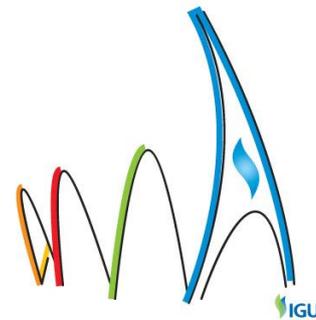




**WGCPARIS2015**  
WORLD GAS CONFERENCE  
*"GROWING TOGETHER TOWARDS A FRIENDLY PLANET"*



**26th World Gas Conference | 1-5 June 2015 | Paris, France**

# MARKET DRIVERS AND FLOATING LNG REGAS PROJECTS

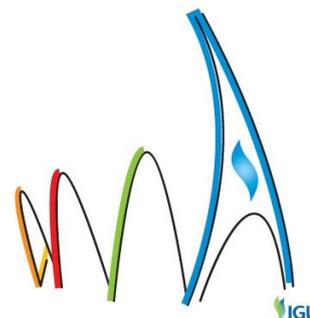
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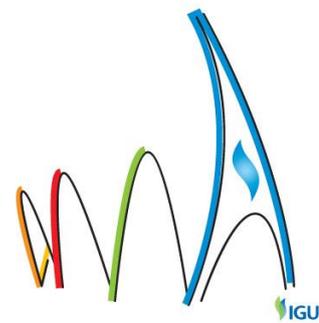
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### Background

The significant growth in the number of floating regasification (FLNG) projects should be viewed in the context of the relative supply and demand for energy, and the relative cost and efficiency of developing primary or alternative energy supplies. The forces driving the development of any particular FLNG project may be many and varied, including such factors as security of supply to securing sufficient supply to meet demand. In this context, the liquidity and development of the global LNG market will be an important factor when considering the development of a FLNG project.

### Aim

To review the impact of market forces on FLNG projects, both positive and negative, and to consider the challenges and legal risks involved in developing a FLNG project. The paper will consider the reasons for the growth in, and challenges facing, FLNG projects. Risks to the development of a FLNG project, and appropriate mitigants, will also be considered.

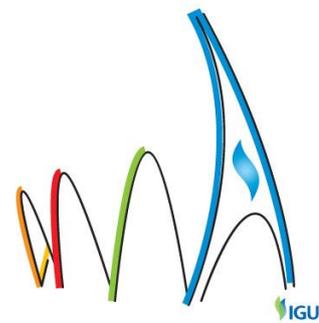
### Methodology and Results

#### Factors Relevant to the Growth of FLNG - LNG Supply and Demand

The significant growth in global LNG demand from 1970 to date has been remarkable, with a near doubling of LNG demand every 15 years, to approximately 240 million tonnes delivered in 2014. Notwithstanding the meagre growth in delivered volumes from 2012 to 2014, an increase of just over 1 million tonnes per annum (mtpa), the period from 1970 to now could be considered an historical growth period for the LNG industry.

Further perspective on the increasing demand for gas is provided by the U.S. Energy Information Administration, which predicts that gas will become the second most important source of energy by 2035, representing a growth of 50% from 2000 levels, accounting for 25% of world energy consumption. Some industry players consider that gas will overtake oil as the dominant fuel within OECD countries by 2030, reaching a share of 31% of primary energy by 2035. Other analysts predict that China and the other non-OECD countries will account for nearly 50% of LNG demand by 2035, and that China alone will import 100 mtpa of LNG by 2020. Countering such view, there have been recent relative declines in LNG demand in China and South Korea, and some analysts consider this recent downward demand trend may also manifest in Japan - depending on the extent of a return to nuclear power in that country. While most industry observers continue to expect robust long-term growth, especially in the emerging markets, short-term demand is less clear.

A significant driver for the increase in worldwide gas demand has been relative cost - specifically, the cost of gas measured against the cost of potential alternative fuels, such as



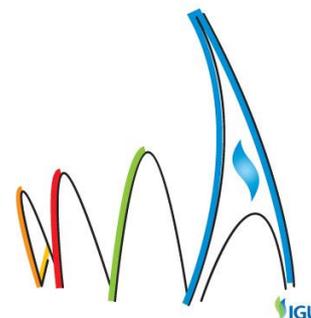
oil, piped gas (when considering LNG), hydro, wind or nuclear. This economic analysis will be made in each country or market based on all the relevant factors, such as demand and supply levels, LNG price, the cost and availability of alternative fuel sources at any particular point in time. However, government policies relating to energy security, the energy mix and the environment, together with such other factors as severe adverse weather and natural disaster, can also be relevant factors.

New technology and innovation are making gas more accessible and cost effective, which is securing demand, as scale and pricing factors move to support substitution of gas for alternative fuels. Examples of this include the monetising of significant reserves of otherwise commercially inaccessible gas resources in the U.S. by means of fracking and advanced seismic drilling techniques. This has resulted in a potential waive of relatively cheap LNG into the market compared to market pricing over the last 7 years.

Complicating this economic analysis however, is that the LNG market is currently experiencing significant deviations from past trends. For example, in the Asian markets, delivered LNG prices in the first quarter of this year have tumbled to US\$7- US\$8 per million British thermal units (mmbtu), down from over US\$20 per mmbtu at the beginning of 2014. This is considered to be a response to several factors, such as the significant oil price decline and the oil-linked LNG pricing in Asian markets, additional LNG supplies coming on-line from Australia and Papua New Guinea, a relative slump in Chinese economic growth and mild Asian weather. LNG pricing in the European market has increased in relative terms, with the UK's National Balancing Point benchmark trading at a small premium to Asian prices in early 2015.

On the supply side of the global LNG market, the question as to whether or not LNG liquefaction capacity will keep pace with LNG demand is under continual review, and noting the recent changes in the LNG markets, could prove difficult to predict in the short to medium term. LNG supply shortfall or overhang, and the scale of changes in the LNG market are fundamental drivers of today's market. In relation to liquefaction, as noted above, there has been a significant increase in the quantity of LNG available in the market, as new LNG liquefaction projects come on line in Qatar, Australia, West Africa and potential new projects in Russia, East Africa, Asia, the U.S. and Canada - and this is currently having an impact on the global supply market. Current industry predictions are that an extra 122 mtpa of LNG supply will become available by 2020. The impact of this additional capacity may already be priced into LNG buy/sell negotiations, however, its full impact will likely only become known as and when it comes on line.

Another development in the Asian market is the potential creation of a joint venture by certain of the market's major players - potentially creating the world's single largest buyer of



LNG. If completed, the resultant joint venture entity could potentially alter the demand dynamics for the world's largest LNG consuming country.

### FLNG Growth and the Contributing Factors

The number and speed at which FLNG projects have been implemented since the first system became operational in 2005 is impressive. As of April 2015, 20 FLNG or equivalent projects have been implemented, including projects subsequently decommissioned, suspended or replaced. These are identified in Figure 1, below - references to a "FSRU" are to a LNG floating storage and regasification unit.

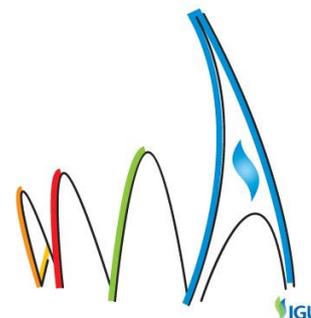
**Figure 1: FLNG Projects Implemented**

Date	Country	Project Details	Operator
2005	USA	Gulf Gateway, TX, Submerged Turret Loading (STL) buoy - decommissioned in 2012	Excelerate
2007	UK	Teesside GasPort, dockside	Excelerate
2008	USA	Northeast Gateway DWP, MA, dual STL buoy	Excelerate
2008	Argentina	Bahia Blanca GasPort, dockside	Excelerate
2009	Brazil	<i>Golar Spirit*</i> , Pecem, over jetty	Golar
2009	Brazil	<i>Golar Winter*</i> , Guanabara Bay, over jetty	Golar
2009	Kuwait	Mina Al-Ahmadi, GasPort, dockside	Excelerate
2010	USA	Neptune DWP, MA, dual STL buoy - operations suspended for 5 years in 2013 (originally <i>Neptune</i> and <i>Cape Ann</i> )	Höegh/GdFS
2010	UAE	<i>Golar Freeze*</i> , Dubai FSRU, moored/side-by-side	Golar
2011	Argentina	GNL Escobar GasPort, dockside	Excelerate
2012	Indonesia	Nusantara Regas FSRU*, West Java, moored/side-by-side	Golar
2013	China	<i>Cape Ann</i> , Tianjin FSRU, moored/side-by-side	Höegh/GdFS - subcharter
2013	Israel	Hadera Gateway, STL buoy	Excelerate
2013	Italy	OLT Toscana, <i>Golar Frost*</i> , moored/side-by-side	Golar
2014	Brazil	Bay of All Saints, Bahia, 2014 - <i>Golar Winter</i> (further modified and relocated from	Golar

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Date	Country	Project Details	Operator
		Guanabara Bay), dockside	
2014	Kuwait	Mina Al-Ahmadi, <i>Golar Igloo</i> , dockside	Golar
2014	Brazil	<i>Excelerate Experience</i> , Guanabara Bay (173,400 cubic meters LNG storage, regas capacity of 800 mmscf/d )	Excelerate
2014	Lithuania	<i>Independence</i> , Klaipeda, Lithuania (170,132 cubic meters LNG storage, regas capacity of 384 mmscf/d)	Höegh
2014	Indonesia	<i>PGN FSRU Lampung</i> , Lampung Province, Sumatra, Indonesia (170,132 cubic meters LNG storage, regas capacity of 360 mmscf/d)	Höegh
2014	Pakistan	<i>Exquisite</i> , Port Qasim (173,400 cubic meters LNG storage, regas capacity of 690 mmscf/d)	Excelerate

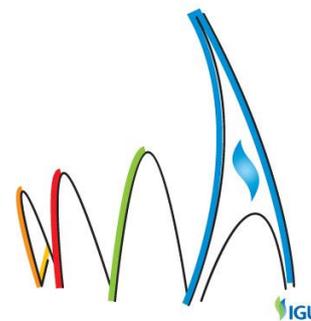
\* denotes LNG conventional vessel converted for LNG regasification  
 "mmscf/d" means millions of cubic feet per day.

In addition, there are many FLNG projects being considered or in various stages of development around the world, including in the following countries, Bangladesh, Bahrain, Benin, Colombia, Dominican Republic, Egypt, Ghana, India, Indonesia, Italy, Jamaica, Lebanon, Lithuania, Malaysia, Malta, Philippines, Puerto Rico, South Africa, Sri Lanka, Uruguay and Vietnam.

The scale of growth in FLNG projects is evident in International Gas Union research that concludes that there was approximately 44.3 mtpa of floating LNG regasification capacity in 2013 (an increase of 34% from 2012), with another 20 mtpa of capacity under construction and a further 100 mtpa of capacity authorised or proposed. Considering that the first FSRU (or equivalent) was implemented in 2005 (see Figure 1), it is clear that floating LNG regasification is one of the leading innovations of the last decade, with significant future growth potential.

Factors contributing to this growth and relative popularity include the following:

**Cost:** low comparative cost to equivalent land based regasification facilities. Whilst it is difficult to provide accurate capex numbers in isolation of all relevant project information, it would not be unreasonable to estimate capex for a typical FLNG project (including vessel and land-side infrastructure) to be in the region of US\$400 million, and the capex for a typical land-based regasification project to be in excess of US\$1 billion. In addition, it is important to note that the FSRU owner and not the charterer bears the FSRU capex cost -



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with the charterer paying a day rate more akin to an opex charge, which is itself a significant potential advantage to the charterer.

Relatively Fast Start-Up: (i) conversion of a conventional LNG vessel to a FSRU can be completed within approximately 6 months (assuming vessel and shipyard slot availability, and that equipment and parts are secured), excluding the development of shore-side infrastructure, such as gas pipelines, etc., and (ii) a newbuild FSRU can be delivered within approximately 33 months from contract signing, depending on market conditions. Whereas, the time required to obtain all necessary approvals and to construct a typical land based regasification project would not be less than 36 months, and could be significantly longer, depending on local laws and regulations.

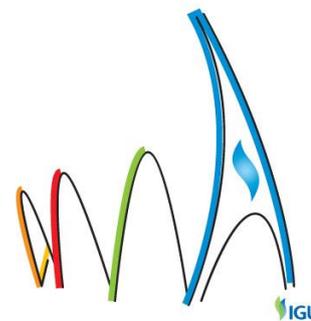
Game Changing Status: a FLNG project can potentially provide rapid access to LNG and gas markets in circumstances where gas would not otherwise be available or economically viable due, for example, to the lack of connecting gas pipelines and related infrastructure. An example of this is where regasified LNG replaces oil for power generation. However, the ability to secure long term LNG supply will be critical to the economic viability of a FLNG project - with the issues being availability and pricing of LNG supply.

Flexibility: a FSRU can be an interim or long term solution - for example, providing a short to mid-term term solution while longer term plans are implemented (like the construction of a gas pipeline or grid).

Capacity and Efficiency: the current generation of FSRUs provide more LNG storage, greater regasification capacity and efficiency than first generation vessels, thereby narrowing the gap between land and floating regasification capabilities. For example, the largest FSRU in operation to date has 173,400 cubic meters of LNG storage and send-out capacity of 800 million cubic feet (20 million cubic meters) of gas per day. In comparison, one currently planned FLNG project will have LNG storage capacity of 263,000 cubic meters. In addition, certain FLNG projects have implemented or have considered utilising an additional floating LNG storage unit (FSU) with the FSRU - providing additional LNG storage capacity, potentially as large again as the FSRU. This flexibility provides significant opportunity for optimisation in the development and operation of a FSRU project.

Fuel Costs: modern tri-fuel vessels provide additional efficiency and cost savings compared to traditional steam turbine engines. Fuel cost savings for the tri-fuel vessels have been estimated to be as much as US\$30,000 per day (with LNG at US\$13 per mmbtu).

Proven Technology: the technology involved is well tested and trusted. In addition, the LNG industry to date has an excellent safety record. Each assisting to increase certainty of completion and to keep operating costs low.



### Challenges to FLNG Projects

Whilst the number and potential growth of FLNG projects has been impressive, it must be acknowledged that this relative popularity is based on specific needs and/or circumstances and that, as a result, the FSRU option will not necessarily be preferred in all circumstances.

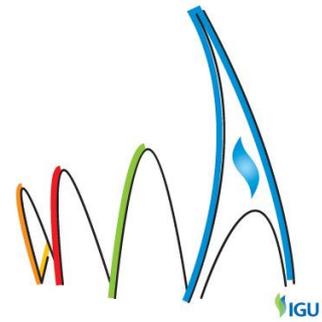
Such factors as the following may be relevant in tipping the scale against selection of a FSRU:

Alternative Energy Source: the existence of abundant and/or cheaper alternative energy. As can be seen from Figure 1, the U.S. floating regasification projects have been decommissioned, suspended or are currently inactive. The reason for this being the sea-change brought about by the "shale gale", with potentially availability of over 100 years' of Henry Hub priced gas. This took the industry by surprise and completely changed the U.S. LNG import/export equation, with many FLNG projects cancelled or shelved, and with up to 22 LNG liquefaction export projects now proposed. This is just one example of how unexpected market shifts can disrupt planned or existing projects - in this case, FLNG projects. Future significant swings in gas supply and demand, and factors affecting supply and demand, will continue to be relevant to evolution and development of FLNG projects.

Competing Energy (cost): where regasified LNG is providing a supply source to meet rapidly growing energy demand or is replacing a trapped fuel source (e.g., oil), then a FSRU could be essential, or at least a cheaper alternative (in terms of pre-2014 oil and LNG prices). However, where regasified LNG is competing against potentially cheaper fuels such as domestic or imported (pipeline) gas, domestic or imported coal, oil, hydro or biofuels, it will not necessarily be the most economical or preferred solution. This analysis is further complicated by the recent significant oil price decline - thereby potentially forestalling the economic gains of a switch to FLNG in markets where the delta between oil and LNG prices has decreased. The volatility of price changes in alternative fuels is another factor - unless long term expectations on pricing prevail over the effects of short term price swings.

Short Term vs. Long Term: a FSRU can provide critical support to local energy supply during the short, medium or long term. However, the desirability of a FLNG project may also change across these relative time periods. Whilst a FSRU may be critical to local needs in the short or medium term, a more viable long term solution may be available. For example, the construction of a national gas grid or (at least) gas pipelines connecting gas supply to demand could make cheaper domestic (or imported) gas available.

LNG Trading Options: historically, the LNG market has developed on the basis of long term LNG supply contracts, with predominantly fixed terms that provided limited flexibility for diversification of supply and demand. While the development of new LNG liquefaction facilities will remain dependent on securing favourable long term LNG supply contracts,



some LNG purchasers have aggregated numerous LNG supply contracts and now market “branded” LNG on more flexible terms. This is possible due to their ability to manage supply and demand across a portfolio of assets. Because of the numerous changes to the LNG supply and consumption markets, today’s global LNG market has evolved in many respects from the purely long term model. One such development is the widespread use of LNG master sale agreements (“spot” contracts) for short, and even some medium term, LNG sales.

Availability of LNG: as in any market, a FLNG project will need to compete for LNG supply with other buyers. While the availability of LNG spot contracts potentially increases flexibility, this comes at a price, as the buyer will continually be competing with the highest bidder in the market. This could potentially jeopardise LNG supply at prices necessary to ensure the long term viability of a FLNG project.

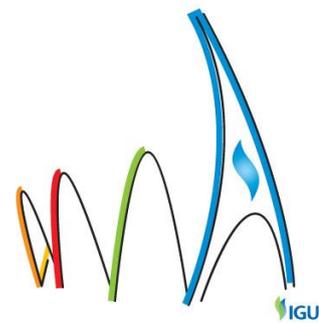
Credit Support: by its very “game-changing” nature, FLNG projects are likely to be attractive to developing states, regions or utilities who may not have sufficient credit, or the means of obtaining sufficient credit support, to secure LNG purchase agreements or financing. This may present a significant obstacle to the implementation of such a FLNG project, or significantly add to the cost and complexity thereof.

Government Policy: energy security policies may work to promote a FLNG project where there is over dependence on another fuel source in any country’s energy mix. This will vary from country to country, depending on each country’s relative fuel sources and uses. On the other hand, where a country has an abundant supply of competing energy, it may be in that country’s interests to promote and use that domestic energy as a purely political or local economic matter (perhaps even where there was an unfavourable price differential in doing so). In addition, a government may also simply prefer a land-based project instead of a FSRU for any number of political or economic factors, potentially including at least a preference for fixed assets permanently located on its territory.

#### **FLNG Risks and Mitigation Strategies**

In developing a FLNG project, careful attention must be paid to the allocation and mitigation of project risk. Many technical, operational and legal challenges need to be considered and, where applicable, addressed in order to ensure the success and long term viability of a FLNG project. In addition to coordinating all commercial and legal terms, applicable project contracts must align the interests of all stakeholders in a manner that encourages the due and proper performance of all contractual obligations. These challenges can include the following.

Environmental and regulatory approvals: Environmental and other regulatory approvals will likely be required in relation to the following: (i) construction and operation of piers; (ii)

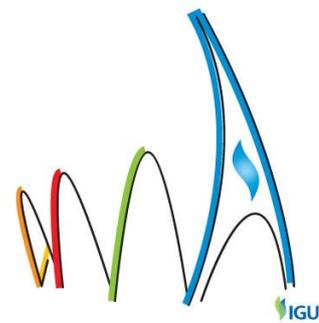


construction and operation of a sub-sea gas pipeline; (iii) operation of the FSRU while moored at the pier, for example, particularly in relation to SO<sub>x</sub> and NO<sub>x</sub> emissions and/or marine impact resulting from "open-loop" regas operations; and (iv) transportation and storage of the LNG/gas shore-side. Failure to address any one of these issues could result in project delay, cancellation and significant liability.

Technology and implementation issues: While LNG vessel and floating regasification technology is tried and tested, careful planning and implementation of the full technical package is essential in order to ensure compatibility and operational effectiveness. A critical factor in this regard is that the FSRU, vessel components (including turrets, buoys and regasification skids), LNG transfer arms, pier and shore-side infrastructure may be designed, constructed and implemented by different contractors under contracts with no or little overall responsibility for the outcome (sometimes called a "wrap") or alignment of commercial and legal provisions. The absence of appropriate responsibility and alignment across this suite of project contracts can result in significant problems for the project: for example, where completion of a critical component bottlenecks the whole project, technologies or equipment fail to interface as intended or where a breach (or potential breach) of the intellectual property rights of a third party result in delay and additional liability.

Coordinating regas vessel and shore-side infrastructure and operations: The FSRU and shore-side facilities must be operationally coordinated and integrated. In addition, the operating specifications of the FSRU will need to take into account the design and operational characteristics of the shore-side gas transmission system or dedicated facility (for example, a power station). This will require coordination at early stages of the project, when the FSRU building contract and downstream construction contracts are being negotiated.

FSRU construction risk: FSRU construction risk is the risk that the vessel will not be delivered on time, on budget, within specification and operating parameters. Any failure by the FSRU builder or owner in relation to the above could have severe financial legal implications for the owner (where the builder is at fault) or the charterer (where either the builder or owner is at fault). For example, apart from not earning revenue for producing and delivering natural gas, the charterer may be liable for its downstream gas delivery obligations. These risks, therefore, need to be eliminated or mitigated in other ways, so as to ensure (as far as possible) that the vessel will comply in all respects with the charterer's needs. This likelihood will be increased by the use of experienced and creditworthy contractors, proven technology and well drafted contracts. In the context of the latter, and in relation to the FSRU shipbuilding contract (SBC), this would include using a lump sum turnkey (LSTK) contract with a full "wrap" on the performance of the vessel (by the builder), backed by a refund guarantee provided by a suitable creditworthy entity. In addition, it will



be important to ensure close alignment between the SBC and FSRU time charter party (TCP) in relation to material terms.

FSRU Operating Risk: FSRU operating risk includes the risk that the FSRU does not perform as required, and that the operator fails to properly discharge its obligations under the TCP. Any failure in relation to the operation of the FSRU could have severe financial and legal consequences for the charterer. Operating risk is passed primarily to the "owner" (as operator of FSRU) under a typical TCP. Under this arrangement, the owner is responsible for the full operation of the vessel, and any failure in relation thereto should result in reasonable and proportionate adverse financial consequences to the owner. Including these provisions incentivises owner to ensure the vessel performs in all respects as it should. This model thereby helps aligns the interests of owner and charterer - as both will be better off if the FSRU performs as intended.

Shipbuilder's Direct Agreement: Without a direct contractual relationship between the charterer, owner and builder, the interests of the charterer may be exposed where a FSRU problem or delay occurs during the FSRU construction phase. In this case, and without such a direct contractual relationship, the charterer may have limited recourse against the owner, but otherwise may be left without a vessel, potentially exposing the charterer to significant downstream liabilities. Shipbuilder direct agreements are intended to mitigate such risks by granting to charterer certain rights and remedies against the builder and the vessel. For example, in the unlikely event that the owner fails to pay builder a due and payable milestone payment under the SBC, and after relevant notice and grace periods, the builder may have the right to sell the partially constructed FSRU to another entity.

### Summary / Conclusions

The significant growth in the number of FLNG projects around the world owes much to the continuing development of the LNG industry, in terms of technical evolution, growth in the supply of LNG and demand for natural gas. However, the selection of a FSRU over other alternatives is driven by a number of factors, such as government energy policy, the relative cost and efficiency of alternative energy supply and the ability to source LNG over the long term at prices that ensure project viability.