gazprom and other partners for the Nord Stream 2 natural gas pipeline from Russia to Europe. Shell will provide a long-term funding facility of 285 million euros (\$310M), expected to be drawn down in 2017, as well as funds of up to 665M euros to cover a combination of short and long-term financing and guarantees. “The first quarter 2017 was a strong quarter for Shell,” said Chief Executive Ben van Beurden “We continue to reshape Shell’s portfolio and to transform the company with over \$20Bln of divestments completed or announced that will strengthen the balance sheet. The strategy we have outlined to deliver a world-class investment case is taking shape. Following the successful integration of BG, we are rapidly transforming Shell through the consistent and disciplined execution of our strategy,” added van Beurden. “This includes investing around \$25Bln this year and the delivery of new projects,” said the CEO.

TAMROTOR MARINE Compressors, the Norway-based equipment supplier, has signed a contract with Samsung Heavy Industries to supply a marine compressed air system to a newbuild floating storage and regasification unit ordered by Hoegh LNG, its third recent award to supply equipment to a South Korea shipyard. Under the contract, international compressor supplier TMC will deliver a complete marine compressed air system consisting of two 44-kilowatt service compressors and two 44-kW control air compressors. The contract value was not disclosed. The systems will be installed on

a 170,000 cubic metres capacity FSRU scheduled for delivery in the second quarter of 2019. It will have a regasification capacity of a minimum 750 million cubic feet per day. TMC’s contract with Samsung also includes options to deliver similar compressed air systems to three additional FSRUs that the shipyard may build for Hoegh. These vessels have scheduled delivery dates of one unit in 2019 and two units in 2020. “Höegh LNG has one of the world’s biggest fleets of TMC compressors for FSRUs. We are very pleased that they, in cooperation with Samsung Heavy Industries, have once again selected our technology for their projects,” said Per Kjellin, managing director of TMC. In recent weeks, TMC has signed two additional contracts to supply marine systems to newbuild FSRUs, including one with Daewoo Shipbuilding and Marine Engineering ordered by BW LNG and another with Hyundai Heavy Industries, also booked to build a unit for Hoegh. “It seems like several players are trying to capitalise on a very favourable newbuild market to position themselves for further expansion in the FSRU segment,” explained Kjellin. “I believe everyone who is exposed to the newbuild segment, including TMC, is very pleased with this development,” he added. The newbuild vessel being built at Hyundai will be used at an LNG import project in Pakistan which Qatar Petroleum, Total, Mitsubishi, ExxonMobil, and Hoegh are developing in collaboration with Global Energy Infrastructure Ltd. TMC was also recently awarded a contract by Golar LNG to supply compressors to the former conventional carrier “Hilli” being transformed into a floating liquefaction production hull in Singapore. The FLNG vessel will produce LNG when eventually deployed in a venture offshore the West African state of Cameroon.

TELLURIAN INC. reported a net loss of \$141 million in the first-quarter of 2017

as it followed its game plan to develop the Driftwood LNG plant near Lake Charles in Louisiana by 2022 to match the Sabine Pass venture of Cheniere Energy with 27 million tonnes per annum of output. “Tellurian continues to consistently execute its plans to build a global natural gas business and has laid the foundation to design, permit, and finance the next world-scale LNG infrastructure in southwest Louisiana,” said Meg Gentle, President and Chief Executive. “We recently began marketing LNG to potential customers and we have received positive feedback and interest in our Driftwood project which we expect to produce first LNG in 2022,” she stated. Tellurian was founded by former Cheniere CEO Charif Souki as well as Martin Houston, who ran the LNG operations of the portfolio company, BG of the UK. In the earnings statement, Tellurian reported five key events during the first three months of the year. Firstly, it issued 23 percent of its common stock to French energy company Total for \$207M of investment. It also closed a reverse subsidiary merger with Magellan Petroleum Corp. to become a public company listed on the Nasdaq global exchange. Tellurian additionally received authorization from the US Department of Energy to export LNG to Free Trade Agreement countries from its Louisiana plant. Driftwood LNG then submitted applications to the Federal Energy Regulatory Commission to construct and operate the liquefaction plant and export terminal on a 1,000-acre site on the west bank of the Calcasieu River near the town of Carlyss in Calcasieu Parish, Louisiana. Fifth and most importantly Tellurian and its Driftwood venture engaged French investment bank Société Générale as a financial advisor to help lead the money-raising efforts to make the plant a reality. Investors were pleased with the progress of the newly listed company and Tellurian shares were last up 6.83 percent on May 11 at \$11.10 per share. The company has 202 million shares outstanding and now has a market capitalization of \$2.2 billion. Tellurian in reporting a net loss attributable to common stockholders said \$22M was spent on development expenses and \$45M went on general and administrative expenses, which included about \$35M of share-based compensation for employees and directors. A further \$78M was taken as an impairment charge from the merger with Magellan in February 2017. As of the end of March, Tellurian said it had \$187M of cash and

cash equivalents, including some of the proceeds from Total’s investment.

TOKYO GAS, the Japanese utility and LNG importer Tokyo Gas has completed a transaction to take a strategic equity investment in a US company with natural gas assets in Louisiana and Texas, including the Haynesville shale play, for future use in liquefaction tolling agreements at Gulf Coast export plants. Castleton Commodities International (CCI) said Tokyo Gas had purchased 30 percent of its subsidiary Castleton Resources. The Haynesville shale lies under parts of three southern states, including East Texas, northwest Louisiana and southwest Arkansas. CCI, based in Stamford, Connecticut had previously purchased the Carthage upstream and midstream assets in East Texas from subsidiaries of Anadarko Petroleum Corp. for over \$1 billion. CCI subsequently combined the acquired assets with the company’s existing East Texas upstream assets under a newly formed company Castleton Resources. “Our partnership with Tokyo Gas will align CCI with one of Japan’s largest LNG market participants and further solidify our company’s commitment to expanding in Asia and connecting Asian and Western markets and investors,” stated Nicholas Haslett, Senior Managing Director and Chief Strategy Officer of CCI. Tokyo Gas currently has volume and tolling agreements with the Cameron LNG plant in Louisiana and the Cove Point project in Maryland, while it is known to be in talks with other US export projects under development in Texas and Louisiana. Castleton Resources is also now focused on the acquisition and development of further oil and gas assets in the East Texas-Louisiana region with a specific focus on Haynesville shale assets. “The Gulf Coast area, specifically East Texas and North Louisiana, is strategically important for Tokyo Gas and we are excited to join forces with CCI and the quality management team at Castleton Resources,” said Shunjiro Yamashita, President and Chief Executive of Tokyo Gas America. “The CCI-Tokyo Gas partnership in Castleton Resources creates a well-capitalized vehicle for growth in the region,” added Yamashita, without saying how much the Japanese utility paid for the stake. Castleton currently owns more than 160,000 net acres of leasehold in East Texas and operates over 1,900 producing wells. The Haynesville shale lies under parts of three

Diary of events

June World LNG & Gas Series 15th Americas Summit June 20-23, 2017 The Houstonian Hotel, Houston, Texas, USA http://lngamericas.cwclng.com/	October 3rd International LNG Congress October 17-17 Barcelona, Spain http://lngcongress.com/
September CWC World LNG & Gas Series 9th Asia Pacific Summit September 19-22 Singapore www.asiapacific.cwclng.com/	LNG Solutions 2017 Fuelling the Future Summit October 24-25, 2017 Nice, France www.futurelng.com/LNG/Solutions

southern states, including East Texas, northwest Louisiana and southwest Arkansas. Craig Jarchow, President and Chief Executive of Castleton Resources, said he welcomed the new partnership with Tokyo Gas America Ltd. “We will remain focused on optimizing and growing our upstream and midstream assets in this region,” added Jarchow. “Castleton Resources is well-positioned to enhance the value of these assets through operational improvements and development of the multiple producing zones in the area, particularly the Haynesville Shale,” he added.

VERESEN Inc. of Canada, developer of the Jordan Cove LNG export project in the US northwest state of Oregon, said the LNG venture was still going ahead even as Veresen proceeded with its planned friendly merger with Canadian peer Pembina Pipeline Corp. in a deal valued at US\$4.3 billion. Veresen and Pembina, both based in the city of Calgary in the Canadian province of Alberta, said their transaction is expected to bolster the delivery of their existing strategy and portfolio of projects. The Jordan Cove LNG venture is one of those projects, though it is being temporarily held up by a lack of a quorum currently at the US Federal Energy Regulatory Commission. Veresen commented on the Pembina merger and the delayed Jordan Cove LNG venture in its first-quarter earnings report. “Following the Federal Energy Regulatory Commission decision to deny the request for rehearing on December 9, 2016, the company undertook a thorough review of the Jordan Cove LNG project to evaluate alternatives to create the most value on a risk-adjusted basis to Veresen. Based on the constructive nature of discussions with both existing and potential buyers following the denial, Veresen announced in the first quarter it intends to continue to pursue the Jordan Cove LNG project. The development budget for 2017 remains at US\$30M, with the expectation that Jordan Cove LNG will finalize agreements with existing buyers and secure additional off-takers. This would position the project for a potential final investment decision in 2019 and an in-service date in 2024 at an estimated total project cost of approximately US\$10Bln,” stated Veresen. Commenting on the Pembina merger proposal, Veresen explained that it had entered into an agreement with Pembina, under which Pembina would acquire all the issued and outstanding common shares of Veresen. “It will feature an asset

base supported by long-life, economic hydrocarbon reserves concentrated in some of the most prolific resource plays in North America,” it said. “The combined entity will continue to build upon the momentum of the Jordan Cove LNG development project as it progresses toward key regulatory and commercial milestones. Jordan Cove is the most advanced LNG export project on the west coast of North America and can compete with LNG from brownfield expansion in the Gulf of Mexico on a delivered to Tokyo basis,” it stated. The FERC quorum issue is likely to be solved soon and move Jordan Cove forward with its necessary approvals. The five-member US agency has been lacking a quorum since Commissioner Norman Bay resigned at the end of January after President Donald Trump appointed Cheryl LaFleur as acting chairman. Three names are being considered to fill the open FERC positions. All three nominees need to be in line with the US President’s agenda of reducing regulation, strengthening the nation’s infrastructure and providing support for the energy industry.

VOPAK, the energy storage giant with LNG terminal assets in Holland and Mexico, and Canadian company AltaGas plan to develop an alternative gas export terminal on Ridley Island in British Columbia where an LNG venture had been planned by BG Group of the UK, now part of Shell. “It will be the first propane export terminal in Western Canada and the project will have a design capacity to ship 1.2 million tonnes a year of propane plus NGL, as well as storage capacity of about 96,000 cubic metres,” said the companies about the projects to be located on what was regarded as a prime LNG export site. Vopak, which recently dropped plans to take over the floating storage and regasification unit (FSRU) fleet of Belgian shipping company Exmar, sees potential in the export of propane brought to the terminal in huge volumes by rail and to be exported to Asia. Canadian natural gas utility AltaGas is turning to the propane project after also cancelling an LNG project proposed for near Kitimat in BC, where the stricter regulatory climate stifled further progress on dozens of LNG export projects at the same time as the oil-prices slump undermined the economics. AltaGas had led the Douglas Channel Floating LNG project in BC with partners, including European and Japanese companies. The DC project had

been awarded a 25-year LNG export licence by the National Energy Board for a floating export plant located on barges. The board had granted the Douglas Channel project permission to export 10.3 billion cubic metres per annum of natural gas, the equivalent of 7.5 million tonnes per annum of LNG. AltaGas held a long-term land lease agreement with the Haisla First Nation, a native North American Indian tribe in favour of LNG developments. The project partners had included Japanese refining company Idemitsu Kosan, Belgian shipping line Exmar and EDF Trading Ltd., a unit of the European utility Electricite de France. “We are excited to form this joint venture with Vopak,” said David Harris, President and Chief Executive of AltaGas. “Vopak is a very strategic global tank storage company and brings significant experience in terminals worldwide,” added Harris. “We are very much looking forward to working together with AltaGas,” said Eelco Hoekstra, Chairman and CEO of Vopak. “Storage and handling of gas is an important strategic focus area for Vopak,” he added. “We are confident that we have found a strong partner in AltaGas that is a well-respected Canadian company with experience in developing energy projects,” stated Hoekstra. With regulatory and permitting processes for the project already under way, the proposed project will cost up to C\$500 million (US\$365M). It will be built on a brownfield site sub-leased from Ridley Terminals Inc. that features existing rail lines and RTI’s existing marine jetty, which offers deepwater access to the Pacific Ocean. As currently planned, the export terminal will receive about 50-60 railcars of C3+ from across British Columbia and Alberta via the existing rail network and be equipped to export between 20-30 cargoes a year.

WOODSIDE Chief Executive Peter Coleman said global liquefied natural gas market conditions are pushing the company towards using its Browse Basin resources offshore Western Australia to double the life of its existing Northwest Shelf liquefaction plant rather than undertaking a separate Browse LNG joint venture. “As you know, we have worked for some years to find the right development concept for the world-class Browse resources,” Coleman told the annual meeting of shareholders in the city of Perth. “I’m very excited about where we are headed,” the CEO said. “Conditions are aligning for us to look

closely at an opportunity to basically double the life of the North West Shelf by bringing the Browse resources into it,” he stated. “Utilising the existing facilities has the dual advantage of ensuring the most efficient use of capital while minimising risk by relying on proven technologies,” he explained. The NWS liquefaction plant, a key supply to Japan and China, is located at Karratha in the Pilbara region of Western Australia and has been in production since 1989 with a nameplate capacity of 16.3 million tonnes per annum from five Trains. “As operator of both Browse and the North West Shelf, Woodside is well-placed to make this happen and we are talking to joint venture participants in both assets,” Coleman said. “It’s still early days but we think this is a compelling option and could be achieved at a competitive price and in a reasonable timeframe,” the CEO added. Coleman noted that sending Browse feed-gas to the NWS plant would come at a time when there is expected to be a tightening in LNG supplies because of the growth in demand from new markets and the current challenging economic conditions for new large-scale developments. “These factors point to a supply shortfall in the 2020s, adding to the case for developing Browse,” said Coleman. “We anticipate that first gas from Browse could enter the North West Shelf plant from the mid-2020s, coinciding with the forecast supply crunch,” he stated. The Woodside CEO added that he was pressing ahead with his strategy of developing the LNG fuel market using the company’s second liquefaction plant in the Pilbara region, Pluto LNG. “We’re finalising plans to support supplying LNG from Pluto to fuel the local mining and marine sectors, which currently rely heavily on imported diesel,” he said. “Supporting the development of LNG as a low-emissions transport fuel has both economic and environmental benefits for Australia, as well as potential long-term commercial benefits for Woodside. To bring these opportunities together, we’re focused on creating a Burrup Hub that will maximise value from existing facilities,” the CEO told shareholders. “Woodside is in a unique position in the Pilbara of having equity in both key onshore infrastructure and offshore resources. In fact, we’re the only company with equity in both the largest undeveloped offshore resources and the two onshore plants that have the most ready expansion capability,” he said. ■

Trelleborg marine unit sees growing need for interface standards for FSRUs and small-scale

Andrew Stafford, Technical Director for Trelleborg's marine systems operation in the UK makes compatibility recommendations

When managing Floating Storage Regasification Unit (FSRU) operations, the ship-to-shore interfaces for gas output and interfaces between liquified natural gas carriers and the FSRU for liquid transfer are mission critical.

The Ship Shore Link (SSL) is part of the emergency shutdown (ESD) and safety chain across this interface, carrying communications and data between ship and shore or between floating assets.

Design

A backward compatible high-speed digital design was developed in 2005/7 to overcome the limited functionality of legacy SSL systems, and with the implementation of FSRUs and Floating Storage Units (FSUs) in 2007/2008 requiring transfer support for multiple processes, this digital design proved an ideal solution.

Regulatory standards, however, took a while to catch up. In 2011, an ISO standard was released covering key compatibility aspects of the traditional large-scale LNGC ship-shore interface, but still nothing to cover the FSU/FSRU interface.

FSRUs/FSUs: considering compatibility: Currently, in the absence of relevant standards, new FSRU-FSU projects are being designed in isolation. Arbitrary bespoke interfaces have been developed without thought for wider compatibility.

Requirements for ultra-fast Ethernet links via legacy fiber-optic infrastructure as well as via standard instrument cable, have been seen without regard for feasibility of implementation or compatibility with other applications.

The further development of mooring arrangements for double bank and direct ship-to-ship transfers have introduced the installation of Quick Release Hooks (QRHs) with integrated load monitoring on-board vessels.

Complex

These require more complex interfacing between FSRU/FSU and the LNGC, in effect turning an FSRU/FSU ship into a shore, whilst always retaining the

flexibility for the FSRU/FSU ship to return to trade as an LNG carrier. Meanwhile, the emergence of small-scale and LNG bunkering is only adding to the debate.

Looking back at large-scale transfer: The large-scale LNG marine transfer industry has used linked shutdown systems since the mid-1970s. The primary function of the link is to mutually shutdown the connected counterpart system in the case of an ESD condition being raised on the local system.

Some connectors started to offer additional functionality, beginning with telecoms and followed by mooring load with environmental data and more recently Ethernet and process data.

Although the actual connectors used ended up being quite standard, the pin configurations within the connectors were open to interpretation by the original system integrators, resulting in most terminal installations pre-2000 using bespoke configurations.

Work on standardization of ship-shore links was undertaken around 2009, with the publication of the SIGTTO document “ESD Arrangements & Linked Ship/Shore Systems for Liquefied Gas Carriers”.

This was followed by the publication of ISO 28460:2010, which defined standard pinouts for the 37 pin and Miyaki-type systems.

Positive

These have had a positive influence on new-build facilities. However, existing terminals have not moved to the standard pin-out meaning vessels are still required to configure per terminal.

What’s more, both of these publications are limited to the transfer of LNG in bulk, and do not directly cover the newer application of FSRU, FSU and small-scale/LNG fueling.

Therefore, these newer markets are subject to interpretation of existing guidance with project-by-project bespoke developments being made.

FSRU compatibility: The first FSRU vessels were delivered around 2005 and at that time were installed with traditional SSL equipment.

This was more than adequate for the initial applications of FSRU Compressed Natural Gas (CNG) discharge at a jetty, or for an offshore buoy with LNG reloading taking place via Ship-Ship transfer, while removed from the jetty.

Increasingly complex operations soon required concurrent, and independent, discharge of CNG and reloading of LNG. This requirement introduced the concept of dual ESD which was not possible using existing SSL systems.

Terminals

Additionally, with FSRU terminals being built by and for domestic utility companies, there was a requirement for gas volumes and qualities to be shared by the FSRU to the terminal.

Newer implementations are now being conceived to simplify the terminal to a simple tie-in location, with the entire process being managed by the FSRU.

This started with sending a few shore data values for temperature and pressure at a national grid tie-in point.

More recent discussions are around the level of control the FSRU should have at the jetty, and specifications are being written and implemented to allow the FSRU to release both the shore quick release hooks and the shore side loading arm Powered Emergency Release Couplings (PERCs).

FSU compatibility: FSU applications typically originate from conversions of existing LNG carriers. During conversion, there is a preference to re-use as much of the pre-existing installation as possible.

In terms of ship-shore links, there will be an existing SSL “ship” system on-board, but techniques used in the original fiber-optic links mean that an LNG carrier link can only ever connect fully to a “terminal” system.

Compatibility

Historically, the optical fiber has never offered a ship-ship mode for both ESD and telephony due to these compatibility issues.

As an FSU is in effect the storage extension of a shore facility, increased

integration between the FSU and terminal is critical.

Existing fiber optic cabling performance must be addressed, as the original SSL fiber-optic specification is for a 50/125µm OM2^[1] offering limited bandwidth over distance.

User expectations for high speed and long distances need to be managed as it may not be possible to implement this link using existing infrastructure.

Depending on the facility, there may be a requirement for enhanced Input/Output (I/O) signaling between terminal and vessel.

If the signal is required to have high integrity, such as an additional level of shutdown, then a hardware based I/O channel within the core SONET packet structure can be implemented. However, for process control I/O, if serial data is not an option, then third-party distributed I/O hardware modules can be implemented with the SONET Ethernet.

Small-scale compatibility: The emerging small-scale LNG applications have presented the industry with a crossroads in terms of ship-shore link compatibilities and functionality.

The first option is retaining the bespoke links and allowing the small-scale market to inherit existing large-scale system types with their limited functionality.

Opportunity

Alternatively, there is the opportunity to globally standardize and simplify new vessels by using up to date and international standard technologies. This both future-proofs the industry and creates flexible trading assets.

Building on the SONET technology, now well-proven in the FSRU market, small-scale shut-down links have an opportunity to integrate the ESD, telecoms and process-control functions together within a simple link.

The current Trelleborg Universal Safety Link is installed on some of the leading projects in the sector and offers operators a level of oversight and control not seen in the LNG transfer market previously.

Process data for the remotely

connected system can be displayed and made available to the local operator and the network link has enabled full control DCS interlink between vessels and terminals.

There are special case considerations for intermediate vessels which could load from an existing large-scale facility and then distribute to some smaller customers.

In this case, the asset would have to be equipped for connection to the legacy system, as well as for the new small-scale systems. As the small-scale technology is based on that contained in FSRU applications, cost-effective solutions allowing connection to all applications exist.

Conclusions

The piecemeal evolution of the large-scale LNG market has led to the proliferation of standards that the industry is still addressing today.

Although ISO standards are now in place, there has been to date no proactive modification to the configuration of existing terminals, which do not conform to the standard pin-out.

This is forcing LNG carriers to continue to install complicated configurable systems that could lead to delayed connections.

As newer fleets of FSRU and FSU vessels are constructed, there is no common standard to build to.

Although there has been much attention paid to ensuring links are physically compatible in terms of connectors and signal transmission format, application data is being implemented at a local level which does not lead to standardization. In an industry that requires worldwide compatibility,

this represents a major challenge.

Consideration should be given to forming an industry working group that looks at the requirements of standard

data and interfacing to generate a core specification.

This core specification could then be adopted as standard practice into future

guidelines helping to reduce project timeframes and simplify integration between systems. ■

[1] As defined by ISO 11801



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Philippines offers LNG infrastructure and module solutions in Asia for small-scale and larger ventures

Atlantic, Gulf and Pacific Co. is gradually building up its project portfolio from regasification to bunkering

Atlantic, Gulf and Pacific Co. of the Philippines, the LNG infrastructure and modules supply company, is gradually building up its own LNG project portfolio from small-scale ventures in the Asia-Pacific region to developing a full-scale import terminal in India.

AG&P signed an accord earlier in 2017 to supply an import terminal as well as cargoes for power stations in the East Godavari region of the state of Andhra Pradesh on the East Coast of India.

The agreement is between AG&P and Hindustan LNG, a Hyderabad-based LNG import terminal development company.



AG&P partner Entec helped set up this LNG facility in Bali, Indonesia

Partner

It has additionally embarked on a joint venture with Gas Entec of South Korea to design and make small-scale and mid-scale LNG facilities.

Manila-based AG&P and Korean company Gas Entec aim to provide modularized onshore and floating LNG facilities covering production, storage, regasification and fuel bunkering as well as power plants and mooring structures.

For the import terminal in India, AG&P signed a memorandum of understanding to deliver regasified LNG to the Indian terminal and will also design and build it at a port in Andhra Pradesh.

AG&P will construct the terminal facilities, including a floating storage and mooring system, regasification equipment and related utilities.

“The MoU has launched a fully integrated solution for delivering tolled gas in India, including design, construction, financing, operations and maintenance of the new terminal, which will ensure a reliable and low-cost supply to power producers, fertilizer plants, cold storage and other industries,” the two companies said.

State needs

“The Indian state Andhra Pradesh is the ideal place for developing an LNG import facility to serve the growing energy demands of the east coast where existing gas-fired power projects urgently need a reliable supply of LNG,” they added.

The partnership between the Indian firm and AG&P will provide a strong platform to develop a fast-track and

low-cost LNG import solution that will enable the region to continue on its growth path.

Jose P. Leviste Jr., Chairman of AG&P, said it was a great privilege to help implement India’s vision for clean, low-cost, flexible and reliable power.

“Andhra Pradesh is playing a critical role in manufacturing and trade. The state and its people are on a strong, upward trajectory,” added Leviste.

“We see the provision of tolled gas to supply power and fuel to factories, homes and even transport in an environmentally clean way as crucial elements of Andhra Pradesh’s future,” he stated.

Among its other projects, AG&P is currently financing the design and construction of small-scale LNG carriers with capacities ranging from 4,000 cubic

metres to 8,000 cubic metres, which will be available for sale or charter.

The Filipino company is building its business on the break-bulk LNG concept whereby cargoes are broken into smaller shipments and transported using coastal tankers or specialized trucks for power generation or other industries.

Break-bulk

Gaztransport and Technigaz (GTT), the French maritime storage tank technology company, has signed a technical assistance and license agreement with AG&P for the construction of onshore LNG tanks and bunkering infrastructure.

The deal in 2016 made AG&P only the third company in the world to be certified as a licensed outfitter and sub-contractor for GTT’s LNG tank technologies.

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These “scalable LNG delivery platform and a fit-for-purpose, onshore modular regasification unit” are based on standard solutions.

Modularization

The LNG facilities will be built in AG&P’s dedicated 150-hectare modularization facilities, which helps speed delivery times and significantly reduces the cost of customized engineering and project man-hours.

AG&P believes these off-the-shelf products have the potential to bolster the small and mid-scale LNG market. Key benefits include:

- AG&P has focused on optimizing the storage and marine design to drive cost efficiencies and adoption
- Selection of shallow draft barge design and conventional vessel hull design allow for fixed cost hull construction over a scalable range, typically:
 - ♦ Platform 1: 4,000 to 8,000 cubic metres capacity for shallow water delivery
 - ♦ Platform 2: 6,000 to 16,500 cubic metres for open water delivery
 - ♦ Utilizes identical hull design and equipment from 6,000, 7,500, 10,000 up to 16,500 cubic metres
- Products utilize existing GTT hull designs specifically configured to optimize membrane tank configuration
- Geometrical membrane tanks are standardized which reduces re-engineering costs
- Detailed designs are completed by AGP/GET, integrating standardized equipment/technologies and prefabricated in our manufacturing facilities in Manila, Philippines,
- All kits, including accommodation fitments and bridge equipment are standardized packages

For the onshore modular, standardized regasification unit Key benefits include:

- Modularized and pre-commissioned in facilities in the Philippines
 - Each unit consists of:
 - ♦ TEMA NJN plate and tube exchanger utilizing indirect glycol/water heat transfer
 - ♦ Uses configuration of 125mmscfd process train, typically, in 250mmscfd modularized package
 - Each individual 250mm/standard cubic feet per day module consists of:
 - ♦ High-pressure pump
 - ♦ Tube and shell exchanger
 - ♦ Boil-off gas (BOG) recondenser
 - ♦ HIPPS
 - ♦ ESDV/F&G/CAMS
 - ♦ Central control room (E-house)
 - Off module equipment or shared utilities consisting of:
 - ♦ Glycol water plate exchanger circuit
 - ♦ BOG compressor
 - ♦ LP booster pumps
 - All equipment is purchased utilizing an in-house approved vendor list
 - Allows competitive pricing based on standard product requiring no re-engineering
 - Enables shorter procurement times based on standard product
 - Typical schedule -12 months ex-works
- “While there is increasing preference for small-scale and mid-scale LNG solutions in emerging economies like Indonesia and India, uptake remains slow with few projects underway,” said Albert Altura, President of AG&P.

Alliances

“Standardization and modular solutions will be the circuit-breaker that will bring projects online, enabling the switch to LNG as a clean and affordable energy source,” added Altura.

“AG&P is combining its modularization capabilities and unique alliances with engineering and technology partners to provide the complete spectrum of infrastructure assets that enable LNG distribution and last-mile delivery.

“Serving as a single point of contact for customers across the LNG value chain, we deliver a whole terminal and sell tolled gas to power plants, mines, bunker fuel operations, transportation fleets, cold storage and other industrial applications,” he stated.

The company explained that it had a long and successful track record of delivering pragmatic solutions for the oil and gas industry with expertise in LNG.

Its partner Gas Entec has already built a floating regasification unit (FRU) operating successfully in Bali, Indonesia.

In addition, the Korean company engineered systems for the first LNG bunkering vessel built in North America that will serve the port of Jacksonville in Florida.

“The dramatically lower cost of LNG, coupled with the advent of new, affordable technologies such as those developed by Gas Entec have fostered a revolution in LNG applications,” said AG&P Chairman Leviste.

“No longer is LNG-fueled power the exclusive domain of the largest utilities. It is also available to a generation of innovative developers, power companies, ship owners, fishing fleets and others in a way that LNG has not been before.

“We are seeing the democratization of LNG,” Leviste stated. “Therefore, this equity partnership between AG&P and

Gas Entec will

*No longer is
LNG-fueled power
the exclusive
domain of the
largest utilities.*

contribute

strongly to

pushing the boundaries of this new, revolutionary industry,” he added.

Innovation

AG&P plans to use its manufacturing facilities and plants and shipyards around the world to produce standardized products and small-scale plants.

AG&P’s Altura said LNG was a source of clean power and provided a compelling alternative to existing coal-fired power plants.

“In addition to providing a vital diversification of fuel supply, LNG also can feed small power units that are appropriate for various islands and communities, from 5 megawatts upwards to traditionally-sized plants.

“As a Filipino, it is so inspiring for me that a Philippines company has managed to bring together such talent from around the world, create outstanding partnerships, as we have done with Gas Entec, and offer cutting-edge LNG products and solutions to our domestic and global customers, floating and onshore,” Altura added. ■







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India's Petronet LNG has made significant progress under CEO Singh and more progress is on the cards

Prabhat Singh, Managing Director and Chief Executive of Petronet LNG, is leading the company through a transition as India itself also adapts to the changing energy horizons.

"In gas-developed countries like the USA, gas has a share of up to 30 percent of the energy mix. In India, this share is about 7 percent of primary energy consumption," observes Singh in summing up the problems going forward.

India needs more natural gas and LNG as well as more developed infrastructure.

Energy mix

"In India, coal being the most dominant in the mix accounts for more than 50 percent of energy consumption in the country and is primarily used in power generation," he added in a recent presentation.

"For gas to replace coal the government needs to enact some carbon tax on coal usage, as gas based on imported LNG will not be able to compete with the low cost of coal," said the CEO.

Prabhat Singh is an engineering graduate from the Indian Institute of Technology in Kanpur in the state of Uttar Pradesh and has around 35 years of relevant experience in the hydrocarbon industry, working for the Indian subsidiary of BG Group as well as the largest energy companies such as Gas Authority of India and National Thermal Power Corp., India's largest electric utility.

The Petronet CEO, aged 60, joined the company in September 2015.

Petronet currently operates the Dahej and Kochi LNG terminals on India's west and southwest coasts with capacities of 15 million tonnes per annum and 5 MTPA respectively. The capacity of the Dahej terminal will rise to 17.5 MTPA at the end of 2018.

Petronet currently meets about 30 percent of India's natural gas demand.

Marketing

Singh was the former marketing director of GAIL. Before joining GAIL in 2010, he headed the Upstream Development and Strategy Division of the Indian operations of the UK's BG.

Because of his promotion to head of Petronet, Singh resigned his position as a member of the GAIL board.

Most of the cargoes delivered to Petronet form part of a long-term contract signed with the Qatar production company RasGas in July 1999.

This was just after Petronet was set up and the volumes amount to 7.5 MTPA over 25 years, recently revised downwards by the Qataris in terms of price.

Petronet was formed by the Government of India in 1998 specifically to import LNG into the Asian country before its economic development hit the fast track. The LNG company still has firm ties to the state.

Stakeholders

In addition to GAIL, other shareholders include national energy operators Indian Oil Corp. and Bharat Petroleum Corp.

India's network of four LNG terminals are all on the West Coast, three of them close to Mumbai.

The country is currently planning to match that number of terminals on the east coast of India where none exists at present.

India is also striving to increase its natural gas pipeline network, which is small in relation to the size of the country.

"As LNG receiving terminals and pipeline infrastructure increases, gas will have more market penetration and more consumption as a result," says Singh.

Refining

"Therefore, gas will pay a major role as a green fuel, as environmental pressures become more severe in India.

It is noted that India today is third largest of consumers of oil with consumption of 196MT in 2015. Oil consumption in India is expected to increase to 229MT in 2020, 329MT in 2030 and 458MT in 2040.

"The refining sector in India has been



CEO Prabhat Singh is veteran of GAIL and Indian unit of BG

expanding since the early 2000s and India exports oil products to the tune of around 60.5MT annually," adds Singh.

"Gas consumption in India is only 45MT of oil equivalent. The key challenge facing the development of gas in India is creation of enabling infrastructure to increase market penetration.

"Petronet's Dahej terminal is currently facing tremendous pressure of capacity constraint due to non-availability of other terminals and operates at more than 100 percent capacity," says the CEO.

"With the addition of new terminals, the availability of pipeline infrastructure continues to be grappled by Indian markets," says Singh.

The existing pipeline network in India is about 16,200 kilometres with a capacity of 430 million standard cubic metres per day capacity.

The plan is to add another 15,000km, while 8,000km is under construction with a capacity of 400 MMscm/d.

Segment

"We at Petronet LNG are now working to create a segment for the replacement of diesel with LNG on a large scale which will enhance consumption of gas in India.

"This will be based on a 'self-sustaining' model with savings in gas vis-a-vis oil providing the funding or support in terms of achieving breakeven

levels required during the initial years," he explains.

Singh was instrumental in putting the country on the world LNG map when he sourced the first cargoes from the US to be priced on the US natural gas benchmark Henry Hub.

He was also instrumental in ushering in the "Open Access Common Carrier Principle" in India and he was one of the core contributors to the concept of gas pooling for power and the fertilizer sector, which is under successful implementation.

He is also leading the push for LNG use in mass transportation in India, especially for buses.

Expertise

He has been a member of the National Auto Fuel Policy as well as of the governing body of the Rajeev Gandhi Institute of Petroleum and Technology.

He is recognized by colleagues and competitors as a visionary professional in the industry for having a great business sense with a human touch, as well as communication skills.

"Today more than 50 percent of demand for oil in India comes from transport and the industrial sector. What Petronet LNG is aiming for is to make this replacement of oil by gas through imports of LNG," says Singh.



Apart from diesel replacement, Petronet LNG is also aiming to create gas infrastructure to replace liquefied petroleum gas (LPG) in domestic households and the target is to replace the fuel in around 10 million households in the next five years.

The government provides a subsidy of around 125 rupees per LPG cylinder. The annual subsidy payments amount to around \$170 million per year.

Investment

The total investment requirement to convert this massive numbers of households will be around \$1.5 billion. This would mean a payback of around 8 years.

Even if 50 percent of the connection cost is recovered from households, the payback period reduces to four years. This will, however, mean a consumption of around 1.2MT equivalent of LNG annually.

LNG imports by India during April 2017 amounted to the equivalent of 1.61MT, or 2.18 billion cubic metres, an increase of 1.90 percent on the 1.58MT brought in during April 2016.

Indian imports had risen 6 percent in March to 1.53MT versus 1.44MT in the same month of last year.

The 2017 fiscal year has now started and data comparisons are given by the Ministry of Petroleum and Natural Gas.

Cumulative LNG imports for the past fiscal year from April 2016 to March 2017 rose 15.5 percent higher to 18.20MT compared with 15.76MT in the previous fiscal year.

Shipments to India had risen 30 percent in the 2016 calendar year to 18.99MT from 14.60MT in 2015, led by Qatar with 11.37MT and countries such as Nigeria with 2.63MT, Equatorial Guinea with 1.33MT and Australia with 1.11MT.

Now that the US is an exporter of cargoes to the Indian terminals, two cargoes have arrived so far in 2017 and seven in total since the Sabine Pass

facility in Louisiana came on stream in February 2016.

India will receive more US cargoes from the end of 2017 when the Cove

Point plant in Maryland starts up and sends shipments to the tolling contract holder, Singh's former company GAIL. ■

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World LNG Carrier Fleet

LNG carrier	Capacity m³	Owned or Ordered by	Builder	Delivery Date	Flag	Power Plant	Cargo System	No. of tanks	Ship built for Export plant
Aamira	266,000	QGTC	Samsung	Dec-10	Liberia	DRL	TZ Mk. III	5	Qatargas IV
Abadi	135,000	Brunei Gas Carriers	Mitsubishi Nagasaki	Jun-02	Brunei	S	Moss	5	Brunei LNG
Abalamabie	174,900	Bonny Gas	Samsung	June-16	Bermuda	DFDE	TZ Mk III	4	Nigeria LNG
Adam LNG	162,000	Oman LNG	Hyundai	Dec-14	Marshall Is.	DFDE	TZ Mk. III	4	Oman LNG
Al Aamriya	210,100	J5 Consortium	Daewoo	Feb-08	Marshall Is.	DRL	GT NO 96	4	Qatargas
Al Areesh	151,700	Teekay LNG	Daewoo	Jan-07	Qatar	S	GT NO 96	4	Ras Gas II
Al Bahiya	266,000	QGTC	Samsung	Oct-09	Liberia	DRL	TZ Mk. III	5	Qatar-Atlantic
Al Biddah	135,275	J4 Consortium	Kawasaki Sakaide	Nov-99	Japan	S	Moss	5	Qatargas
Al Daayen	151,700	Teekay LNG	Daewoo	Apr-07	Qatar	S	GT NO 96	4	RasGas II
Al Dafna	266,000	QGTC	Samsung	Oct-09	Marshall Is.	LR DRL	GT NO 96	4	Qatar-Atlantic
Al Deebel	145,000	Peninsular LNG	Samsung	Dec-05	Bahamas	S	TZ Mk. III	4	Qatargas
Al Gattara	216,200	OSG/Nakilat	Hyundai	Oct-07	Marshall Is.	DRL	TZ Mk. III	4	Qatargas II
Al Ghariya	210,100	ProNav	Daewoo	Feb-08	Bahamas	DRL	GT No. 96	4	Qatargas
Al Gharaffa	216,200	OSG/Nakilat	Hyundai	Jan-08	Marshall Is.	DRL	TZ Mk. III	4	Various
Al Ghashamiya	216,000	QGTC	Samsung	Mar-09	Liberia	DRL	TZ Mk. III	4	Qatar-Atlantic Basin
Al Ghuwairiya	261,700	QGTC	Daewoo	Aug-08	Marshall Is.	DRL	GT NO. 96	5	Qatar-Atl’c Basin
Al Hamla	216,000	OSG	Samsung	Feb-08	Marshall Is.	DRL	TZ Mk. III	4	QatarGas
Al Hamra	137,000	National Gas Shipping	Kvaerner-Masa	Jan-97	Liberia	S	Moss	4	ADGAS
Al Huwaila	217,000	Teekay	Samsung	May-08	Bahamas	DRL	TZ Mk. III	4	RasGas III
Al Jasra	137,100	J4 Consortium	Mitsubishi Nagasaki	Jul-00	Japan	S	Moss	5	Qatargas
Al Jassasiya	145,700	Maran-Nakilat	Daewoo	May-07	Greece	S	GT No 96	4	RasGas
Al Kharaitiyat	216,200	QGTC	Hyundai	May-09	Liberia	DRL	TZ Mk. III	4	Qatargas III
Al Kharaana	210,000	QGTC	Daewoo	Oct-09	Marshall Is.	DRL	GT NO 96	4	Qatargas IV
Al Kharsaah	217,000	Teekay	Samsung	May-08	Bahamas	DRL	TZ Mk. III	4	RasGas III
Al Khattiya	210,000	QGTC	DSME	Oct-09	Marshall Is.	DRL	GT No. 96	4	Qatargas IV
Al Khaznah	135,500	National Gas Shipping	Mitsui Chiba	Jun-94	Liberia	S	Moss	5	ADGAS
Al Khor	137,350	J4 Consortium	Mitsubishi Nagasaki	Dec-96	Japan	S	Moss	5	Qatargas
Al Khuwair	217,000	Teekay LNG	Samsung	Jul-08	Korea	DRL	TZ Mk. III	4	RasGas
Al Mafyar	266,000	OSG/Nakilat	Hyundai	Oct-07	Marshall Is.	DRL	TZ Mk. III	4	Qatargas II
Al Marrouna	151,700	Teekay	Daewoo	Nov-07	Bahamas	S	GT NO 96		Ras Gas I
Al Mayeda	266,000	QGTC	Samsung	Jan-09	Liberia	DRL	TZ Mk. III	5	Qatar-US/Var.
Al Nuaman	210,000	QGTC	DSME	Dec-09	Marshall Is.	DRL	GT No. 96	4	Qatargas IV
Al Oraiq	210,000	J5 Consortium	Daewoo	Apr-08	Marshall Is.	DRL	GT No. 96	4	Various
Al Rayyan	135,360	J4 Consortium	Kawasaki Sakaide	Mar-97	Japan	S	Moss	5	Qatargas
Al Rekayyat	216,200	QGTC	Hyundai	Jun-09	Bahamas	DRL	TZ Mk.III	4	Qatar-Atlantic
Al Ruwais	210,100	ProNav	Daewoo	Nov-07	Germany	DRL	GT NO 96	4	Qatargas II
Al Sadd	210,100	QGTC	Daewoo	Mar-09	Liberia	DRL	GT NO 96	4	Qatar-Atlantic Basin
Al Safliya	210,100	ProNav	Daewoo	Dec-07	Bahamas	DRL	GT NO 96	4	Qatargas II
Al Sahla	216,200	J5	Hyundai	Jun-08	Japan	DRL	TZ Mk. III	4	Ras Gas III
Al Samriya	261,700	QGTC	Daewoo	Sep-08	Marshall Is.	DRL	GT NO. 96	5	Qatargas II
Al Sheehaniya	210,100	QGTC	Daewoo	Feb-09	Liberia	DRL	GT NO 96	4	Qatar-Atlantic Basin
Al Shamal	217,000	Teekay LNG	Samsung	Jun-08	Qatar	DRL	TZ Mk. III	4	RasGas
Al Thakhira	145,000	Peninsular LNG	Samsung	Sep-05	Bahamas	S	TZ Mk. III	4	Qatargas
Al Thumama	216,000	J5 Consortium	Hyundai	Apr-08	Japan	DRL	TZ Mk. III	4	Rasgas
Al Utouriya	215,000	J5	Hyundai	Sep-08	Panama	DRL	TZ Mk. III	4	RasGas
Al Utourma	215,000	J5	Hyundai	Sep-08	Panama	DRL	TZ Mk. III	4	Ras Gas III
Al Wajbah	137,350	J4 Consortium	Mitsubishi Nagasaki	Jun-97	Japan	S	Moss	5	Qatargas
Al Wakrah	135,360	J4 Consortium	Kawasaki Sakaide	Dec-98	Japan	S	Moss	5	Qatargas
Al Zhubarah	137,570	J4 Consortium	Mitsui Chiba	Dec-96	Japan	S	Moss	5	Qatargas
Alto Acrux	147,000	LNG Marine Transport	Mitsubishi	Mar-08	Bahamas	S	Moss	4	Various
Amali	148,000	Brunei-Shell	DSME	Jul-11	Brunei	DFDE	GT No. 96	4	Brunei LNG
AmanI	154,800	Brunei-Shell	Hyundai	Nov-14	Brunei	DFDE	TZ Mk. III	4	Brunei LNG
Aman Bintulu	18,928	Perbadanan / NYK Line	NKK Tsu	Oct-93	Malaysia	S	TZ Mk. III	3	Petronas
Aman Hakata	18,800	Perbadanan / NYK Line	NKK Tsu	Nov-98	Malaysia	S	TZ Mk. III	3	Petronas
Aman Sendai	18,928	Perbadanan / NYK Line	NKK Tsu	May-97	Malaysia	S	TZ Mk. III	3	Petronas
Arctic Aurora	160,000	Dynagas	Hyundai	Jul-13	Marshall Is.	DFDE	TZ Mk. III	4	Various
Arctic Discoverer	140,000	K Line	Mitsui Chiba	Jan-06	Bahamas	S	Moss	4	Various
Arctic Lady	147,200	MOL/Hoegh LNG	Mitsubishi Nagasaki	Apr-86	Norway	S	Moss	4	Various
Arctic Princess	147,200	MOL/Hoegh LNG	Mitsubishi Nagasaki	Jan-06	Norway	S	Moss	4	Various
Arctic Sun	89,880	Arctic LNG Shipping	IHI Chita	Dec-93	Liberia	S	IHI SPB	4	ConocoPhillips/Marathon
Arctic Voyager	140,000	K Line	Kawasaki	Jul-06	Bahamas	S	Moss	4	Statoil
Arkat	148,000	Brunei-Shell	DSME	Feb-11	Brunei	DFDE	GT. No. 96	4	Brunei LNG
Arwa Spirit	165,000	Teekay LNG	Samsung	Sep-08	Marshall Is.	DFDE	TZ Mk. III	4	Various
Aseem	154,850	K Line-Petronet	Samsung	Nov-09	Malta	S	GT No 96	4	Qatar-India
Asia Endeavour	160,000	Chevron	Samsung	Dec-14	Bahamas	DFDE	TZ Mk. III	4	Various
Asia Energy	160,000	Chevron	Samsung	Sept-14	Bahamas	DFDE	TZ Mk. III	4	Various
Asia Excellence	160,000	Chevron	Samsung	Sept-13	Bahamas	DFDE	TZ Mk. III	4	Various
Asia Vision	160,000	Chevron	Samsung	June-14	Bahamas	DFDE	TZ Mk. III	4	Various
Barcelona Knutsen	173,400	Knutsen	Daewoo	May-10	N.I.S.	DFDE	GT NO 96	4	Various
Bebatic	75,060	Brunei Shell Tankers	Atlantique	Oct-72	Brunei	S	TZ Mk. I	6	Brunei LNG
Beidou Star	172,000	MOL	Hudong	Oct-15	Hong Kong	DRL	GT NO. 96	4	Various
Berge Arzew	138,088	BW Gas	Daewoo	Jul-04	Norway	S	GT NO 96	4	Sonatrach
BW GDF-Suez Boston	138,059	BW Gas	Daewoo	Jan-03	Norway	S	GT NO 96	4	Suez LN
BW GDF Suez Everett	138,028	BW Gas	Daewoo	Jun-03	Norway	S	GT NO 96	4	Suez LNG
Bilbao Knutsen	138,000	Knutsen / Marpetrol	IZAR Sestao	Jan-04	Spain	S	GT NO 96	4	Atlantic LNG
Bilis	77,730	Brunei Shell Tankers	La Seyne	Mar-75	Brunei	S	GT NO 82	5	Brunei LNG
Bishu Maru	162,000	K Line-Transpacific	Kawasaki Sakaide	Dec-15	Panama	S	Moss	4	Australia-Japan
British Diamond	155,000	BP Shipping	Hyundai	Sep-08	IOM	DFDE	TZ Mk. II	4	Indonesia-Various
British Emerald	155,000	BP Shipping	Hyundai	Jun-07	UK	DFDE	TZ Mk. III	4	Tangguh LNG
British Innovator	138,200	BP Shipping	Samsung	Jul-03	Isle of Man	S	TZ Mk. III	4	Various
British Merchant	138,000	BP Shipping	Samsung	Apr-03	Isle of Man	S	TZ Mk. III	4	Various
British Ruby	155,000	BP Shipping	Hyundai	Jan-08	U.K.	DFDE	TZ Mk. III	4	Various
British Sapphire	155,000	BP Shipping	Hyundai	Sep-08	IOM	DFDE	TZ Mk. III	4	Tangguh

British Trader	138,000	BP Shipping	Samsung	Dec-02	Isle of Man	S	TZ Mk. III	4	Engas
Broog	135,466	J4 Consortium	Mitsui Chiba	May-98	Japan	S	Moss	5	Qatargas
Bu Samara	266,000	QGTC	Samsung	Dec-08	Qatar	DRL	TZ Mk. III	5	Qatargas
BW Suez Paris	162,400	BW Gas	Daewoo	May-09	N.I.S.	DFDE	GT NO 96	4	Yemen-Atlantic
BW Suez Brussels	162,400	BW Gas	Daewoo	May-09	N.I.S.	DFDE	GT NO 96	4	Yemen-Atlantic
Cadiz Knutsen	138,826	Knutsen / Marpetrol	IZAR Puerto Real	Jun-04	Spain	S	GT NO 96	4	Engas
Castillo de Santisteban	173,600	Elcano	STX	Aug-10	Malta	S	GT NO. 96		Various
Castillo de Villalba	138,000	Elcano	IZAR	Nov-03	Spain	S	GT NO 96	4	Sonatrach
Catalunya Spirit	138,000	Teekay LNG Partners	IZAR Sestao	Mar-03	Liberia	S	GT NO 96	4	Atlantic LNG
Celestine River	145,000	KLNG	Kawasaki	Dec-07	Bahamas	S	Moss		Various
Cesi Beihai	174,100	MOL-China LNG	Hudong	June-17	Hong Kong	S	GT No 96	4	Australia-China
Cesi Gladstone	174,100	MOL-China LNG	Hudong	Oct-16	Hong Kong	S	GT No 96	4	Australia-China
Cesi Qingdao	174,100	MOL-China LNG	Hudong	Nov-16	Hong Kong	S	GT No 96	4	Australia-China
Cheikh Bouamama	75,500	Skikda LNG Transport	USC	Jul-08	Bahamas	S	TZ Mk. III	4	Sonatrach
Cheikh El Mokrani	75,500	Med LNG Corp	USC	Jun-07	Bahamas	S	TZ Mk. III	4	Sonatrach
Christophe de Margerie	172,600	SCF	Daewoo	Nov-16	Cyprus	DFDE	GT NO 96	4	Various
Clean Energy	150,000	Dynagas	Hyundai	Mar-07	Marshall Is.	S	TZ Mk. III	4	Various
Clean Force	150,000	Dynagas	Hyundai	Jan-08	Marshall Is.	S	TZ Mk. III	4	Various
Clean Ocean	155,900	Dynagas	Hyundai	Mar-14	Marshall Is.	DFDE	TZ Mk. III	4	Various
Clean Planet	155,900	Dynagas	Hyundai	Mar-14	Marshall Is.	DFDE	TZ Mk. III	4	Various
Clean Vision	160,000	Dynagas	Hyundai	Jun-15	Marshall Is.	DFDE	TZ Mk. III	4	Various
Cool Explorer	160,000	Thenamaris	Samsung	Oct-13	Bermuda	DFDE	TZ Mk. III	4	Various
Cool Runner	160,000	Thenamaris	Samsung	May-14	Bermuda	DFDE	TZ Mk. III	4	Various
Cool Voyager	160,000	Thenamaris	Samsung	Oct-13	Bermuda	DFDE	TZ Mk. III	4	Various
Corcovado LNG	160,106	TMSC Gas	Daewoo	Jun-14	Malta	TFDE	GT No 96	4	Various
Creole Spirit	174,000	Teekay	Daewoo	Jan-16	Bahamas	MEGI-DF	NO. 96 GW	4	Cheniere
Cubal	160,400	Mitsui/NYK/Teekay	Samsung	Jan-12	Bahamas	DFDE	TZ Mk. III	4	Various
Cygnus Passage	145,400	Cygnus LNG	Mitsubishi	Feb-09	Panama	S	Moss	4	Various
Dapeng Moon	147,000	China Ships	Hudong	Jul-09	China	S	GT NO 96	4	Various
Dapeng Star	147,000	China Ships	Hudong	Nov-09	China	S	GT NO 96	4	Various
Dapeng Sun	147,000	China Ships	Hudong	Jul-07	China	S	GT NO 96	4	Woodside Energy
Disha	136,000	Petronet LNG Ltd.	Daewoo	Jan-04	Malta	S	GT NO 96	4	Qatargas
Doha	137,350	J4 Consortium	Mitsubishi Nagasaki	Jun-99	Japan	S	Moss	5	Qatargas
Duhail	210,100	ProNav	Daewoo	Jan-08	Germany	DRL	GT NO 96	4	Various
Dukhan	135,000	J4 Consortium	Mitsui Chiba	Oct-04	Japan	S	Moss	4	Qatargas
Dwiputra	127,385	Humpuss Consortium	Mitsubishi Nagasaki	Mar-94	Bahamas	S	Moss	4	Pertamina
Ebisu	147,547	Golar LNG	Kawasaki	Sep-08	Bahamas	S	Moss	4	Various
Ejnan	145,000	4J	Samsung	Jan-07	Bahamas	S	TZ Mk. III		RasGas
Ekaputra	136,400	Humpuss Consortium	Mitsubishi Nagasaki	Jan-90	Liberia	S	Moss	5	Pertamina
Energy Advance	145,000	Tokyo LNG Tankers	Kawasaki Sakaide	Mar-05	Japan	S	Moss	4	Darwin
Energy Atlantic	159,924	Alpha	STX Jinhae	Sep-15	Malta	DFDE	No. 96	4	Various
Energy Confidence	155,000	Tokyo LNG Tankers	Kawasaki	Apr-09	Panama	S	Moss	4	Various
Energy Frontier	147,600	Tokyo LNG Tankers	Kawasaki Sakaide	Sep-03	Japan	S	Moss	4	Darwin
Energy Horizon	177,000	Tokyo LNG Tankers	Kawasaki	Jul-11	Japan	S	Moss	4	Pluto LNG
Energy Navigator	147,000	Tokyo LNG Tankers	Kawasaki Sakaide	May-08	Japan	S	Moss	4	Various
Energy Progress	145,000	MOL	Kawasaki	Nov-06	Japan	S	Moss	4	Bayu Undan LNG
Esshu Maru	162,000	K Line-Transpacific	Kawasaki Sakaide	Dec-14	Panama	S	Moss	4	Australia-Japan
Excalibur	138,200	Exmar/ Excelerate	Daewoo	Oct-02	Belgium	S	GT NO 96	4	Various
Excel	138,106	Exmar/ MOL	Daewoo	Sep-03	Belgium	S	GT NO 96	4	Various
Excelerate	138,000	Exmar/Excelerate	Daewoo	Oct-06	Belgium	S	GT NO 96	4	Various
Excellence	138,000	GKFF Ltd.	Daewoo	May-05	Belgium	S	GT NO 96	4	Excelerate Energy
Excelsior	138,000	Exmar	Daewoo	Jan-05	Belgium	S	GT NO 96	4	Various
Exemplar	150,900	Excelerate	Daewoo	Jun-10	Belgium	S	GT NO 96	4	Various
Expedient	151,000	Excelerate	Daewoo	Nov-09	Belgium	S	GT NO 96	4	Various
Experience RV	174,000	Exmar/Excelerate	Daewoo	Jul-14	Marshall Is.	DFDE	GT NO 96		Various
Explorer	150,900	Exmar/Excelerate	Daewoo	Mar-08	Belgium	S	GT NO 96	4	Excelerate
Express	151,000	Exmar/Excelerate	Daewoo	May-09	Belgium	S	GT NO 96	4	Various
Exquisite	150,900	Excelerate	Daewoo	Sep-09	Belgium	S	GT NO. 96	4	Various
Fraiha	210,100	J5 Consortium	Daewoo	Sep-08	Marshall Is.	DRL	GT NO 96	4	Qatargas
FSRU Independence	170,000	Hoegh	Hyundai	Feb-14	NIS	DFDE	TZ Mk. III	4	Various
FSRU Lampung	170,000	Hoegh	Hyundai	May-14	Indonesia	DFDE	TZ Mk. III	4	Various
Fuji LNG	147,895	TMSC Gas	Kawasaki	Jun-04	Malta	S	Moss	4	Various
Fuwairit	138,000	Peninsular LNG	Samsung	Jan-04	Bahamas	S	TZ Mk. III	4	RasGas II
Galea	134,425	Shell Shipping	Mitsubishi Nagasaki	Oct-02	Singapore	S	Moss	5	Shell
Galia Spirit	140,620	Teekay LNG Partners	Daewoo	Jul-04	Liberia	S	GT NO 96	4	Engas
Gaselys	153,500	GdF/NYK	Atlantique	Mar-07	France	DFDE	CS 1	4	Engas
Gallina	134,425	Shell Shipping	Mitsubishi Nagasaki	Oct-02	Singapore	S	Moss	5	Shell
GasLog Chelsea	153,000	GasLog	Hanjin Korea	Dec-09	Panama	TFDE	TZ Mk. III	4	Various
Gaslog Geneva	174,000	GasLog	Samsung	Sept-16	Bermuda	TFDE	TZ Mk. III	4	Shell charter
Gaslog Gibraltar	174,000	GasLog	Samsung	Oct-16	Bermuda	TFDE	TZ Mk. III	4	Shell charter
Gaslog Glasgow	174,000	GasLog	Samsung	Jun-16	Bermuda	TFDE	TZ Mk. III	4	Shell charter
Gaslog Greece	174,000	GasLog	Samsung	Mar-16	Bermuda	TFDE	TZ Mk. III	4	Shell charter
GasLog Salem	165,000	GasLog	Samsung	Apr-15	Liberia	TFDE	TZ Mk. III	4	various
GasLog Santiago	155,000	GasLog	Samsung	Mar-13	Liberia	TFDE	TZ Mk. III	4	Various
GasLog Saratoga	155,000	GasLog	Samsung	Dec-14	Bermuda	TFDE	TZ Mk. III	4	Various
Gaslog Savannah	155,000	GasLog	Samsung	May-10	Bermuda	DFDE	TZ Mk. III	4	Various
GasLog Seattle	155,000	GasLog	Samsung	Oct-13	Bermuda	TFDE	TZ Mk. III	4	Various
GasLog Shanghai	155,000	GasLog	Samsung	Jan-13	Liberia	TFDE	TZ Mk. III	4	Various
Gaslog Singapore	155,000	GasLog	Samsung	Jul-10	Bermuda	DFDE	TZ Mk. III	4	Various
Gaslog Skagen	155,000	GasLog	Samsung	Oct-13	Bermuda	DFDE	TZ Mk. III	4	Various
Gaslog Sydney	155,000	GasLog	Samsung	May-13	Bermuda	DFDE	TZ Mk. III	4	Various
GDF-Suez Global Energy	74,000	Gaz de France	Chantiers	Dec-06	France	DFDE	CS1	4	Sonatrach
GDF-Suez Cape Ann	145,000	Hoegh LNG/MOL	Samsung	May-10	Liberia	DFDE	TZ Mk. III	4	Various
GDF-Suez Neptune	145,000	Hoegh LNG/MOL	Samsung	Dec-09	Liberia	DFDE	TZ Mk. III	4	Various
GDF-Suez Point Fortin	154,200	LNG Japan	Imabari/Koyo	Feb-10	Panama	DFDE	TZ Mk. III	4	Various
Gemmata	138,100	Shell Shipping	Mitsubishi Nagasaki	Mar-04	Singapore	S	Moss	5	Shell
Ghasha	137,510	National Gas Shipping	Mitsui	Jun-95	Liberia	S	Moss	5	ADGAS
Gigira Laitebo	177,000	MOL-Itochu	Hyundai	Feb-09	Panama	DFDE	TZ Mk. III	4	Various
Golar Arctic	140,645	Golar LNG	Daewoo	Dec-03	Marshall Is.	S	GT NO 96	4	Shell Spot

CARRIER FLEET

Golar Bear	160,000	Golar	Samsung	Mar-14	Bermuda	DFDE	TZ Mk. III	4	Various
Golar Celsius	160,000	Golar LNG	Samsung	Sep-13	Bermuda	DFDE	TZ Mk. III	4	Various
Golar Crystal	160,000	Golar LNG	Samsung	Oct-13	Bermuda	DFDE	TZ Mk. III	4	Various
Golar Eskimo (FSRU)	160,000	Golar LNG	Samsung	Jan-15	Bermuda	DFDE	TZ Mk. III	4	Various
Golar Freeze	125,850	Golar LNG	HDW	Feb-77	UK	S	Moss	5	Various
Golar Glacier	162,000	Golar LNG	Hyundai	Sep-14	Marshall Is.	DFDE	TZ Mk. III	4	Various
Golar Grand	145,880	Golar LNG	Daewoo	2006	IoM		GT NO 96	4	Various
Golar Ice	160,000	Golar LNG	Samsung	Feb-15	Bermuda	DFDE	TZ Mk. III	4	Various
Golar Igloo (FSRU)	160,000	Golar LNG	Samsung	Oct-13	Bermuda	DFDE	TZ Mk. III	4	Various
Golar Kelvin	160,000	Golar LNG	Samsung	Jan-15	Bermuda	DFDE	TZ Mk. III	4	Various
Golar Maria	145,950	Golar LNG	Daewoo	2006	Marshall Is.		GT NO 96	4	Various
Golar Mazo	135,225	Golar LNG/CPP	Mitsubishi	Jan-00	Liberia	S	Moss	5	Pertamina
Golar Penguin	160,000	Golar LNG	Samsung	Mar-14	Marshall Is.	DFDE	TZ Mk. III	4	Various
Golar Seal	160,000	Golar LNG	Samsung	Aug-13	Bermuda	DFDE	TZ Mk. III	4	Various
Golar Singapore (FSRU)	160,000	Golar LNG	Samsung	June-15	Bermuda	DFDE	TZ Mk. III	4	Various
Golar Snow	160,000	Golar LNG	Samsung	Jan-15	Bermuda	DFDE	TZ Mk. III	4	various
Golar Tundra (FSRU)	160,000	Golar LNG	Samsung	Dec-15	Bermuda	DFDE	TZ Mk. III	4	Various
Golar Viking	140,000	Golar LNG	Hyundai	Jan-05	Marshall Is.	S	Moss	4	Various
Golar Winter	138,250	Golar LNG	Daewoo	Apr-04	Marshall Is.	S	GT NO 96	4	Petrobras
Grace Acacia	150,000	Algaet Shipping	Hyundai	Jan-07	Japan	S	TK MK III	4	Various
Grace Barleria	150,000	Swallowtail Ship	Hyundai	Oct-07	Japan	S	TZ Mk. III	4	Various
Grace Cosmos	150,000	AGH Shipping	Hyundai	Mar-08	Japan	S	TZ Mk. III	4	Various
Grace Dahlia	177,000	Tokyo Gas	Kawasaki	Oct-13	Japan	S	Moss	4	Various
Gracilis	138,830	Golar LNG	Hyundai	Jan-05	Marshall Is.	S	TZ Mk. III	4	Shell BG
Granatina	140,645	Shell Shipping	Daewoo	Dec-03	Singapore	S	GT NO 96	4	Shell
Grand Aniva	147,200	Sovcomflot/NYK	Mitsubishi	Jan-08	Japan	S	Moss	4	Various
Grand Elena	147,200	Sovcomflot/NYK	Mitsubishi	Oct-07	Japan	S	Moss	4	Various
Grand Mereya	147,200	Primorsk/MOL/K Line	Chiba	May-08	Japan	S	Moss	4	Sakhalin II
Hanjin Muscat	138,200	Hanjin Shipping	Hanjin	Jul-99	Panama	S	GT NO 96	4	Oman Gas
Hanjin Pyeong Taek	130,600	Hanjin Shipping	Hanjin	Sep-95	Panama	S	GT NO 96	4	Pertamina
Hanjin Ras Laffan	138,214	Hanjin Shipping	Hanjin	Jul-00	Panama	S	GT NO 96	4	QatarGas
Hanjin Sur	138,333	Hanjin Shipping	Hanjin	Jan-00	Panama	S	GT NO 96	4	Oman Gas
Hispania Spirit	140,500	Teekay LNG Partners	Daewoo	Sep-02	Spain	S	GT NO 96	4	Atlantic LNG
Hoegh Gallant FSRU	170,050	Hoegh LNG	Hoegh Hyundai	May-14	Marshall Is.	DFDE	TZ Mk. III	4	chartered
Hoegh Grace FSRU	170,050	Hoegh LNG	Hoegh LNG Hyundai	May-15	Marshall Is.	DFDE	TZ Mk. III	4	various
Hyundai Aquapia	135,000	Hyundai MM	Hyundai	Mar-00	Panama	S	Moss	4	Oman Gas
Hyundai	135,000	Hyundai MM	Hyundai	Jan-00	Panama	S	Moss	4	RasGas
Hyundai Ecopia	145,000	Hyundai	Hyundai	Nov-08	Panama	S	TZ Mk. III	4	Various
Hyundai Greenpia	125,000	Hyundai MM	Hyundai	Nov-96	Panama	S	Moss	4	Pertamina
Hyundai Oceanpia	135,000	Hyundai MM	Hyundai	Jul-00	Panama	S	Moss	4	Oman Gas
Hyundai Technopia	135,000	Hyundai MM	Hyundai	Jul-00	Panama	S	Moss	4	RasGas
Hyundai Utopia	125,182	Hyundai MM	Hyundai	Jun-94	Panama	S	Moss	4	Pertamina
Iberica Knutsen	138,000	Knutsen OAS	Daewoo	Aug-06	Norway	S	GT 96	4	Gas Natural
Ibra LNG	147,100	Oman Gas	Samsung	Jun-06	Panama	S	TK Mk. III	4	Oman LNG
Ibri LNG	145,000	Oman Gas	Mitsubishi	Jul-06	Panama	S	TK Mk. III	4	Oman LNG
Ish	137,540	National Gas Shipping	Mitsubishi Nagasaki	Nov-95	Liberia	S	Moss	5	ADGAS
K Acacia	138,017	Korea Line	Daewoo	Jan-00	Panama	S	GT NO 96	4	Oman Gas
K Freesia	135,256	Korea Line	Daewoo	Jun-00	Panama	S	GT NO 96	4	RasGas
K Jasmine	145,700	Korea Line	Daewoo	Mar-08	Panama	S	GT NO 96	4	Kogas offtake
K Mugungwha	152,000	K Line	Daewoo	Nov-08	Panama	S	GT NO 96	4	Various
Kita LNG	160,106	TMSC Gas	Daewoo	Jun-14	Malta	TFDE	GT No 96	4	Various
Kotawaka Maru	125,200	J3 Consortium	Kawasaki Sakaide	Jan-84	Japan	S	Moss	5	Darwin
Kumul	172,000	MOL	Hudong	May-16	Hong Kong	DRL	GT NO. 96	4	PNG-Asia
Lala Fatma N'Soumer	145,000	Algeria Nippon Gas	Kawasaki Sakaide	Dec-04	Japan	S	Moss	4	Sonatrach
Larbi Ben M'Hidi	129,750	SNTM-Hyproc	La Seyne	Jun-77	Algeria	S	GT NO 85	5	Sonatrach
Lijmilya	261,700	QGTC	Daewoo	Sep-08	Marshall Is.	DRL	GT NO. 96	5	Various
LNG Abuja	126,530	Bonny Gas Transport	GD Quincy	Sep-80	Bahamas	S	Moss	5	Nigeria LNG
LNG Adamawa	141,000	Bonny Gas Transport	Hyundai	Jun-05	Bermuda	S	Moss	4	Various
LNG Akwa Ibom	141,000	Bonny Gas Transport	Hyundai	Nov-04	Bermuda	S	Moss	4	Various
LNG Aquarius	126,300	MOL/LNG Japan	GD Quincy	Jun-77	Marshall Is.	S	Moss	5	Various
LNG Barka	153,000	NYK	Kawasaki	Jan-09	Bahamas	S	Moss	4	Various
LNG Bayelsa	137,500	Bonny Gas Transport	Hyundai	Feb-03	Bermuda	S	Moss	4	Nigeria LNG
LNG Benue	145,700	BW Gas	Daewoo	Mar-06	Bermuda	S	GT NO 96	4	Nigeria LNG
LNG Bonny	177,000	Bonny Gas Transport	Hyundai	Oct-15	Bermuda	DFDE	TZ Mk III	4	Nigeria LNG
LNG Borno	149,600	NYK Line	Samsung	Aug-07	Japan	S	TZ Mk. III	4	Nigeria LNG
LNG Capricorn	126,300	MOL/LNG Japan	GD Quincy	Jun-78	Marshall Is.	S	Moss	5	Pertamina
LNG Cross River	141,000	Bonny Gas Transport	Hyundai	Sep-05	Bermuda	S	Moss	4	Various
LNG Dream	145,000	Osaka Gas	Kawasaki	Sep-06	Japan	S	Moss	4	Woodside Energy
LNG Ebisu	147,500	MOL	Kawasaki	Sep-08	Bahamas	S	Moss	4	Various
LNG Edo	126,530	Bonny Gas Transport	GD Quincy	May-80	Bahamas	S	Moss	5	Nigeria LNG
LNG Enugu	145,000	BW Gas	Daewoo	Oct-05	Bermuda	S	GT NO 96	4	Nigeria LNG
LNG Flina	175,000	Bonny Gas Transport	Samsung	Oct-15	Bermuda	DFDE	TZ Mk III	4	Nigeria LNG
LNG Flora	127,700	J3 Consortium	Kawasaki Sakaide	Mar-93	Japan	S	Moss	4	Pertamina
LNG Fukurokuju	165,000	MOL	Kawasaki	June-15	Japan	S	Moss	4	Various
LNG Gemini	126,300	MOL/LNG Japan	GD Quincy	Sep-78	Marshall Is.	S	Moss	5	Pertamina
LNG Imo	148,300	BW Gas	Daewoo	Jun-08	Bermuda	S	GT NO 96	4	Nigeria LNG
LNG Jamal	135,330	Osaka Gas/J3 Consortium	Mitsubishi Nagasaki	Oct-00	Japan	S	Moss	5	Oman Gas
LNG Jupiter	145,000	NYK Line	Kawasaki	Jul-09	Bahamas	S	Moss	4	Various
LNG Jurojin	155,300	MOL	MHI Nagasaki	Nov-15	Japan	S	KM	4	Various
LNG Kano	148,471	BW Gas	Daewoo	Jan-07	Bermuda	S	GT No. 96	4	NLNG
LNG Lagos	177,000	Bonny Gas	Hyundai	Oct-15	Bermuda	DFDE	TZ Mk III	4	Nigeria LNG
LNG Leo	126,400	MOL/LNG Japan	GD Quincy	Dec-78	Marshall Is.	S	Moss	5	Pertamina
LNG Lerici	65,000	Exmar	Italcantieri Sestri	Mar-98	Italy	S	GT NO 96	4	Sonatrach
LNG Libra	126,400	Hoegh LNG	GD Quincy	Apr-79	Marshall Is.	S	Moss	5	Various
LNG Lokoja	148,300	BW Gas	Daewoo	Dec-06	Bermuda	S	GT No. 96	4	Nigeria LNG
LNG Mars	155,000	MOL/Osaka Gas	Mitsubishi	Oct-16	Marshall Is.	S	Moss	5	Various
LNG Ogun	148,300	NYK Line	Samsung	Aug-07	Japan	S	TZ Mk. III	4	Nigeria LNG
LNG Ondo	148,300	BW Gas	Daewoo	Sep-07	Bermuda	S	GT NO 96	4	Nigeria LNG
LNG Oyo	140,500	BW Gas	Daewoo	Dec-05	Bermuda	S	GT NO 96	4	Nigeria LNG
LNG Pioneer	138,000	MOL	Daewoo	Jul-05	Bahamas	S	GT No 96	4	Idku

LNG Port Harcourt	175,000	Bonny Gas	Samsung	Oct-15	Bermuda	DFDE	TZ Mk III	4	Nigeria LNG
LNG Portovenere	65,000	Exmar	Italcantieri Sestri	Jun-96	Italy	S	GT No 96	4	Sonatrach
LNG River Niger	141,000	Bonny Gas Transport	Hyundai	May-06	Bermuda	S	Moss	4	Various
LNG River Orashi	145,910	BW Gas	Daewoo	Nov-04	Bermuda	S	GT No 96	4	Nigeria LNG
LNG Rivers	137,231	Bonny Gas Transport	Hyundai	Jun-02	Bermuda	S	Moss	4	Nigeria LNG
LNG Saturn	153,000	MOL	MHI	Nov-15	Japan	S	Moss	4	Various
LNG Sokoto	137,231	Bonny Gas Transport	Hyundai	Aug-02	Bermuda	S	Moss	4	Nigeria LNG
LNG Taurus	126,300	MOL/LNG Japan	GD Quincy	Aug-79	Marshall Is.	S	Moss	5	Various
LNG Venus	155,000	Osaka/MOL	MHI	Oct-14	Japan	S	Moss	4	Various
LNG Vesta	127,547	Tokyo Gas Consortium	Mitsubishi Nagasaki	Jun-94	Japan	S	Moss	4	Pertamina
LNG Virgo	126,400	MOL/LNG Japan	GD Quincy	Dec-79	Marshall Is.	S	Moss	5	Pertamina
Lobito	160,400	Mitsui/NYK/Teekay	Samsung	Oct-11	Bahamas	DFDE	TZ Mk. III	4	Various
Lusail	138,000	Peninsular LNG	Samsung	May-05	Bahamas	S	TZ Mk. III	4	Qatar
Madrid Spirit	138,000	Teekay LNG Partners	IZAR Puerto Real	Jan-05	Spain	S	GT No 96	4	Engas
Magellan Spirit	165,500	Teekay LNG Partners	Samsung	Sep-08	Denmark	DFDE	TZ Mk. III	4	Various
Malanje	160,400	Mitsui/NYK/Teekay	Samsung	Jul-11	Bahamas	DFDE	TZ Mk. III	4	Various
Maran Gas Achilles	174,000	Maran	Hyundai Samho	Feb-16	Greece	DFDE	GT No 96	4	Various
Maran Gas Agamemnon	174,000	Maran	Hyundai Samho	May-16	Greece	DFDE	GT No 96	4	Various
Maran Gas Alexandria	161,870	Maran	Hyundai Samho	Sep-15	Greece	DFDE	TZ Mk. III	4	Various
Maran Gas Amphilopolis	173,400	Maran	Daewoo	Aug-16	Greece	DFDE	GT No 96	4	Various
Maran Gas Apollonia	161,870	Maran	Daewoo	Jan-14	Greece	DFDE	GT No 96	4	Various
Maran Gas Asclepius	145,000	Kristen Navigation	Daewoo	Jul-05	Bermuda	S	GT No 96	4	Qatar
Maran Gas Coronis	145,700	Maran	Daewoo	Sep-07	Greece	S	GT No 96	4	Rasgas II
Maran Gas Delphi	159,800	Maran	Daewoo	Feb-14	Greece	DFDE	GT No 96	4	Various
Maran Gas Efessos	159,800	Maran	Daewoo	Jun-14	Greece	DFDE	GT No 96	4	Various
Maran Gas Hector	174,000	Maran	Hyundai Samho	Nov-16	Greece	DFDE	GT No 96	4	Various
Maran Gas Lindos	159,800	Maran	Daewoo	Jun-15	Greece	DFDE	GT No. 96	4	Various
Maran Gas Mystras	155,900	Maran Gas	Daewoo	May-15	Greece	DFDE	GT No 96	4	various
Maran Gas Pericles	174,000	Maran	Hyundai Samho	June-16	Greece	DFDE	GT No 96	4	Various
Maran Gas Posidonia	161,870	Maran	Daewoo	May-14	Greece	DFDE	GT No 96	4	Various
Maran Gas Roxana	173,400	Maran	Daewoo	Jan-17	Greece	DFDE	GT No 96	4	Various
Maran Gas Sparta	161,870	Maran	Hyundai Samho	April-15	Greece	DFDE	G TZ Mk. III	4	Various
Maran Gas Troy	155,900	Maran Gas	Daewoo	May-15	Greece	DFDE	GT No 96	4	various
Maran Gas Ulysses	174,000	Maran	Hyundai Samho	Jan-17	Greece	DFDE	GT No 96	4	Various
Maria Energy	174,000	Tsakos	Hyundai	Mar-15	Marshall Is.	TFDE	GTT Mk II	4	Various
Marib Spirit	165,000	Teekay LNG	Samsung	May-08	Marshall Is.	DFDE	TZ Mk. III	4	Various
Matthew	126,540	Suez LNG Shipping	Newport News	Jun-79	Bahamas	S	TZ Mk. I	6	Atlantic LNG
Mekaines	266,000	Nakilat	Samsung	Mar-09	Liberia	DRL	GT No 96	4	Qatar-Atlantic Basin
Meridian Spirit	165,500	Teekay LNG	Samsung	Jan-10	Denmark	DFDE	TZ Mk. III	4	Various
Mesaimmer	210,100	Nakilat	Hyundai	Mar-09	Liberia	DRL	GT No 96	4	Qatar-Atlantic Basin
Methane Alison Victoria	145,000	GasLog	Samsung	Aug-07	Bermuda	S	TZ III	4	Eq.Guinea LNG
Methane Becki Anne	170,000	GasLog	Samsung	Sep-10	Bermuda	TFDE	TZ Mk. III	4	Various
Methane Heather Sally	145,000	GasLog	Samsung	Jul-07	Bermuda	S	Tz Mk. III	4	Eq.Guinea LNG
Methane Jane Elizabeth	145,000	GasLog	Samsung	Jun-06	Bermuda	TFDE	TZ Mk. III	4	Engas
Methane Julia Louise	170,000	GasLog	Samsung	Dec-09	Bermuda	TFDE	TZ Mk. III	4	Various
Methane Kari Elin	138,200	Shell	Samsung	Jun-04	Bermuda	S	TZ Mk. III	4	Various
Methane Lake Charles	145,000	Shell	Samsung	Feb-07	Bermuda	S	TZ Mk. III	4	Marathon Oil
Methane Lydon Volney	145,000	Shell	Samsung	Aug-06	Bermuda	S	TZ Mk. III	4	Engas
Methane Mickie Harper	170,000	Shell-GasLog	Samsung	Nov-10	Bermuda	TFDE	TZ Mk. III	4	Various
Methane Nile Eagle	145,000	Shell-GasLog	Samsung	Dec-07	Bermuda	S	TZ Mk. III	4	Engas
Methane Patricia Camila	170,000	Shell-GasLog	Samsung	Oct-10	Bermuda	TFDE	TZ Mk. III	4	Various
Methane Princess	138,159	Golar LNG	Daewoo	2003	UK	S	GT No 96	4	Spot BG
Methane Rita Andre	145,000	GasLog	Samsung	Mar-06	Bermuda	S	TZ Mk. III	4	Engas
Methane Shirley Elizabeth	145,000	GasLog	Samsung	Apr-07	Bermuda	S	TZ Mk. III	4	Marathon Oil
Methane Sprit	165,000	Teekay LNG	Samsung	Mar-08	Singapore	DFDE	TZ Mk. III	4	Various
Milaha Qatar	145,000	Milaha	Samsung	Apr-06	Denmark	S	TZ Mk. III	4	Qatar
Milaha Ras Laffan	138,270	Milaha	Samsung	Mar-04	Denmark	S	TZ Mk. III	4	RasGas II
Min Lu	147,000	China Ships	Hudong	Aug-09	China	S	GT No 96	4	Various
Min Rong	147,000	China LNG Ships	Hudong	Feb-09	Hong Kong	S	GT No 96	4	Australia-China
Mourad Didouche	126,130	SNTM-Hyproc	Atlantique	Jul-80	Algeria	S	GT No 85	5	Sonatrach
Mozah	266,000	QGTC	Samsung	Aug-08	Qatar	DRL	TZ Mk III	5	Qatargas II
Mraweh	137,000	National Gas Shipping	Kvaerner-Masa	Jun-96	Liberia	S	Moss	4	ADGAS
Mubaraz	137,000	National Gas Shipping	Kvaerner-Masa	Jan-96	Liberia	S	Moss	4	Various
Muraq	210,100	J5-K Line	Daewoo	May-08	Marshall Is.	DRL	GT No 96	4	Qatar-Atl'c Basin
Murwab	210,100	J5 Consortium	Daewoo	May-08	Marshall Is.	DRL	GT No. 96	4	Qatargas
Muscat LNG	149,170	Oman Gas/MOL	Kawasaki Sakaide	Mar-04	Japan	S	Moss	4	Oman Gas
Neo Energy	149,700	Tsakos	Hyundai	Feb-07	Liberia	S	GTT Mk II	4	Various
Nizwah LNG	145,000	Oryx LNG Carriers	Kawasaki Sakaide	Dec-05	Japan	S	Moss	4	Oman Gas
Northwest Sanderling	127,525	Australia LNG	Mitsubishi Nagasaki	Jun-89	Australia	S	Moss	4	NWS
Northwest Sandpiper	127,500	Australia LNG	Mitsui Chiba	Feb-93	Australia	S	Moss	4	NWS
Northwest Seaeagle	127,450	Australia LNG	Mitsubishi Nagasaki	Nov-92	Bermuda	S	Moss	4	NWS
Northwest Shearwater	127,500	Australia LNG	Kawasaki Sakaide	Sep-91	Bermuda	S	Moss	4	NWS
Northwest Snipe	127,747	Australia LNG	Mitsui Chiba	Sep-90	Australia	S	Moss	4	NWS
Northwest Stormpetrel	127,600	Australia LNG	Mitsubishi Nagasaki	Dec-94	Australia	S	Moss	4	NWS
Northwest Swallow	127,708	J3 Consortium	Mitsui Chiba	Nov-89	Japan	S	Moss	4	NWS
Northwest Swan	138,000	Australia LNG	Daewoo	Mar-04	Australia	S	GT NO 96	4	NWS
Northwest Swift	127,590	J3 Consortium	Mitsubishi Nagasaki	Sep-89	Japan	S	Moss	4	NWS
Oak Spirit	173,400	Teekay	Daewoo	Jan-16	Bahamas	MEGI-DF	NO. 96 GW	4	Cheniere
Ob River	150,000	Lance Shipping	Hyundai	Oct-07	Marshall Is.	S	TZ Mk. III	4	Various
Onaiza	210,100	Nakilat	Daewoo	Apr-09	Liberia	DRL	GT NO 96	4	Qatar-Atlantic Basin
Pacific Arcadia	147,200	NYK Line	MHI	Oct-14	Bahamas	S	KM		Various
Pacific Enlighten	145,000	LNG MT	Mitsubishi	Mar-09	Japan	S	Moss	4	Various
Pacific Eurys	137,000	LNG Marine Transport	Mitsubishi Nagasaki	Mar-06	Bahamas	S	Moss	4	Darwin
Pacific Notus	137,006	Pacific LNG Shipping	Mitsubishi Nagasaki	Sep-03	Bahamas	S	Moss	5	Darwin
Palu LNG	160,106	TMSC Gas	Daewoo	Jun-14	Malta	TFDE	GT No 96	4	Various
Papua	171,800	MOL-China	Hudong	Jan-15	Hong Kong	DFDE	SSD	4	PNG LNG
Polar Eagle	89,880	Polar LNG	IHI Chita	Jun-93	Liberia	S	IHI SPB	4	ConocoPhillips/Marathon
Prachi	173,000	NYK-SCI	Hyundai	Nov-16	Singapore	TFDE	GT No 96	4	Petronet
Provalys	153,500	Gaz de France	Chantiers	Nov-06	France	DFDE	CS1	4	ELNG
Puteri Delima	130,400	MISC	Atlantique	Jan-95	Malaysia	S	GT NO 96	4	Petronas

CARRIER FLEET

Puteri Delima Satu	137,100	MISC	Mitsui Chiba	Apr-02	Malaysia	S	GT NO 96	4	Petronas
Puteri Firuz	130,400	MISC	Atlantique	May-97	Malaysia	S	GT NO 96	4	Petronas
Puteri Firuz Satu	137,100	MISC	Mitsubishi Nagasaki	Sep-04	Malaysia	S	GT NO 96	4	Petronas
Puteri Intan	130,400	MISC	Atlantique	Aug-94	Malaysia	S	GT NO 96	4	Petronas
Puteri Intan Satu	137,100	MISC	Mitsubishi Nagasaki	Dec-01	Malaysia	S	GT NO 96	4	Petronas
Puteri Mutiera Satu	137,100	MISC	Mitsui Chiba	Apr-05	Malaysia	S	GT NO 96	4	Petronas
Puteri Nilam	130,400	MISC	Atlantique	Jun-95	Malaysia	S	GT NO 96	4	Petronas
Puteri Nilam Satu	137,100	MISC	Mitsubishi Nagasaki	Sep-03	Malaysia	S	GT NO 96	4	Petronas
Puteri Zamrud	130,400	MISC	Atlantique	May-96	Malaysia	S	GT NO 96	4	Petronas
Puteri Zamrud Satu	137,100	MISC	Mitsui Chiba	Apr-87	Malaysia	S	GT NO 96	4	Atlantic LNG
Raahi	136,000	Petronet LNG Ltd	Daewoo	Dec-04	Malta	S	GT NO 96	4	Qatargas
Ramdane Abane	126,130	SNTM-Hyproc	Atlantique	Jul-81	Algeria	S	GT NO 85	5	Sonatrach
Rasheeda	266,000	QGTG	Samsung	Jun-10	Liberia	DRL	TZ Mk. III		Various
Ribera del Duero Knutsen	173,400	Knutsen	Daewoo	Nov-10	Nor-NIS	DFDE	GT NO. 96	4	Various
Rioja Knutsen	176,300	Knutsen	Daewoo	Dec-16	Nor-NIS	DFDE	TZ Mk III	4	Various
Salalah LNG	147,000	Oman Gas/MOL	Samsung	Dec-05	Japan	S	TZ Mk. III	4	Oman
SCF Polar	71,500	Sovcomflot	Kockums	Aug-69	Liberia	S	GT NO 82	6	Sonatrach
Seishu Maru	162,000	K Line-Transpacific	Kawasaki Sakaide	Jan-15	Panama	S	Moss	4	Australia-Japan
Seri Alam	138,000	MISC	Samsung	Oct-05	Malaysia	S	TZ Mk. III	4	Yemen LNG
Seri Amanah	145,000	MISC	Samsung	Mar-06	Malaysia	S	TZ Mk. III	4	Yemen LNG
Seri Anggun	145,000	MISC	Samsung	Nov-06	Malaysia	S	TZ Mk. III	4	Yemen LNG
Seri Angkasa	145,000	MISC	Samsung	Feb-07	Malaysia	S	TZ Mk. III	4	Petronas
Seri Ayu	145,000	MISC	Samsung	Oct-07	Malaysia	S	TZ Mk. III	4	Various
Seri Bakti	152,300	MISC	Mitsubishi	Mar-07	Malaysia	S	GT NO 96	4	Petronas
Seri Balhaf	152,000	MISC	Mitsubishi	Sep-08	Malaysia	S	GT NO 96	4	Various
Seri Balquis	152,000	MISC	Mitsubishi	Dec-08	Malaysia	S	GT NO 96	4	Various
Seri Begawan	152,300	MISC	Mitsubishi	Dec-07	Malaysia	S	GT NO 96	4	Various
Seri Bijaksana	152,300	MISC	Mitsubishi	Feb-08	Malaysia	S	GT NO 96	4	Petronas
Seri Camellia	150,000	MISC	Hyundai	Nov-16	Malaysia	S	Moss	5	Petronas
Seri Cenderawasih	150,000	MISC	Hyundai	Jan-17	Malaysia	S	Moss	5	Petronas
Sestao Knutsen	138,000	Knutsen	IZAR Sestao	Jan-07	Spain	S	GT NO 96	4	Atlantic LNG
Sevilla Knutsen	173,400	Knutsen	Daewoo	Jun-10	N.I.S.	DFDE	GT NO 96	4	Various
Shahamah	135,500	National Gas Shipping	Kawasaki Sakaide	Oct-94	Liberia	S	Moss	5	ADGAS
Shangra	266,000	QGTG	Samsung	Nov-09	Liberia	DRL	TZ Mk. III	5	Qatargas IV
Shen Hai	147,100	China LNG	Hudong Zhonghua	Sep-12	China	AB/CC Steam	GT NO 96	4	Various
Simaisma	147,700	Maran Gas Maritime	Daewoo	Jul-06	Greece	S	GT No 96	4	Qatar
SK Splendor	138,375	SK Shipping	Samsung	Mar-00	Panama	S	TZ Mk. III	4	Oman Gas
SK Stellar	138,375	SK Shipping	Samsung	Dec-00	Panama	S	TZ Mk. III	4	RasGas
SK Summit	138,000	SK Shipping	Daewoo	Aug-99	Panama	S	GT NO 96	4	RasGas
SK Sunrise	138,306	I. S. Carriers	Samsung	Sep-03	Panama	S	TZ Mk. III	4	RasGas
SK Supreme	138,200	SK Shipping	Samsung	Jan-00	Panama	S	TZ Mk. III	4	RasGas
Sohar LNG	137,250	Oman Gas/ MOL	Mitsubishi Nagasaki	Oct-01	Malta	S	Moss	5	Oman Gas
Solaris	155,000	GasLog	Samsung	Jul-14	Bermuda	TFDE	TZ Mk. III	4	Various
Sonangol Benguela	160,500	Sonangol	Daewoo	Sep-11	Bahamas	S	GT No. 96	4	Angola LNG
Sonangol Etosha	160,500	Sonangol	Daewoo	Sep-11	Bahamas	S	GT No. 96	4	Angola LNG
Sonangol Sambizanga	160,500	Sonangol	Daewoo	Sep-11	Bahamas	S	GT No. 96	4	Angola LNG
Southern Cross	172,000	MOL	Hudong	May-15	Hong Kong	DRL	GT NO. 96	4	Various
Soyo	160,400	Mitsui/NYK/Teekay	Samsung	May-11	Bahamas	DFDE	TZ Mk. III	4	Various
Spirit of Hela	177,000	MOL	Hyundai	Oct-09	Panama	DFDE	TZ Mk. III	4	Various
Stena Blue Sky	145,700	Stena	Daewoo	Jan-06	Panama	S	GT No 96	4	Various
Stena Clear Sky	171,800	Stena	Daewoo	Sep-10	Panama	DFDE	GT NO 96	4	Various
Stena Crystal Sky	171,800	Stena	Daewoo	Jul-10	Panama	DFDE	GT NO 96	4	Various
STX Kolt	145,700	STX Panocean	Korea Hanjin	Nov-08	Panama	DFDE	TZ Mk. III	4	Various
Suez Point Fortin	154,200	Trinity LNG	Koyo Japan	Nov-09	Panama	S	TZ Mk. III	4	Yemen LNG
Taitar No. 1	145,000	NYK Line	Mitsubishi	Oct-09	Liberia	S	Moss	4	Various
Taitar No. 3	145,000	NYK Line	Mitsubishi	Jan-10	Liberia	S	Moss	4	Various
Taitar No. 4	145,000	NYK	Mitsubishi	Jan-10	Liberia	S	Moss	4	Various
Tangguh Batur	145,700	Sovcomflot/NYK	Daewoo	Dec-08	Cyprus	S	GT NO 96		Tangguh
Tangguh Foja	155,000	K Line	Samsung	Jul-08	Panama	DFDE	TZ Mk. III	4	Tangguh LNG
Tangguh Hiri	155,000	Teekay LNG	Hyundai	Nov-08	IOM	DFDE	TZ Mk. III	4	Tangguh
Tangguh Jaya	145,700	K Line	Samsung	Nov-08	Panama	DFDE	TZ Mk. III	4	Tangguh
Tangguh Palung	155,000	K Line	Samsung	Mar-09	Panama	DFDE	TZ Mk. III	4	Tangguh
Tangguh Sago	155,000	Teekay LNG	Hyundai	Mar-09	IOM	DFDE	TZ Mk. III	4	Tangguh LNG
Tangguh Towuti	145,700	Sovcomflot/NYK	Daewoo	Oct-08	Cyprus	S	GT NO 96	4	Tangguh
Tembek	216,200	OSG/Nakilat	Samsung	Sep-07	Marshall Is.	DRL	TZ Mk. III	4	Qatargas II
Tenaga Satu	130,000	MISC	Dunkerque	Sep-82	Malaysia	S	GT NO 88	5	Petronas
Trinity Arrow	154,900	K Line	Imabari Shipbuilding	Mar-08	Panama	S	TZ Mk. III	4	Various
Umm Al Amad	210,100	J5	Daewoo	Aug-08	Marshall Is.	DRL	GT NO 96	4	Ras Gas III
Umm Al Ashtan	137,000	National Gas Shipping	Kvaerner- Masa	May-97	Liberia	S	Moss	4	ADGAS
Umm Bab	145,000	Kristen Navigation	Daewoo	Nov-05	Bermuda	S	GT NO 96	4	Qatargas
Umm Slaal	266,000	QGTG	Samsung	Nov-08	Qatar	DRL	TZ Mk. III	5	Qatargas
Valencia Knutsen	173,400	Knutsen	Daewoo	Sep-10	Nor-NIS	DFDE	GT NO. 96	4	Various
Velikiy Novgorod	170,200	SovComFlot	STX	Feb-14	Liberia	DFDE	GT No. 96	4	Various
Wakaba Maru	125,000	J3 Consortium	Mitsui Chiba	Apr-85	Japan	S	Moss	5	Pertamina
WilEnergy	125,500	Awilco LNG	Mitsubishi	Oct-83	NIS	S	Moss	5	Various
WilForce	156,000	Teekay LNG	Daewoo	Aug-13	NIS	DFDE	GT NO 96	4	Various
WilGas	125,500	Awilco LNG	Mitsubishi	Jul-84	NIS	S	Moss	5	Various
WilPower	125,500	Awilco LNG	Mitsubishi	Jul-84	NIS	S	Moss	5	Various
Woodside Cheney	174,000	Maran	Hyundai Samho	March-16	Greece	DFDE	GT No 96	4	Various
Woodside Donaldson	165,500	Teekay LNG	Samsung	Dec-09	Singapore	DFDE	TZ Mk. III	4	Various
Woodside Goode	159,800	Maran	Daewoo	Jul-14	Greece	DFDE	GT No. 96	4	Various
Woodside Reeswithers	173,400	Maran	Daewoo	Nov-16	Greece	DFDE	GT No 96	4	Various
Woodside Rogers	155,900	Maran Gas	DSME	Jul-13	Greece	DFDE	GT NO 96	4	Various
Yari LNG	159,983	TMSC Gas	Daewoo	Jun-14	Malta	TFDE	GT No 96	4	Various
Yenisei River	155,000	Dynagas	Hyundai	Jul-13	Marshall Is.	DFDE	TZ Mk. III	4	Various
YK Sovereign	127,125	SK Shipping	Hyundai	Dec-94	Panama	S	Moss	4	Pertamina
Zarga	266,000	QGTG	Samsung	Dec-09	Liberia	DRL	TZ Mk. III	5	Qatar-Atlantic
Zekreet	135,420	J4 Consortium	Mitsui Chiba	Dec-98	Japan	S	Moss	5	Qatargas

Any observations, additions or suggested revisions to the LNG journal World LNG Carrier Fleet list should be sent to editor@lngjournal.com

LNG Import Terminals

Explanatory Notes

- The tables do not include the following types of LNG facilities :
 - ◆ Small marine satellite terminals receiving LNG from liquefaction plants in their own country (such as exist in Norway) or which receive LNG transhipped from nearby reception terminals in their own country (such as in Japan)
 - ◆ Satellite LNG storage facilities that receive LNG transported only by road or rail
- Expansions of LNG reception terminals are only shown if they involve new storage tanks
- Where there is a blank in the table the information is uncertain or unknown.

Any comments on the tables, and corrections / additional information from terminal shareholders and project developers would be most welcome, and should be sent to [John McKay](mailto:John.McKay@lngjournal.com) e-mail editor@lngjournal.com

Country	Location (Project)	Owners	Start up	Storage	
				Tanks	Capacity
Belgium	Zeebrugge	Fluxys	1987	4	380,000
Canada	Canaport Saint John	Irving Oil, Repsol	2009	3	480,000
Chile	Quintero	ENAP, Metrogas, Enagas	2009	3	334,000
	Mejillones	Engie, Codelco	2010	1	175,000
China	Beihai LNG, Guangxi	Sinopec	2015	4	640,000
	Dalian	PetroChina	2011	3	480,000
	Dongguan, Guangdong	Jovo Group	2013	2	160 000
	Fujian LNG (Xiuyu)	CNOOC, Fujian I&D Corp.	2008	2	640,000
	Guangdong	CNOOC,BP	2006	3	480,000
	Haikou, Hainan LNG	CNOOC	2014	3	480,000
	Ningbo, Zhejiang	CNOOC, Zhejiang Energy	2012	3	480,000
	Qingdao, Shandong	Sinopec	2014	3	480,000
	Rudong	PetroChina	2011	3	530,000
	Shanghai	CNOOC, Shenergy Group	2009	3	495,000
	Shanghai, Mengtougou	Shanghai Gas	2008	3	120 000
	Shenzen, Diefu	CNOOC	2016	2	320,000
	Tangshan, Hebei	PetroChina	2013	3	480,000
	Tianjin FSRU	CNOOC	2014	1	60,000
	Yuedong, Guangdong	CNOOC	2016	2	320,000
	Zhuhai, Gaolan	CNOOC	2013	3	480,000
Dominican Republic	Punta Caucedo	AES Andres	2003	1	160 000
Finland	Pori	Gasum Skangas	2016	1	30,000
France	Fos Tonkin	Elengy	1972	3	150,000
	Montoir-de-Bretagne	Elengy	1980	3	360,000
	Fos Cavaou	Engie, Total	2010	3	330,000
	Dunkirk LNG	EDF, Fluxys, Total	2016	3	570,000
Greece	Revithoussa	DEPA	2000	2	130,000
India	Dabhol	GAIL, NTPC (Ratnagiri Gas & Power)	2009	3	480,000
	Dahej	Petronet LNG	2004	4	592,000
	Hazira	Shell India, Total	2005	2	320,000
	Kochi, Kerala	Petronet LNG	2013	2	320,000
Indonesia	Arun	Pertamina	2015	5	507,000
Italy	Panigaglia	Snam	1969	2	100,000
	Porto Levante (offshore GBS)	ExxonMobil, Qatar Petroleum, Edison Gas	2009	2	250,000
Japan	Negishi	Tokyo Gas	1969	14	1,180,000
	Sodegaura	Tokyo Gas	1973	35	2,660,000
	Ohgishima	Tokyo Gas	1998	4	850,000
	Higashi-Ohgishima	Tokyo Electric	1984	9	540,000
	Futtsu	Tokyo Electric	1985	10	1,110,000
	Yokkaichi LNG	Chubu Electric	1988	4	320,000
	Kawagoe	Chubu Electric	1997	6	840,000
	Yokkaichi Works	Toho Gas	1991	2	160,000
	Chita LNG Joint	Toho Gas, Chubu Electric	1978	4	300,000
	Chita LNG	Toho Gas, Chubu Electric	1983	7	640,000
	Chita - Midorihama	Toho Gas	2001	3	600,000
	Senboku I	Osaka Gas	1972	4	180,000
	Senboku II	Osaka Gas	1977	18	1,585,000
	Himeji	Osaka Gas	1984	8	740,000
	Himeji LNG	Kansai Electric	1979	7	520,000
	Yanai	Chugoku Electric	1990	6	480,000
	Niigata	Nihonkai LNG, Tohoku Electric	1984	8	720,000
	Oita	Oita Gas, Kyushu Electric	1990	5	460,000
	Tobata	Kitakyushu LNG	1977	8	480,000
	Fukuoka	Saibu Gas	1993	2	70,000
	Sodeshi	Shizuoka Gas	1996	3	337,200
	Hatsukaichi	Hiroshima Gas	1996	2	170,000
	Kagoshima	Nippon Gas	1996	2	136,000
	Shin-Minato	Sendai City Gas	1997	1	80,000
	Nagasaki	Saibu Gas	2003	1	36,000
	Sakai	Kansai Electric, Cosmo Oil	2006	3	420,000
	Mizushima	Nippon Oil, Chugoku Electric	2006	2	320,000
	Sakaide	Shikoku Electric, Cosmo Oil	2011	1	180,000
	Ishikari LNG	Hokkaido Gas, Hokkaido Electric	2012	2	380,000
	Okinawa	Okinawa Electric Power	2012	2	280,000
	Naoetsu	Inpex	2013	2	360,000
	Joetsu	Chubu	2011	3	540,000
	Hachinohe LNG	Nippon Oil	2015	2	280,000
	Hitachi LNG	Tokyo Gas	2015	1	230,000
Korea	Boryeong	GS Energy, SK E&S	2017	3	200,000
	Incheon	Kogas	1996	20	2,880,000
	Kwangyang	POSCO	2005	4	530,000
	Pyeong-Taek	Kogas	1986	23	3,360,000
	Samcheok	Kogas	2014	3	600,000
	Tong-Yeong	Kogas	2002	17	2,620,000
Mexico	Altamira	Vopak, Enagas	2006	2	300,000
	Energia Costa Azul	Sempre LNG	2008	2	320,000
	Manzanillo	Samsung, Kogas, Mitsui	2012	2	300,000
Netherlands	Gate LNG	Gasunie, Royal Vopak	2011	3	540,000
Poland	Swinoujscie	Baltic Gaz System	2015	2	320,000

LNG Import Terminals (continued)

Country	Location (Project)	Owners	Start up	Storage	
				Tanks	Capacity
Portugal	Sines	REN Atlantico	2004	3	390,000
Puerto Rico	Penuelas	EcoElectrica	2000	1	160,000
Singapore	Singapore	Singapore Energy Authority	2013	3	540,000
Spain	Barcelona	Enagas	1969	8	840,000
	Huelva	Enagas	1988	5	610,000
	Cartagena	Enagas	1989	5	587,000
	Bilbao	Enagas, EVE	2003	3	450,000
	Sagunto	GNF, Osaka Gas, Oman Oil	2006	4	600,000
	Reganosa, Ferrol	Galicia, Sonatrach, Tojeiro	2006	2	300,000
	El Musel, Gijón,	Enagas	2013	2	300,000
Taiwan	Yung-An	CPC	1990	6	690,000
	Tai-chung	CPC	2009	3	480,000
Thailand	Map Ta Phut	PTT LNG	2011	2	320,000
Turkey	Marmara Ereglisi	Botas	1994	3	255,000
	Izmir	EgeGaz	2006	2	280,000
USA	Everett	Suez LNG NA	1971	2	155,000
	Lake Charles	Shell, ETE	1982	4	425,000
	Elba Island	Kinder	2001	5	535,000
	Cove Point	Dominion	2003	5	530,000
	Freeport	Freeport LNG Development	2008	2	320,000
	Cameron	Sempra LNG	2009	3	480,000
	Golden Pass, TX	Qatar Petroleum, ExxonMobil	2010	5	775,000
	Pascagoula, MS	Gulf LNG, Kinder	2012	2	320,000
UK	Isle of Grain	National Grid	2005	8	1,000,000
	South Hook	ExxonMobil, Qatar Petroleum, Total	2009	5	775,000
	Dragon LNG, Milford Haven	Shell, Petronas	2009	2	310,000

LNG Import Terminal Projects

Country	Location/Project	Owners/Project Developers	Start up	Storage	
				Tanks	Capacity
China	Tianjin North	Sinopec	2017	2	320,000
	Zhoushan Zhejiang	Enn Group	2018	2	320,000
Finland	Tornio	Gasum Skanga	2018	1	30,000
Gibraltar	Gasnor	Shell	2017	1	5,000
India	Ennore	Indian Oil Corp	2018	2	320,000
	Mundra	Gujarat State Petroleum, Adani Group	2018	2	320,000
	FSRU Andhra Pradesh	Engie, Andhra Pradesh Gas	2018	1	135,000
	Pipovav LNG (FSRU), Gujarat	Swan Energy	2018	2	320,000
	Andhra Pradesh	Hindustan LNG, Andhra Pradesh	studies	1	135,000
Indonesia	Labuhan Maringgai	Perusahaan Gas Negara	2018	1	135,000
Japan	Soma, Fukushima	Japan Petroleum	2018	1	230,000
Malaysia	Lahad Datu LNG, Sabah	Petronas	2018	studies	
	Pengerang Johor	Petronas	2019	2	320,000
Panama	Costa Norte	AES	2018	1	130,000
Philippines	Pagbilao LNG	Energy World Corp.	2017	1	130,000
UK	Port Meridian, Barrow-in-Furness	Port Meridian Energy Ltd.	2018	1	150,000
Uruguay FSRU	Montevideo	Gas Sayago, Mitsui Osk Lines	2018	1	230,000

LNG FSRU Import Facilities

Country	Location (Project)	Owners	Start up
Argentina	Bahia Blanca GasPort	Excelerate/YPF Repsol	2008
	Escobar GasPort	Excelerate/Enarsa	2011
Brazil	Pecem, FSRU	Petrobras	2009
	Guanabara Bay FSRU	Petrobras	2009
	Salvador, Bahia FSRU	Petrobras	2013
Colombia	Cartagena FSRU	Promigas, Sociedad Portuaria El Cayao	2016
Egypt	Ain Sokhna, Suez	EGAS, Hoegh	2015
	Ain Sokhna, Suez	EGAS, BW Gas	2015
Indonesia	Lampung	Hoegh LNG, PGN LNG	2014
	Nusantara (Jakarta Bay)	Golar LNG, Pertamina	2012
Italy	Livorno	OLT Offshore LNG Toscana	2013
Jordan	Aqaba, Jordan	Golar LNG	2015
Kuwait	Mina Al-Ahmadi	KPC	2009
Lithuania	Klaipeda	Klaipedos Nafta Hoegh LNG	2014
Malaysia	Malacca FSRU	Petronas	2012
Malta	FSU Armada Mediterrana	ElectroGas	2016
Pakistan	Port Qasim	Excelerate, Engro Corp	2015
Turkey	Aliaga FSRU, Neptune	Etki LNG	2016
UAE	Ruwais, Abu Dhabi	Gasco (UAE)	2016
	Jebel Ali Port, Dubai	DSA (UAE)	2010
UK	Teesside GasPort	Excelerate	2007

LNG Export Projects

Country	Location/Project	Project Developers	Planned Start Up	Number of Trains	Capacity In MTPA
AUSTRALIA	Browse LNG	Woodside, BHP, BP Chevron, Shell, Mitsubishi, Mitsui	2021+	2	10.0
	Ichthys LNG	INPEX, Total	2017	2	8.4
	Prelude FLNG	Shell, Inpex, Kogas CPC	2018	1	3.5
	Sunrise LNG	Woodside, Osaka Gas, ConocoPhillips, Shell	2020+	1	3.5
	Wheatstone LNG	Chevron, Apache, Shell , Kuwait FPEC	2017	2	9.0
CANADA	Aurora LNG BC	CNOOC, Inpex Corp. and JGC Corp.	2024	4	24.0
	Bear Head LNG, Nova Scotia	LNG Ltd.	2024	4	8.0
	GNL Quebec, Saquenay	Freestone Capital and Breyer Capital	2024	4	10.0
	Goldboro LNG, Nova Scotia	Pieridae Energy	2024	2	10.0
	Grassy Point LNG	Woodside Petroleum	2024	studies	
	Kitimat LNG, BC	Woodside, Chevron	2024	2	10.0
	LNG Canada, BC	Shell, Mitsubishi, Kogas, PetroChina	2024	2	12.0
	Melford LNG project, Nova Scotia	H-Energy Hiranandani Group	Studies		
	Pacific Northwest LNG, BC	Petronas, Japex, Sinopec, Indian Oil, Brunei Petroleum	2021	2	12.0
	Steelhead LNG, Bamfield	Steelhead LNG Corp	2021	2	12.00
	Vancouver Tilbury	WesPac Midstream	2021	1	3.25
	Woodfibre LNG, Squamish	Pacific Oil & Gas Co	2020	2	2.1
EQ.GUINEA	Equatorial Guinea Fortuna FLNG	Ophir and Golar LNG	2019	1	2.0
INDONESIA	Sengkang LNG	Energy World Corp.	2017	4	2.0
MALAYSIA	Rotan FLNG (Sabah)	Petronas	2019	1	1.5
MOZAMBIQUE	Area 1 Onshore	Anadarko Petroleum and partners	2021	2	10
	Area 4 Onshore	Eni and partners	2021	2	10
	Area 4 FLNG	Eni and partners	2019	1	2.5
NIGERIA	NLNG Train 7	NNPC, Shell, BP, Total	2020+	1	8.4
PAPUA NEW GUINEA	Elk-Antelope LNG	Total, InterOil, Oil Search, Petromin	Studies		
RUSSIA	Yamal LNG Siberia	Novatek, Gazprom, Total	2018	3	16.5
	Sakhalin II expansion	Gazprom, Shell, Mitsui, Mitsubishi	2021	studies	
	Vladisvostok LNG	Gazprom, Itochu, various	2021	2	10.0
USA	Alaska LNG Nikiski	Alaska Gasline Development Corp.	2022	3	20.0
	Annova LNG, Brownsville	Exelon Corp.	2021	6	6.0
	Cameron LNG, Louisiana	Sempra	2018	5	24.92
	Corpus Christi Liquefaction, Texas	Cheniere	2019	5	22.5
	Cove Point LNG, Maryland	Dominion	2018	1	5.25
	Delfin LNG, Louisiana	Delfin, Hoegh	2021	3	9.0
	Driftwood LNG, Louisiana	Tellurian Investments	2022	6	26.0
	Elba Island, Georgia	Kinder Morgan, EIG Energy	2018	10	2.5
	Freeport LNG, Texas	Freeport LNG	2018	4	20.4
	Golden Pass, Texas	Qatar Petroleum, ExxonMobil	2021	3	15.6
	Jordan Cove, Coos Bay	Veresen Inc.	2024	2	7.8
	Lake Charles, Louisiana	Shell, ETE	2024	3	15.0
	Magnolia LNG	Louisiana LNG Ltd.	2021	4	8.0
	Port Arthur LNG	Sempra	2021	2	10.0
	Rio Grande LNG	NextDecade	2021	6	27.0
	Sabine Pass LNG, Louisiana	Cheniere	2016-19	5	22.5
	Texas LNG Brownsville	Chandra, Meyer, Samsung, others	2021	2	4.0
	VG LNG (Cameron Parish)	Venture Global	2021	5	10.0
	VG LNG (Plaquemines)	Venture Global	2021	10	20.0

LNG Exporters

Country	Location/Project	Shareholders	Start up	Liquefaction		Storage	
				Trains	capacity (nominal) mtpa	No. of tanks	Total capacity m³
ABU DHABI (UAE)	Das Island (Adgas)	ADNOC, Mitsui, BP, Total	1977 1994	2 1	3.2 2.5	3	240,000
ALGERIA	Arzew	Sonatrach GL4Z	1964	3	1.1	3	35,000
	Arzew	Sonatrach GL1Z	1978	6	7.8	3	300,000
	Arzew	Sonatrach GL2Z	1980	6	8.0	3	300,000
	Arzew	Sonatrach	2014	1	4.7		
	Skikda	Sonatrach GL1K II	1980	3	3.0	5	308,000
	Skikda	Sonatrach (rebuild)	2013	1	4.5		
ANGOLA	Soyo	Sonangol, Chevron, BP, ENI, Total	2012	1	5.2	2	370,000
AUSTRALIA	Karratha	NWS Woodside, Shell, BHP	1989	2	5.0	4	260,000
		(BP, Chevron	1992	1	2.5	1	130,000
		(Mitsubishi/Mitsui)	2004	1	4.4	1	130,000
		NWS partners	2008	1	4.4	1	130,000
		Darwin (Bayu Undan) ConocoPhillips, Santos, Eni, Inpex, TEPCO, Tokyo Gas	2006	1	3.5	1	188,000
	Australia Pacific LNG	ConocoPhillips, Origin Energy, Sinopec	2016	2	7.5	2	320,000
	Gladstone LNG	Santos, Petronas, Total, Kogas	2015	2	7.8	2	280,000
	Gorgon LNG	Chevron, Shell, ExxonMobil	2016	3	15.6	2	360,000
	Pluto LNG	Woodside, Tokyo Gas, Kansei	2012	1	4.8	2	240,000
	QCLNG	Shell, CNOOC	2014	2	8.0	2	280,000
BRUNEI	Lumut	Brunei/Shell/Mitsubishi/Total	1972-74	5	7.2	3	176,000
EGYPT	Damietta	Union Fenosa, EGPC, EGAS	2004	1	5.0	2	300,000
	Idku	EGPC, EGAS, Shell, Engie, Petronas	2005	2	7.2	2	280,000
EQ.GUINEA	Bioko Island	Marathon, Sonagas, Mitsui, Marubeni	2007	1	3.4	2	272,000
INDONESIA	Bontang I	Pertamina, VICO, JILCO, Total	1977	2	5.2	5	635,000
	Bontang II		1983	2	5.2		
	Bontang III		1989	1	2.8		
	Bontang IV		1993	1	2.8		
	Bontang V		1997	1	2.8		
	Bontang VI		1999	1	3.0		
	Sulawesi LNG	Medco Energi, Pertamina, Mitsubishi	2015	1	2.0	1	170,000
	Tangguh	BP, MI Berau, CNOOC, Nippon, LNG Japan	2008	2	7.6	2	340,000
MALAYSIA	Bintulu (MLNG Satu)	Petronas, Sarawak, Mitsubishi	1983	3	8.1	4	260,000
	Bintulu (MLNG Dua)	Petronas, Shell, Sarawak, Mitsubishi	1995	3	7.8	1	65,000
	Bintulu (MLNG Tiga)	Petronas, Shell, Sarawak, Mitsubishi, Nippon Oil	2003	2	6.8	1	120,000
	Bintulu Train 9	Petronas	2016	1	3.6		
	Kanowit FLNG	Petronas	2016	1	1.2		
NIGERIA	Bonny Island	NNPC, Shell, Total, Eni	1999	2	6.4	2	168,400
		Nigeria LNG (formed by above)	2002	1	3.2	1	84,200
		Nigeria LNG	2006	2	8.2		
		Nigeria LNG	2008	1	4.1	1	84,200
NORWAY	Snøhvit/Melkoya Island	Statoil, Total, GDF-Suez, Petoro	2007	1	4.2	2	280,000
OMAN	Oman LNG	Oman Govt., Shell, Total, Korea LNG	2000	2	7.1	2	240,000
		Mitsubishi, Mitsui, Partex and Itochu					
		Oman Govt., Oman LNG Union Fenosa, Osaka Gas, & Itochu	2006	1	3.7	2	240,000
PAPUA NEW GUINEA	PNG LNG	ExxonMobil, Oil Search, Santos, JX Nippon Oil	2014	2	6.9	2	320,000
PERU	Peru LNG	Hunt Oil, Shell, Marubeni, SK Group	2010	1	4.4	2	260,000
QATAR	Qatargas 1-T1&2	QP, ExxonMobil, Total, Marubeni, Mitsui	1997	2	6.4	4	340,000
	Qatargas 1-T3	QP, ExxonMobil, Total, Marubeni, Mitsui	1999	1	3.1		
	Qatargas II-T1	QP, ExxonMobil	2009	1	7.8		
	Qatargas II-T2	QP, ExxonMobil, Total	2009	1	7.8	8	1,160,000
	Qatargas III-T1	QP, ConocoPhillips, Mitsui	2010	1	7.8		
	Qatargas IV-T1	QP, Shell	2010	1	7.8		
	RasGas I- T1&2	QP, ExxonMobil, Kogas, Itochu, LNG Japan	1999	2	6.6		
	RasGas II- T3	QP, ExxonMobil	2004	1	4.7	6	840,000
	RasGas II- T4	QP, ExxonMobil	2005	1	4.7		
	RasGas II- T5	QP, ExxonMobil	2007	1	4.7		
	Rasgas III – T6	QP, ExxonMobil	2009	1	7.8		
	Rasgas III – T7	QP, ExxonMobil	2010	1	7.8		
RUSSIA	Sakhalin Island	(Sakhalin Energy) Gazprom, Shell, Mitsui, Mitsubishi	2009	2	9.6	2	200,000
TRINIDAD & TOBAGO	Point Fortin Train 1	BP, Shell, Suez, NGC	1999	1	3.0	2	204,000
	Train 2	BP, Shell	2002	1	3.3	1	160,000
	Train 3	BP, Shell	2003	1	3.3	1	160,000
	Train 4	BP, Shell, NGC	2005	1	5.2	1	160,000
USA	Cheniere Sabine Pass	Cheniere Energy	2016	1	4.5	5	800,000
	Kenai - Alaska	ConocoPhillips, Marathon Oil	1969	2	1.3	3	108,000
YEMEN	Bal-Haf	Yemen LNG, Total, Yemen Gas, Hunt Oil, SK Group, Hyundai	2009	2	6.7	2	320,000

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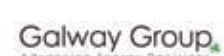


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