



AMERICAN UNIVERSITY OF BEIRUT

QATAR AND THE EVOLVING GLOBAL GAS MARKETS

by  
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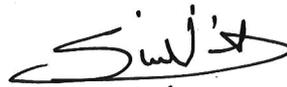
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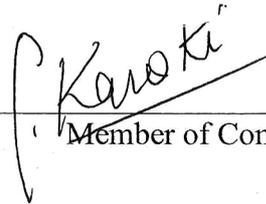
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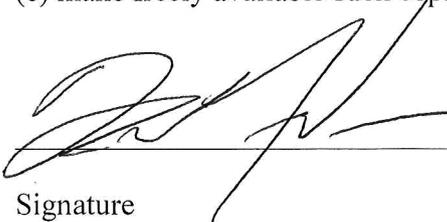
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# AN ABSTRACT OF THE THESIS OF

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Title: Qatar and the Evolving Global Gas Markets

The liquefied natural gas (LNG) market is currently dominated by Qatar. Between the two Qatari LNG producers, Qatargas and RasGas, the Gulf energy giant has a nominal export capacity of just over 77 million tons per year – representing about a third of the global LNG market in 2014. However, the structure of the LNG market is set to change dramatically in the coming years.

New sources of LNG supply and the uncertain trajectory of demand will put pressure on Qatar's position in key LNG markets. Most importantly, significant new LNG volumes will target Asia Pacific demand centers from Australia and North America, eroding Qatar's influence in Asia Pacific – home to the world's largest LNG markets.

The ongoing moratorium on new gas developments at Qatar's North Field – where reserves may top 900 trillion cubic feet – handicaps the country's efforts to respond to the changing LNG market. Qatar has no plans to expand LNG production capacity and would be unable to do so in the light of the ongoing North Field moratorium. In fact, by the end of 2015, Qatar may approach a gas production plateau – at least until it lifts the moratorium or finds success in its thus far disappointing drive to explore deep pre-Khuff formations for gas. The thesis also examines the other ways in which Qatar monetizes its gas output (condensate splitting and exports, natural gas liquids output, petrochemicals and gas-to-liquids) and the constraints facing those monetization options in the years ahead.

This thesis studies LNG market developments and their impact on Qatar. Because Qatar enjoys the lowest LNG production costs in the world today, it can sustain far lower sales prices than its competitors. Indeed, Qatari LNG will remain profitable in nearly any price scenario. However, Qatar must carefully monitor the market pressures discussed in this thesis: Doha has ambitious and expensive development plans in the works and must take into account the evolving LNG market in its forward planning. In the discussion section, this thesis studies ways in which Qatar can respond to market forces.

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# CHAPTER I

## INTRODUCTION



Fig. 1.1: Map of Qatar's Oil and Gas Assets and Infrastructure  
Source: Middle East Economic Survey

Qatar is the world's leading supplier of liquefied natural gas (LNG), controlling about a third of the global trade of the super-cooled gas in 2014. Since completing its final LNG liquefaction train in 2011, Qatar has boasted a world-leading export capacity of more than 77 million tons per year between the country's two LNG producers, Qatargas and RasGas – which are the world's first and second largest LNG producers, respectively. Qatargas is currently able to export some 42 million tons per year (mn t/y) while RasGas produces about

37mn t/y. Qatar's position in the market has afforded the country significant leverage over contract terms and the price paid for its LNG. It has long been able to secure 20- and 25-year Supply and Purchase Agreements (SPAs) with buyers using oil-linked pricing mechanisms. However, the global LNG market is undergoing a significant transformation – with the effects of new sources of supply and demand set to be felt throughout the industry starting in 2015 when significant new volumes of Australian LNG hit the international waters. By 2017, Australia will likely pass Qatar as the world's largest supplier of LNG, and Qatar's position will continue to erode over the coming decade as the United States emerges as a major exporter of LNG – enabled by a boom in shale gas production over the past five years. Importantly, Supply and Purchase Agreements signed in advance of construction of LNG export infrastructure in the United States have been based on US domestic gas prices – which will prove disruptive to Qatar's most important markets in Asia-Pacific over the coming several years.

Riding the wave of LNG export facilities that Qatargas and RasGas completed between 1996 and 2011, Qatar's economy expanded dramatically and the country developed into one of the wealthiest on a per capita basis. A lesser role in the LNG industry does not necessarily threaten the Gulf producer's economic strength: indeed, Qatari LNG will remain profitable for several reasons, not least of which is the fact that the cost of producing gas from the prolific North Field, from which nearly all Qatari gas is sourced, is said to be the lowest of any major gas development in the world.<sup>1</sup>

This thesis examines the ways in which the LNG industry is expected to evolve over the coming decade and studies the effect of the coming changes to the global LNG market on Qatar's position in an increasingly liquid market. It traces the history of Qatar's LNG

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<sup>1</sup> Ibrahim, I.; Harrigan, F. "Qatar's Economy: Past, Present and Future." QScience Connect. Qatar, 2012. Pg 7.  
[http://www.gsdp.gov.qa/portal/page/portal/gsdp\\_en/knowledge\\_center/Tab2/Qatar%20economy%20past%20present%20and%20future.pdf](http://www.gsdp.gov.qa/portal/page/portal/gsdp_en/knowledge_center/Tab2/Qatar%20economy%20past%20present%20and%20future.pdf)

industry and the relationships that Qatar built with its buyers in its early efforts to reach the world's most valuable LNG markets. It explores the role that international oil companies (IOCs) have played in getting Qatari gas to market. It also studies the constraints under which Qatar operates in the LNG market and the limitations it faces in expanding gas and LNG output in the context of an ongoing moratorium on new developments at the North Field. Absent a change in policy on the North Field or a major find in Qatar's drive to explore pre-Khuff deep gas, Qatar will hit peak gas output by the end of 2015. In this context, Qatar has little room to maneuver in response to the changing LNG market except to direct its capital towards opportunities in the international LNG industry.

## CHAPTER II

### LITERATURE REVIEW

The global liquefied natural gas (LNG) industry is undergoing a significant transformation that puts into jeopardy Qatar's kingmaker role. While Qatari LNG will remain profitable as new sources of supply and demand emerge around the world, it is important to understand the ways in which the changes will affect the country's chief source of revenue. Many researchers have studied the evolving LNG market and the growing role of gas as a globally traded commodity, though few have examined the effect of these changes on Qatar and its position in the LNG market. Perhaps this is due to the fact that Qatar has dominated the global LNG trade for more than a decade. Indeed, since Qatar supplies about a third of the world's LNG and its LNG sales have propelled the country to lead the world in GDP per capita, observers are mostly unconcerned with the effect of new market pressures on Qatar's position in the industry. However, a forthcoming report from the Oxford Institute for Energy Studies, entitled "The US Shale Gas Revolution and its Impact on Qatar's Position in Gas Markets" will address a similar topic.

Vivoda (2014) suggested that LNG import diversification is gradually rising in Asia, the principal market in the global LNG trade and Qatar's targeted market – where it is able to fetch the highest price for its LNG exports. Asian LNG buyers, he said, hope to mitigate risk through diversification of their import portfolio. He employed a Herfindahl-Hirschman index (HHI) of market concentration in his study and discovered that China, in particular, has aggressively diversified its LNG purchases since launching imports in 2006, though its HHI rose in recent years as the proportion of total LNG imports sourced from Qatar continues to rise. Interestingly, more mature LNG markets – such as Japan and South Korea, which

represent Qatar's two largest markets – have also gradually diversified their LNG portfolios, thereby lowering their HHI. Vivoda (2014) suggested that LNG importers avoid overreliance on a single source of LNG: “For mature importers, such as Japan and South Korea, that have a well diversified LNG import portfolio, a way forward is to at the very least maintain the levels of diversification they have achieved over the past decade. In order to do so, they should avoid becoming overly reliant on any one single supplier (e.g. Qatar), and increase (Japan) or maintain high levels of non-regional imports (South Korea) from as many countries as possible, again avoiding Qatar as much as possible.”<sup>2</sup> Studies regularly single out overreliance on Qatari LNG as a sign of an LNG importer's exposure to market risk. For example, in their study of Turkey's LNG supply security strategy, Biresselioglu, et al. (2012), wrote that dependence on imports from Algeria, Qatar and Nigeria results in a threat to Turkey's energy security in terms of source and supply diversity.<sup>3</sup>

As LNG importers develop more diversified sources of LNG supply, new sources of supply are developing with Australia and the United States in the lead. According to Medlock, et al. (2014), much of the recent literature on US LNG exports “suggests that the largest impacts of US LNG exports may not be in the US; rather they may occur in Asia which is expected to be the destination for new LNG exports from North America. Indeed, the US LNG export contracts already signed are primarily committed to Asia.”<sup>4</sup> Meanwhile, Rogers (2012) noted that since the bulk of LNG exports are sent to Asian markets, the “Asian markets are assumed to take whatever LNG they require to meet their demand.” The

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<sup>2</sup> Vivoda, V. “LNG Import Diversification in Asia.” *Energy Strategy Reviews* 2 (2014). Pg 295. Retrieved from ScienceDirect 8 November 2014.

<sup>3</sup> Biresselioglu, M.; Demir, M.; Kandemir, C. “Modeling Turkey's Future LNG Supply Security Strategy.” *Energy Policy* 46 (2012) 144-152. Retrieved from ScienceDirect 8 November 2014. Retrieved from ScienceDirect on 7 November 2014.

<sup>4</sup> Medlock, K.; Jaffe, A.; O'Sullivan, M. “The Global Gas Market, LNG Exports and the Shifting Geopolitical Presence.” *Energy Strategy Reviews* (2014) Article in Press. 1-12. Retrieved from ScienceDirect on 7 November 2014.

remainder is available to other markets.<sup>5</sup> US LNG exports, according to Moryadee, et al. (2014), will displace “a significant market share of other suppliers.” Qatar can expect to see its market share in Japan and South Korea fall by 20-30%.<sup>6</sup>

The issue of how LNG will be priced in the years ahead is important to buyers and sellers of LNG and will affect Qatar’s future Sales and Purchase Agreements. Gradual convergence of gas prices across global markets is at least in part the result of diminished influence on the part of suppliers like Qatar in the global LNG market. Ritz (2014) said that “regional price differentials arise because of LNG exporters’ market power.”<sup>7</sup> Supplier influence will erode due to the above factors and the differential between prices across regions will grow less significant. Jensen (2014) wrote that the spread between US Henry Hub gas prices and Japanese LNG prices based on Japan Customs-cleared Crude (JCC) prices is unrealistically large for the time being but that a spread between the two will persist over the long-term. He suggested that an equilibrium price in international gas markets might be one based on Henry Hub prices that allow for gas-on-gas competition to spread across global markets: “In such a theoretical system, the European gas value might be based on US prices plus the cost of transport from the US Gulf coast to Europe. Then those prices might be netted back to Qatar where they would in turn establish Asian ‘equilibrium’ prices.”<sup>8</sup> Indeed, Medlock (2014) said that Henry Hub prices will rise to some extent once US LNG exports

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<sup>5</sup> Rogers, H. “The Impact of a Globalising Market on Future European Gas Supply and Pricing: the Importance of Asian Demand and North American Supply.” The Oxford Institute for Energy Studies, January 2012. Pg 11. [http://www.oxfordenergy.org/wpcms/wp-content/uploads/2012/01/NG\\_59.pdf](http://www.oxfordenergy.org/wpcms/wp-content/uploads/2012/01/NG_59.pdf).

<sup>6</sup> Moryadee, S.; Gabriel, S.; Avetisyan, H. “Investigating the Potential Effects of U.S. LNG exports on Global Natural Gas Markets.” *Energy Strategy Reviews* 2 (2014) Pg 286. Retrieved from ScienceDirect on 7 November 2014.

<sup>7</sup> Ritz, R. “Price Discrimination and Limits to Arbitrage: An Analysis of Global LNG Markets.” *Energy Economics* 45 (2014). Pg 325. Retrieved from ScienceDirect on 7 November 2014.

<sup>8</sup> Jensen, J. “OPED – US Shale Gas: A New Option for Japanese LNG Supply.” *Middle East Economic Survey*. 7 February 2014. Volume 57, Issue 06. Accessed 8 November 2014. <http://archives.mees.com/issues/1516/articles/51111>

commence while Asian LNG prices will inevitably fall: “Price rises in the domestic market and falls in the foreign market.” However, absent policy decisions that affect pricing dynamics, “equilibrium will be reached in which price in the two markets differs only by the cost associated with trade...”<sup>9</sup> But Medlock (2014) also noted that the developments in North American LNG are not the only factors that will impact LNG prices internationally, listing several other possibilities: “(i) the relative long-run elasticity of domestic and foreign supply, (ii) the relative long-run elasticity of domestic and foreign demand, (iii) the role of short-term capacity constraints as they will be impacted by the introduction of trade, and (iv) the cost of developing and utilizing export capacity.”<sup>10</sup> Asian LNG prices will weaken and several factors (in addition to the introduction of new pricing mechanisms from North American LNG exports), including shale gas developments in China and Australia, new piped gas supplies to China, and an eventual nuclear restart in Japan, will support “deepening and increased liquidity” in the LNG market.<sup>11</sup>

The growth of short-term and spot LNG markets in Asia and the possibility of an LNG trading hub are other features of the changing landscape in the global LNG market that affect Qatargas and RasGas forward planning. Hartley (2013) said that because LNG markets are growing increasingly liquid – a phenomenon expected to grow in scale over the next decade – spot price variability is on the decline. This will “reduce the superiority of long-term contracts relative to short-term and spot trading.”<sup>12</sup> Vivoda (2014) noted that buyers are increasingly coordinating to reduce prices in Asia with efforts underway to establish a trading

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<sup>9</sup> Medlock, K. “Natural Gas Price in Asia: What to Expect and What it Means.” James A. Baker III Institute for Public Policy, Rice University. 2014. Pg. 9 <http://bakerinstitute.org/media/files/Research/3d101582/CES-pub-NaturalGasPriceAsia-021814.pdf>

<sup>10</sup> Ibid, Pg. 8.

<sup>11</sup> Ibid, Pg. 16.

<sup>12</sup> Hartley, P. “The Future of Long-Term LNG Contracts.” James A. Baker III Institute for Public Policy, Rice University. 2013. Pg 40. <http://bakerinstitute.org/research/future-long-term-lng-contracts/>

hub in Singapore.<sup>13</sup> Talus (2014) is skeptical of the ability for Asian buyers to force this kind of change, however: “While contractual schemes can quite easily be modified if the parties agree, the Asia-Pacific markets have features that cannot easily be changed. Long distances, differing regulatory regimes, different national gas markets and approaches to energy as a strategic commodity, among other things, restrict efforts to create larger scale short-term spot-markets.”<sup>14</sup>

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<sup>13</sup> Vivoda, V. “Natural Gas in Asia: Trade, Markets and Regional Institutions.” *Energy Policy* 74 (2014) Pg 85. Retrieved from ScienceDirect on 7 November 2014.

<sup>14</sup> Talus, K. “United States Natural Gas Markets, Contracts and Risks: What Lessons for the European Union and Asia-Pacific Natural Gas Markets?” *Energy Policy* 74 (2014) pg. 34. Retrieved from ScienceDirect on 10 November 2014.

## CHAPTER III

### WORLDWIDE LNG MARKET DEVELOPMENTS AND THEIR IMPACT ON QATAR

#### A. Supply & Demand Side Changes

Figures vary to some extent, but Groupe International des Importateurs de Gaz Naturel Liquéfié (GIIGNL - 2014) reports that Qatar supplied the liquefied natural gas (LNG) market with 78.02 million tons in 2013 – close to one million tons higher than the country’s nominal capacity – which represented nearly a third of the global LNG trade of 236.9mn tons in 2013.<sup>15</sup> Despite its position as the leading supplier of LNG over the past several years, Qatar is monitoring several developments on both the supply and demand sides of the global LNG industry. First, supply of LNG is set to increase dramatically through 2020 and beyond. The LNG market has been tight for several years and will remain that way until 2015, after which point a number of liquefaction projects will be brought online. Market tightness has persisted for several years: first, no substantial new liquefaction plants came online between 2011 and 2013, though the first of the coming wave of plants were completed in 2014. Second, LNG demand has been strong in this period, driven by strong demand in Asia Pacific – where a number of key economies are growing increasingly reliant on gas and LNG in their respective energy mixes. As figure 3.1 demonstrates, Asia is the largest LNG market and demand is growing in large energy consumers, such as Japan and China.

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<sup>15</sup> “The LNG Industry in 2013.” Groupe International des Importateurs de Gaz Naturel Liquéfié. Neully-sur-Seine, France. 2014. Accessed 1 November 2014. [http://www.giignl.org/sites/default/files/PUBLIC\\_AREA/Publications/giignl\\_the\\_lng\\_industry\\_fv.pdf](http://www.giignl.org/sites/default/files/PUBLIC_AREA/Publications/giignl_the_lng_industry_fv.pdf)

<b>Global LNG Trade By Consuming Nation 2009-2013 (mn cubic meters)</b>						<b>% of Total,</b>
<b>Consumer</b>	<b>2009</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>2013</b>
Argentina	773	1788	3860	4500	6250	2.0%
Belgium	6557	6033	4242	5246	5655	1.8%
Brazil	-	2642	940	3562	5360	1.7%
Canada	-	2111	3351	1714	949	0.3%
Chile	-	3021	3677	3871	3769	1.2%
China	7634	11495	16586	18610	24680	7.7%
Taipei	11589	14526	15986	15177	15272	4.8%
Dominican Republic	511	795	881	1113	1113	0.3%
France	10827	13304	12678	11068	7800	2.4%
Greece	825	1142	1195	1312	614	0.2%
India	11962	12852	18024	17523	16682	5.2%
Italy	2890	8943	8901	7269	5680	1.8%
Japan	92896	98787	116455	121611	122823	38.5%
Korea	33719	43815	46729	47789	53158	16.6%
Kuwait	-	2780	3460	2650	2184	0.7%
Mexico	3630	5241	4063	5206	6320	2.0%
Netherlands	-	-	-	1014	994	0.3%
Poland	-	-	3	5	7	0.0%
Portugal	2686	2834	2868	2220	1747	0.5%
Spain	27229	27822	23595	21141	15452	4.8%
Thailand	-	-	-	1360	1850	0.6%
Turkey	6171	8175	1600	7864	6082	1.9%
United Arab Emirates	-	-	1925	1350	1530	0.5%
United Kingdom	10053	18579	24830	13418	9278	2.9%
United States	12797	12205	9881	4946	2742	0.9%
Other	3597	928	6474	799	1311	0.4%
<b>Total</b>	<b>246346</b>	<b>299818</b>	<b>332204</b>	<b>322338</b>	<b>319302</b>	

Source: IEA Natural Gas Information 2014

Fig. 3.1: Global LNG Trade by Consuming Nation 2009 – 2013 (million cubic meters)

Japanese LNG demand grew substantially following the Fukushima-Daiichi nuclear disaster in March 2011. In February 2011, the month prior to the earthquake and resultant tsunami that severely damaged Tokyo Electric Power Company’s nuclear plant on the northeastern coast of Japan, nuclear power provided 31.2% of the country’s electricity supply. The TEPCO plant was brought fully offline by the end of the year, and – as Japan

decided to launch a study of its nuclear power industry – Japan’s entire nuclear fleet of 54 reactors, with a total capacity of 48,960 MW, was shut down by May 2012.<sup>16</sup>

Japan was already the world’s largest LNG importer before the nuclear disaster, importing 69.2mn tons in 2010. Hayashi and Hughes (2013) note that Japan’s LNG imports increased by nearly 18% March 2012, rising to about 81.8mn tons on an annualized basis. To meet additional demand, Japan exercised the “Upward Quantity Tolerance option (an option right to increase the import volume between 5% and 10% based on the long-term contracts between electricity suppliers and LNG exporters) and procurement on the spot market.”<sup>17</sup> Japan’s increased demand for LNG coincided with Qatar’s expansion of LNG production capacity to its maximum level of just over 77mn t/y in 2011. Qatar also saw some 20mn t/y freed up for alternate markets around this time, as the shale gas “revolution” in the United States gradually curtailed and, eventually, eliminated US LNG imports (see figure 3.1). As a result of these factors, Qatar was well positioned to take advantage of explosive demand growth in Japan – indeed, Qatari LNG exports to Japan soared in the aftermath of the Fukushima-Daiichi disaster (see figure 3.2).

Looking ahead, though, there are several unanswered questions regarding the trajectory of Japanese LNG demand. If Japan were to restart the majority of its nuclear power fleet, LNG demand would surely contract. But it remains unclear how many of its nuclear plants will come back online. Japan’s Nuclear Regulation Authority accepts applications for safety reviews of nuclear power plants. If the plants pass the review and receive public approval at the local government level, individual nuclear plants can restart operations. The International Energy Agency (IEA) suggests that the nuclear restart will have only a limited impact on LNG imports over the medium term, since it will first displace costlier oil-fired

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<sup>16</sup> Hayashi, M.; Hughes, L. “The Fukushima Nuclear Accident and its Effect on Global Energy Security,” *Energy Policy*, Volume 59, August 2013, Pages 102-3, <http://www.sciencedirect.com/science/article/pii/S0301421512010282>

<sup>17</sup> *Ibid*, Pg 103.

electricity generation. Coal-fired power generation is also expected to increase, regardless of the nuclear restart, due to the comparatively lower cost of coal versus LNG and the fact that a number of coal-fired plants have recently started production with more planned. The IEA (2014) notes, however, “the future LNG demand in Japan highly depends on the pace of the restarting of nuclear power plants, and this is almost impossible to predict with certainty.”<sup>18</sup> Meanwhile, the International Gas Union (IGU – 2014) says: “The lack of clarity in Japanese power sector policy continues to provide significant uncertainty in the global LNG market. Although the current administration has a pro-nuclear stance, local governments must also grant approval and in some areas opposition remains strong.”<sup>19</sup>

South Korea is the world’s second largest LNG consumer, but its LNG demand typically swings alongside disruptions to the country’s nuclear power capacity. For example, the IEA (2014) says that Korean LNG demand rose by 12% in 2013 compared with 2012 volumes “due to the closure of several nuclear power plants during 2013.” The plants were taken offline after it was discovered that four nuclear reactors had falsified safety documentation; the scandal also led to delays in construction of new nuclear power plants. “[In 2013] Korea faced a drop in nuclear generation while demand increased slightly... In that context, both coal and gas-fired plants contributed additional power supplies, but gas took the lion’s share.”<sup>20</sup> Because the future of Korean nuclear power remains uncertain, it is unclear how LNG demand will develop in the years ahead, an important market factor for Qatar’s forward planning. Qatar is Korea’s largest supplier of LNG, and its 2013 deliveries represented about 17% of total Qatari exports. Additionally, while Korean firms have long-

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<sup>18</sup> “2014 Medium Term Gas Market Report: Market Analysis and Forecasts to 2019.” International Energy Agency. Paris, June 2014. Pg 26.

<sup>19</sup> “World LNG Report – 2014 Edition.” International Gas Union. Fornebu, Norway. pg 49. Accessed 1 November 2014. [http://www.igu.org/sites/default/files/node-page-field\\_file/IGU%20-%20World%20LNG%20Report%20-%202014%20Edition.pdf](http://www.igu.org/sites/default/files/node-page-field_file/IGU%20-%20World%20LNG%20Report%20-%202014%20Edition.pdf)

<sup>20</sup> “2014 Medium Term Gas Market Report: Market Analysis and Forecasts to 2019.” International Energy Agency. Paris, June 2014. Pg 23.

term supply agreements for Qatari gas, the IEA says that approximately 28% of Korean LNG imports come from the spot market – leading the country to pay a comparatively high average price for its LNG.<sup>21</sup>

Chinese LNG demand, meanwhile, is also growing steadily as overall Chinese energy demand increases in tandem with economic growth. Indeed, China is the world’s fastest-growing market for gas, according to the IEA’s 2014 Medium Term Gas Market Report, and it will “become the second-largest net importing region of natural gas behind Europe as soon as 2016.”<sup>22</sup> Though a number of economic forecasts predict slightly less robust economic growth in China over the medium-term, the IEA says that “a stronger priority to environmental issues will result in a higher use of gas in the transport, power, and industry sectors, therefore compensating almost entirely for the GDP effect.”<sup>23</sup> Unlike Japan, China is a gas producer and is able to partially supply its market with domestic gas production; however, it relies heavily on growing levels of imports via LNG and pipeline.

China launched LNG imports in 2006 and regasified less than a million tons at its Guangdong Dapeng import terminal that year. By 2013, however, imports had risen to 18mn tons, moving China into third place in Asia’s LNG market behind Japan and South Korea.<sup>24</sup> Through 2020, LNG imports are set to expand in China, though potential shale gas development may offset some demand in the years ahead. China has the world’s largest technically recoverable shale gas resources, but a 2014 study by the World Resources Institute estimates that due to water stress, China will encounter difficulties in exploiting these resources. According to the report, over 60% of China’s shale resources “are in areas of

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<sup>21</sup> Ibid, Pg 198-199.

<sup>22</sup> Ibid, Pg 178.

<sup>23</sup> Ibid, Pg 33.

<sup>24</sup> Fesharaki, Fereidun. “China’s LNG Import Potential: A Realistic Assessment.” Facts Global Energy (FGE). Chairman’s Corner. August 2014, Issue 64. Page 1.

high to extremely high baseline water stress or arid conditions.”<sup>25</sup> Nevertheless, China is expected to ramp up domestic gas production over the coming five years after growing into the world’s sixth largest gas producer in 2013. The IEA notes that tariff reforms introduced in 2013 – set to take full effect by 2015 when residential gas prices are revised upwards – will help Chinese gas producers exploit unconventional resources such as shale gas and coalbed methane (price reform will also support higher levels of LNG imports; previously, LNG importers operated at a loss due to the relatively high price paid for LNG on the international market versus the price paid by Chinese consumers).<sup>26</sup>

China’s LNG demand might take a major hit by the mid-2020s when the “Power of Siberia” gas pipeline ramps up to full output. In 2014, Russia’s Gazprom and Chinese authorities finalized a \$400bn, 30-year deal to build a 4000km pipeline connecting Russian gas production to the Chinese market. Initial gas deliveries of just under 500mn cfd (equivalent to about 3.7mn t/y LNG) will commence, in theory, in 2019; the pipeline will ramp up to full output of close to 3.7bn cfd (approximately 28mn t/y LNG equivalent) by the mid-2020s. However, in the era of oil and gas megaproject cost- and schedule- overruns, the likelihood of delay is high, pushing back the point at which Russian gas displaces any LNG import volumes. According to an Ernst and Young study (2014), 68% of oil and gas mega projects in Asia face cost overruns and 80% of oil and gas megaprojects face schedule delays in the same region.<sup>27</sup>

In all likelihood, Chinese LNG demand will continue to expand and will represent a major opportunity for existing and future LNG suppliers. According to the IGU (2014),

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<sup>25</sup> Reig, Paul; Luo, Tianyi; Proctor, Jonathan. “Global Shale Gas Development: Water Availability and Business Risks.” World Resources Institute. Washington, 2014. Pg 54. Accessed 1 November 2014. [http://www.wri.org/sites/default/files/wri14\\_report\\_shalegas.pdf](http://www.wri.org/sites/default/files/wri14_report_shalegas.pdf)

<sup>26</sup> “2014 Medium Term Gas Market Report: Market Analysis and Forecasts to 2019.” International Energy Agency. Paris, June 2014. Pg 111.

<sup>27</sup> “Spotlight on Oil and Gas Megaprojects.” EYGM Limited, 2014. Accessed 1 November 2014. [http://www.ey.com/Publication/vwLUAssets/EY-spotlight-on-oil-and-gas-megaprojects/\\$FILE/EY-spotlight-on-oil-and-gas-megaprojects.pdf](http://www.ey.com/Publication/vwLUAssets/EY-spotlight-on-oil-and-gas-megaprojects/$FILE/EY-spotlight-on-oil-and-gas-megaprojects.pdf)

China has only the sixth largest fleet of regasification facilities but is the third largest LNG importer, and 20% of regasification capacity currently under construction worldwide is located in China. Chinese utilization rates at its regasification facilities hit 94% in 2013.<sup>28</sup>

As figure 3.1 demonstrates, the number of LNG importers is growing steadily. New demand centers are emerging in Asia and the Middle East, as well, and the number of LNG importers is set to expand in the years ahead. In 2013, Israel, Singapore and Malaysia all completed their first LNG regasification facilities while China, India, Italy, Brazil and Japan also completed additional regasification facilities in 2013 and early 2014. Floating storage and regasification units (FSRUs) are growing in importance to potential LNG buyers who want cheaper, more flexible options than the traditional onshore receiving and regasification facilities. Jordan is installing an FSRU near ‘Aqaba on the Red Sea capable of regasifying about 4.5mn t/y of LNG.<sup>29</sup> Bahrain is also exploring options and will likely hire an FSRU to help the kingdom meet growing gas demand.<sup>30</sup>

At the end of 2013, global regasification capacity reached 688mn t/y, some 44mn t/y higher than 2012 levels. Gas demand is seasonal in many markets, resulting in utilization rates (excluding United States regasification capacity) of around 46%. The United States has the world’s second largest amount of regasification capacity, according to the International Gas Union (2014); however, because the shale gas revolution has displaced LNG imports, the

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<sup>28</sup> “World LNG Report – 2014 Edition.” International Gas Union. Fornebu, Norway. pg 34. Accessed 1 November 2014. [http://www.igu.org/sites/default/files/node-page-field\\_file/IGU%20-%20World%20LNG%20Report%20-%202014%20Edition.pdf](http://www.igu.org/sites/default/files/node-page-field_file/IGU%20-%20World%20LNG%20Report%20-%202014%20Edition.pdf)

<sup>29</sup> “Jordan Advances Gas Strategy With Shell LNG Supply Deal.” Middle East Economic Survey. 7 March 2014. Volume 57, Issue 10. Accessed 1 November 2014. <http://archives.mees.com/issues/1520/articles/51213>

<sup>30</sup> “Bahrain Oil and Gas Sector Steady in 2013, but Challenges Ahead.” Middle East Economic Survey. 23 May 2014. Volume 57, Issue 21. Accessed 1 November 2014. <http://archives.mees.com/issues/1531/articles/51507>

United States used just 1% of its regasification capacity in 2013.<sup>31</sup> While not necessarily a close indicator of demand growth, 26 new regasification facilities were under construction by mid-2014 – set to add 73.7mn t/y of capacity by 2016.

**Regasification Terminals Under Construction (April 2014)**

Country	Name	Capacity (mn t/y)	Start Year
Spain	El Musel	1.7	N/A
Spain	Bilbao	3	2014
India	Dahej LNG	2.5	2014
Chile	Quintero LNG	1	2014
Chile	Mejillones LNG	1.5	2014
Brazil	Guanabara LNG	6	2014
Singapore	Jurong Island LNG	2.5	2014
Indonesia	Arun LNG	3	2014
Japan	Hibiki LNG	3.5	2014
Indonesia	Lampung LNG	2	2014
Japan	Naoetsu	1.5	2014
China	Hainan LNG	2	2014
Lithuania	Klaipeda LNG	2.2	2014
China	Qingdao	3	2014
India	Kochi LNG	2.5	2015
France	Dunkirk LNG	10	2015
Japan	Hachinohe LNG	1.5	2015
Jordan	Jordan LNG	4	2015
Japan	Kushiro LNG	0.5	2015
Colombia	Pacific Rubiales LNG	N/A	2015
Korea	Samcheok	6.8	2015
Poland	Swinoujscie	4	2015
China	Beihai, Guangxi LNG	3	2015
China	Shenzhen	4	2015
Japan	Hitachi	N/A	2016
Korea	Boryeong	2	2016

Total Under Construction: 73.7mn t/y  
Source: IGU World LNG Report - 2014 Edition

Fig. 3.2: Regasification Terminals Under Construction (April 2014)

As gas grows in importance as a source of energy, energy import dependent countries – particularly those demand centers too far from gas sources for piped gas to be considered economical – are increasingly turning to LNG to meet gas demand. As a result, a large

<sup>31</sup> “World LNG Report – 2014 Edition.” International Gas Union. Fornebu, Norway. pg 34. Accessed 1 November 2014. [http://www.igu.org/sites/default/files/node-page-field\\_file/IGU%20-%20World%20LNG%20Report%20-%202014%20Edition.pdf](http://www.igu.org/sites/default/files/node-page-field_file/IGU%20-%20World%20LNG%20Report%20-%202014%20Edition.pdf)

number of liquefaction plants are under construction or planned. In its medium-term forecast for global LNG demand, the IEA (2014) says that the global LNG trade will grow by almost 130bn cubic meters by 2019 to reach 450bn cubic meters. Indeed, the LNG trade will grow twice as fast as piped gas in the period. By 2019, LNG will make up some 62% of the total international gas trade and will meet 11% of total global gas demand (most gas is consumed in close proximity to where it is produced).<sup>32</sup>

Qatar has controlled approximately one-third of the LNG market since it completed its expansion to more than 77mn t/y of liquefaction capacity in 2011 (see chapter four and figure 3.3). It enjoys significant influence in the market as a provider of both fixed, long-term LNG supplies and flexible and spot LNG cargoes (also see chapter four). However, a new supply threat to Qatar's dominance is emerging: Qatar's market share will begin to erode in 2015 and, by 2017, Australia will overtake Qatar as the world's leading supplier of LNG. In addition to Australian volumes, new LNG sources will emerge in the years ahead from North America, Russia and, eventually, East Africa. As of mid-2014, 117mn t/y of liquefaction capacity was under construction (see figure 3.5).

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<sup>32</sup> "2014 Medium Term Gas Market Report: Market Analysis and Forecasts to 2019." International Energy Agency. Paris, June 2014. Pg 143-145.

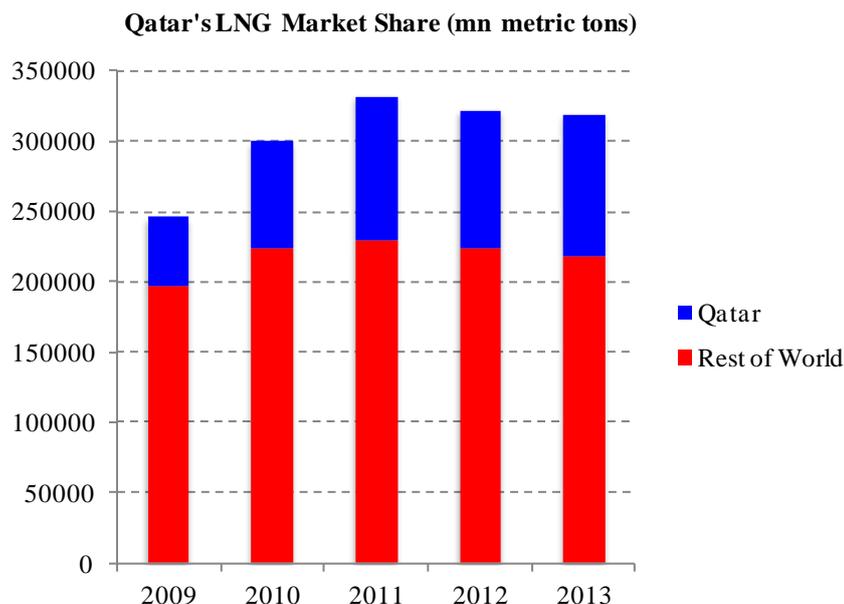


Fig. 3.3: Qatar's LNG Market Share (million metric tons)  
Source: GIIGNL 2014.

**Global LNG Trade By Origin 2009-2013 (mn cubic meters)**

	2009	2010	2011	2012	2013
Australia	25709	24888	25464	30174	31353
Belgium	78	162	334	836	515
France	-	-	-	89	180
Italy	8	-	37	-	-
Norway	3011	4374	4325	4471	3724
Spain	-	-	-	266	504
United States	860	1245	1504	365	-
Algeria	20975	18861	16150	15148	15258
Brunei	9076	9343	9548	9371	8319
Egypt	12821	9808	8610	5910	3173
Equatorial Guinea	4792	4252	6014	5142	3715
Indonesia	26406	31448	27246	23784	22864
Libya	758	579	86	-	-
Malaysia	30179	32551	33936	31217	33703
Nigeria	13679	24198	26590	27063	22252
Oman	11933	11541	11827	10745	11933
Peru		1129	3633	4041	4757
Qatar	49069	75255	102269	98079	101066
Russia	7802	13510	15261	14475	14681
Trinidad & Tobago	19396	19015	18144	18995	16888
UAE	7364	8148	8317	7761	7395
Yemen	334	5241	8489	6184	9153
Non-Specified	2096	4270	4420	8222	7869
<b>Total</b>	<b>246346</b>	<b>299818</b>	<b>332204</b>	<b>322338</b>	<b>319302</b>

\*Figures include re-exports

Left data in original units because IEA does not list average calorific value

Source: IEA Natural Gas Information 2014

Fig. 3.4: Global LNG Trade by Origin, 2009 – 2013 (million cubic meters)

<b>Liquefaction Plants Under Construction</b>		<b>Capacity</b>		
<b>Country</b>	<b>Project Name</b>	<b>(mn t/y)</b>	<b>Company (-ies)</b>	<b>Start Year</b>
Algeria	Arzew - GL3Z (Gassi	4.7	Sonatrach	2014
Papua New Guinea	PNG LNG Trains 1 & 2	7	ExxonMobil, Oil Search, Others	2014
Australia	Queensland Curtis LNG - Train 1	4.3	BG, CNOOC	2014
Australia	Queensland Curtis LNG - Train 2	4.3	BG, Tokyo Gas	2015
Colombia	Pacific Rubiales	0.5	Exmar	2015
Indonesia	Donggi-Senoro LNG	2	Mitsubishi, Pertamina, Others	2015
Malaysia	Petronas LNG 9	3.6	Petronas	2015
Australia	Australia Pacific LNG Trains 1 & 2	9	ConocoPhillips, Origin Energy, Sinopec	2015
Australia	Gladstone LNG Train 1	3.9	Santos, Petronas, Total, KOGAS	2015
Malaysia	Petronas FLNG	1.2	Petronas	2015
US	Sabine Pass Train 1	4.5	Cheniere	2015
Australia	Gorgon LNG Trains 1 & 2	10.4	Chevron, ExxonMobil, Shell, Others	2015
Australia	Gorgon LNG Train 3	5.2	Chevron, ExxonMobil, Shell, Others	2016
Australia	Gladstone LNG Train 2	3.9	Santos, Petronas, Total, KOGAS	2016
Australia	Wheatstone LNG Train 1	4.5	Chevron, Kufpec, others	2016
US	Sabine Pass Trains 2	9	Cheniere Shell, INPEX,	2016
Australia	Prelude LNG (Floating)	3.6	KOGAX INPEX, Total,	2016
Australia	Ichthys LNG Train 1	4.2	Others	2016
US	Sabine Pass Train 4	4.5	Cheniere	2017
Australia	Wheatstone LNG Train 2	4.5	Chevron, Kufpec, others	2017
Australia	Ichthys LNG Train 2	4.2	INPEX, Total, Others	2017
Russia	Yamal LNG Train 1	5.5	Novatek, Total, CNPC	2017
Russia	Yamal LNG Train 2	5.5	Novatek, Total, CNPC	2018
Malaysia	Rotan FLNG	1.5	Petronas, MISC, Murphy	2018
Russia	Yamal LNG Train 3	5.5	Novatek, Total, CNPC	2019

Total Under Construction: 117mn t/y

Source: IGU World LNG Report - 2014 Edition

Fig. 3.5: Liquefaction Plants Under Construction

## B. Australia

Australia produced about 22.4mn tons of LNG in 2013 – making it the third largest LNG exporter that year, behind Qatar and Malaysia. However, Australia poses the most immediate supply threat to Qatar. Not only will Australia surpass Qatar’s liquefaction capacity by 2017, its volumes will almost exclusively target Qatar’s preferred markets in Asia. In 2013, for example, more than 99% of Australian LNG exports were sold in East Asian markets (see figure 3.6) and Australia was Japan’s largest supplier of LNG. While Qatar supplied 16.41mn tons to Japan in 2013, 18.16mn tons of Australian LNG reached the Japanese market.

**Figure 3.6**

**Australia's LNG Exports by Destination - 2013**

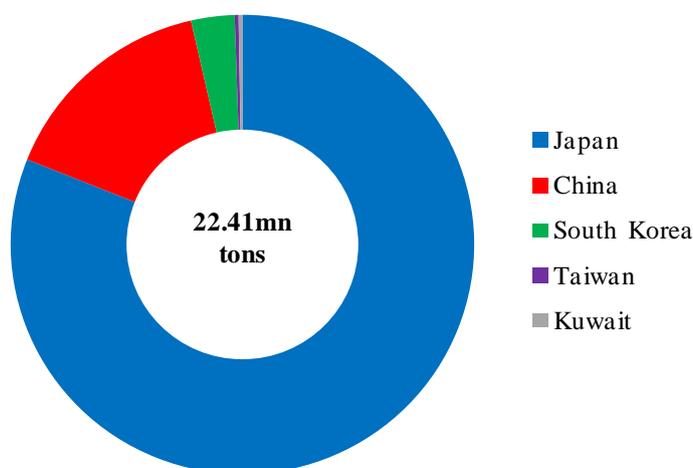


Fig. 3.6: Australia’s LNG Exports by Destination – 2013  
*Source: GIIGNL (2014)*

Given the pipeline for liquefaction projects, Australia will have an LNG export capacity of 86mn t/y by 2018; however, plans to expand capacity to as much as 150mn t/y in the 2020s will be constrained by a number of factors. According to Ledesma, et al. (2014), “the well-documented cost overruns and delays in many of the current developments,

combines with an increasing domestic lobby focused on rising gas prices and environmental issues, have coincided with growing indications of increased international competition in the global LNG market.”<sup>33</sup> This raises questions about the viability of plans to expand liquefaction capacity beyond what is already under construction. However, Ledesma, et al. (2014), note that more than 60% of the 78mn t/y of LNG export capacity under consideration comes from brownfield expansion of existing projects and projects under construction. Because brownfield expansions of LNG liquefaction trains cost “about 60-70% of equivalent greenfield projects...this means that brownfield expansions, even in a high cost environment such as Australia, can be very competitive in the global gas market compared with other new LNG supply sources.”<sup>34</sup>

Projects currently under construction were underpinned by long-term, oil-linked sales and purchase agreements with mostly Asian buyers. These contracts were concluded before project developers and LNG buyers understood the implications of potential future United States LNG exports with pricing mechanism based on US Henry Hub prices. Even though contracts are already locked in at oil-linked prices, there are significant risks for high-cost Australian LNG over the medium term, particularly if Henry Hub prices remain so far below other regional markets: “Most of the newer contracts include some form of price review, to ensure that neither the buyer nor seller are stuck in a long-term contract that is out of the market...”<sup>35</sup> Ledesma, et al. (2014), point out that new projects “will have to adapt to a lower price environment and will need to be competitive with US LNG exports, based on the

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<sup>33</sup> Ledesma, D.; Henderson, J.; Palmer, N. “The Future of Australian LNG Exports: Will Domestic Challenges Limit the Development of Future LNG Export Capacity?” The Oxford Institute for Energy Studies, September 2014. pg 2.

<http://www.oxfordenergy.org/wpcms/wp-content/uploads/2014/09/NG-90.pdf>

<sup>34</sup> Ibid, Pg 58.

<sup>35</sup> Ledesma, D.; Henderson, J.; Palmer, N. “The Future of Australian LNG Exports: Will Domestic Challenges Limit the Development of Future LNG Export Capacity?” The Oxford Institute for Energy Studies, September 2014. Pg 60.

<http://www.oxfordenergy.org/wpcms/wp-content/uploads/2014/09/NG-90.pdf>

assumption of Henry Hub prices.”<sup>36</sup> In fact, Ledesma, et al. (2014), suggest that a BG contract signed in November 2013 with China’s CNOOC is “priced on a hybrid US Henry Hub/oil-related basis” and that some of the LNG BG sources for the sale comes from Australia’s Queensland Curtis LNG project.<sup>37</sup>

### C. The United States & Canada

The United States represents the single most significant threat to Qatari LNG because it has introduced a new, more competitive pricing mechanism to the international LNG trade that will likely erode the price Qatar is able to fetch across its market base, though the impact may be most significant in Asia – where Qatar sent about 71% of its LNG exports in 2013. The shale gas revolution has unlocked previously stranded gas reserves, even as conventional gas production gradually declines (see figure 3.7).

**US Gas Production 2007 - 2013 (bn cfd)**

	2007	2008	2009	2010	2011	2012	2013
Conventional	41.07	41.46	39.49	36.29	33.67	34.26	30.84
Associated	15.57	15.37	15.55	15.99	16.19	13.61	14.87
Shale Gas	5.45	7.86	10.84	15.94	23.29	28.86	32.59
Coalbed Wells	5.48	5.54	5.51	5.25	4.87	4.22	3.91
Total Production	67.57	70.24	71.39	73.47	78.02	80.94	82.21

Source: Energy Information Agency

Fig. 3.7: US Gas Production 2007 – 2013 (billion cubic feet per day)

The scale of future US LNG exports hinges on several factors: first, the continued success of the shale gas revolution in boosting overall gas output in the United States will affect the amount of gas available for export as LNG. According to the US Energy Information Administration (EIA - 2014), several other factors will affect the scale of future US LNG exports, “including the speed and extent to which natural gas competes with oil in

<sup>36</sup> Ibid

<sup>37</sup> Ibid

U.S. and international gas markets, and the pace of natural gas supply growth outside the United States.”<sup>38</sup> In the EIA’s 2014 reference case forecast, it expects US LNG exports to ramp up to 3.5 tcf (about 73.5mn t/y) by 2030. In its High Oil Price case – which envisions higher LNG demand and higher LNG prices than does the reference case – US LNG exports reach 6.7 tcf (about 140.7mn t/y) by 2028; meanwhile, in its Low Oil Price case, net exports reach just 0.8 tcf (about 16.8mn t/y) in 2018 and remain at that level through the projection period (2014-2040). The EIA (2014) also studies two other scenarios: in a High Oil and Gas Resource case, in which higher than anticipated production “puts downward pressure on U.S. natural gas prices,” LNG exports will reach 5.1 tcf (about 107.1mn t/y) after 2025. In a Low Oil and Gas Resource case in US gas prices are driven higher, LNG exports top out at 2.1 tcf (44.1mn t/y) in 2027.

As discussed in detail in Chapter 5, companies hoping to export LNG to countries with which the United States does not have a free trade agreement – such as the key LNG markets of Japan and China – must secure licensing from both the US Department of Energy and the Federal Energy Regulatory Commission (FERC). This is an expensive and time-consuming process completed by just a select few companies at the time of writing. Only one US LNG export facility is expected to be completed and begin LNG exports in the next three years: Cheniere Energy’s Sabine Pass terminal on the Gulf of Mexico in Texas. The first 4.5mn t/y train may be completed as early as 2015; trains 2 and 3 (each capable of liquefying 4.5mn t/y) will be completed in 2016 (see figure 3.5 above). Cheniere Energy will add the United States to the growing list of LNG exporters with its 13.5mn t/y of LNG liquefaction capacity currently under construction, and it plans to eventually build three additional trains – bringing total liquefaction capacity to 27mn t/y. Three other firms have overcome regulatory

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<sup>38</sup> “Annual Energy Outlook 2014 With Projections to 2040.” U.S. Energy Information Administration . Washington, April 2014. Pg. MT-24. Accessed 1 November 2014. [http://www.eia.gov/forecasts/aeo/pdf/0383\(2014\).pdf](http://www.eia.gov/forecasts/aeo/pdf/0383(2014).pdf)

hurdles. Two of the other approved projects are also located on the Gulf coast, while Dominion's Cove Point LNG 5.75mn t/y facility will be located on the Chesapeake Bay near the Atlantic coast in Maryland. Construction commenced at Cove Point LNG's site in October 2014.<sup>39</sup> Sempra Energy's planned Cameron LNG facility in Louisiana received approval to export 12mn t/y to countries with which the US does not have a free trade agreement; Freeport LNG in Texas, meanwhile, received approval to move forward with its plans to export some 13.2mn t/y.

US LNG exports will benefit from the expansion of the Panama Canal, which will be wide enough to allow all LNG carriers (with the exception of Qatar's Q-Max and Q-Flex carriers) to pass once it is completed in 2016. The expansion has faced delay, however, and was previously scheduled to be opened in 2015 – in time for Cheniere Energy's first LNG exports from the Texas Gulf coast. Cost overruns at the expansion project led to a shutdown of construction in early 2014. If the widened canal is not ready for LNG transit by the time Sabine Pass production comes online in 2015, ships will require an extra 10 days of travel to reach the same northeast Asian destinations, according to the IGU (2014).<sup>40</sup> Even taking into account transit fees, LNG carriers traversing the canal will save on costs: the round-trip cost of an LNG shipment traversing the widened Panama Canal from Sabine Pass to Fukuoka, Japan will amount to \$8mn – \$3.4mn less expensive than the traditional route.<sup>41</sup> Moryadee, et al. (2014), suggest that the expanded Panama Canal will allow US Gulf Coast LNG exports to reach East Asia at a delivered price of about \$9/mn BTU given a Henry Hub reference

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<sup>39</sup> "Construction Begins on Cove Point LNG Export Project." Oil & Gas Journal. 30 October 2014. Accessed 3 November 2014. <http://www.ogj.com/articles/2014/10/construction-begins-on-cove-point-lng-export-project.html>

<sup>40</sup> "World LNG Report – 2014 Edition." International Gas Union. Fornebu, Norway. pg 48v. Accessed 1 November 2014. [http://www.igu.org/sites/default/files/node-page-field\\_file/IGU%20-%20World%20LNG%20Report%20-%202014%20Edition.pdf](http://www.igu.org/sites/default/files/node-page-field_file/IGU%20-%20World%20LNG%20Report%20-%202014%20Edition.pdf)

<sup>41</sup> Arnsdorf, Isaac. "Panama Canal's LNG Surprise to Redefine Trade in Fuel: Freight." Bloomberg. 5 November 2013. Accessed 3 November 2014. <http://www.bloomberg.com/news/2013-11-05/panama-canal-s-lng-surprise-to-redefine-trade-in-fuel-freight.html>

price of \$3/mn BTU, liquefaction and storage cost of \$3/mn BTU and a shipping cost of between \$2.5-3/mn BTU.<sup>42</sup> This is a “very competitive price for the Asian buyers when compared to the spot price which oscillates between the \$15-17/[mn BTU] mark.”<sup>43</sup> Though the Panama Canal’s transit fee has yet to be finalized, it is expected to cost LNG exporters the equivalent of about \$0.30/mn BTU to transit the canal. If the finalized tariff is indeed in that range, Moryadee, et al. (2014), conclude that significant volumes of US LNG will be shipped to East Asia via the Panama Canal – which will result in lower LNG prices in key markets such as South Korea and Japan.

Another competitive advantage afforded US LNG exporters is that they are able to convert existing LNG import facilities to handle liquefaction and exports. Whereas other LNG export projects, such as those in Australia, are weighed down by high construction costs driven by rising steel prices, the cost of converting a existing import facilities is roughly half that of building a new export facility from scratch.<sup>44</sup>

Canada is also emerging as a supply challenge to the Qatar-dominated LNG market, where project developers have proposed some 120mn t/y of pre-Final Investment Decision LNG export capacity on the country’s Pacific coast. As in the United States, not all of the proposed projects will be built due to LNG market and regulatory constraints. Canadian LNG exports will lag behind US exports, according to the IGU (2014): “Developments in the US have also generated interest in Western Canada, though this area has seen less drilling thus far. Combined with the more nascent state of commercial and project structures, proposed plants in the region are on a longer timeframe.” If Canadian West Coast LNG export projects

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<sup>42</sup> Moryadee, S.; Gabriel, S.; Rehulka, F. “The Influence of the Panama Canal on Global Gas Trade.” *Journal of Natural Gas Science and Engineering* 20 (2014) pg 161-162.

<http://www.sciencedirect.com/science/article/pii/S1875510014001656>

<sup>43</sup> Ibid, Pg 162.

<sup>44</sup> Moryadee, S.; Gabriel, S.; Avetisyan, H. “Investigating the Potential Effects of U.S. LNG Exports on Global Natural Gas Markets.” *Energy Strategy Reviews* 2 (2014) pg 274.

<http://www.sciencedirect.com/science/article/pii/S2211467X13001028>

materialize, however, their relative proximity to East Asian LNG markets will, by default, pose a challenge to Qatari exports.

Additionally, Qatar's LNG competitors can take advantage of a favorable shipping environment: the IEA notes in the 2014 Medium Term Gas Market Report that because LNG shipping capacity increases at a rate faster than LNG production, charter rates are already falling even before new supplies are available. The IEA (2014) says that LNG shipping rates reached \$150,000 per day after the Fukushima-Daiichi nuclear disaster in Japan – which led to an immediate jump in Japanese LNG demand. By the time the IEA published its MTGMR in June 2014, the charter rate had fallen to some \$70,000 per day.<sup>45</sup> Because the lead-time for LNG infrastructure development is so long and the LNG tanker fleet will continue to grow to accommodate expected supply and demand changes, an LNG exporter in the United States, for example, can expect to benefit from relatively low charter rates in the years ahead.

#### **D. Henry Hub Pricing of LNG**

Like most liquefaction projects around the world, the development of US LNG export facilities has been underpinned by long-term Sales and Purchase Agreements (SPAs); however, the pricing mechanism employed in US-sourced LNG sales breaks with the traditional oil link. US natural gas prices, priced on the Henry Hub, serve as the basis for future LNG sales. The Henry Hub is the most important pricing point in the United States for natural gas futures and spot sales. Unlike oil, which is traded globally on a much larger scale than gas, the price of gas can differ dramatically at the regional level depending on local and regional supply and demand dynamics (though in many markets, including Asia, gas prices follow oil price dynamics rather than being directly tied to the supply and demand dynamics of gas itself). Henry Hub prices, for example, have disconnected from other regional gas

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<sup>45</sup> “2014 Medium Term Gas Market Report: Market Analysis and Forecasts to 2019.” International Energy Agency. Paris, June 2014. Pg 145.

prices over the past several years as the shale gas revolution led to a surge in US gas supplies (see figure 3.8). While the Henry Hub is a gas-on-gas pricing system, LNG prices in Japan and elsewhere in Asia are linked to oil prices, which accounts for the bulk of the large discrepancy between US gas prices and Japanese LNG prices.

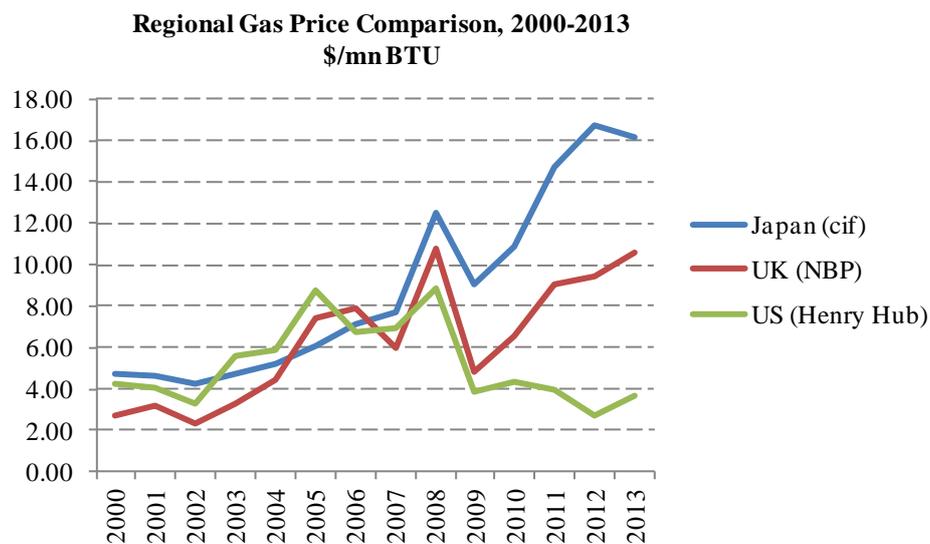


Fig. 3.8: Regional Gas Price Comparison, 2000 – 2013 (\$/mn BTU)<sup>46</sup>

<sup>46</sup> BP Statistical Review of World Energy, 2014.  
<http://www.bp.com/en/global/corporate/about-bp/energy-economics/statistical-review-of-world-energy.html>

**Japan LNG Import Prices - 2006-2013 (\$/mn BTU)**

Origin	2006	2007	2008	2009	2010	2011	2012	2013
Australia	6.50	6.96	11.69	8.98	11.82	15.00	16.03	15.09
Algeria	10.11	10.49	17.73	-	7.41	-	17.50	15.79
Brunei	5.90	6.38	13.16	10.47	12.21	15.49	17.84	15.79
Egypt	11.69	11.12	16.36	17.77	13.52	15.98	17.80	16.99
Indonesia	8.16	8.53	11.65	7.59	9.49	15.17	18.36	17.52
Malaysia	6.56	7.83	12.97	9.65	11.94	15.68	18.00	17.32
Nigeria	10.60	11.09	17.27	11.73	8.79	13.58	16.33	16.33
Oman	8.88	8.09	12.31	6.99	7.12	9.71	11.99	10.30
<i>Qatar</i>	<i>7.68</i>	<i>8.20</i>	<i>13.58</i>	<i>11.11</i>	<i>12.52</i>	<i>15.92</i>	<i>17.53</i>	<i>16.93</i>
Trinidad	11.50	10.83	16.40	10.14	10.12	10.49	12.88	16.05
UAE	6.81	7.21	11.48	9.08	11.71	13.78	17.53	17.05
<b>Japan Average (All Origins)</b>	<b>7.18</b>	<b>7.80</b>	<b>12.64</b>	<b>9.23</b>	<b>11.02</b>	<b>14.73</b>	<b>16.75</b>	<b>16.02</b>
<b>European Union Average LNG Price</b>	<b>6.47</b>	<b>6.45</b>	<b>9.18</b>	<b>6.24</b>	<b>6.85</b>	<b>9.45</b>	<b>10.26</b>	<b>10.60</b>
<b>South Korea Average LNG Price</b>	<b>9.22</b>	<b>10.08</b>	<b>14.15</b>	<b>10.50</b>	<b>10.17</b>	<b>12.67</b>	<b>14.77</b>	<b>14.98</b>

Source: IEA Natural Gas Information 2014

Fig. 3.9: Japan LNG Import Prices, 2006 – 2013 (\$/mn BTU)<sup>47</sup>

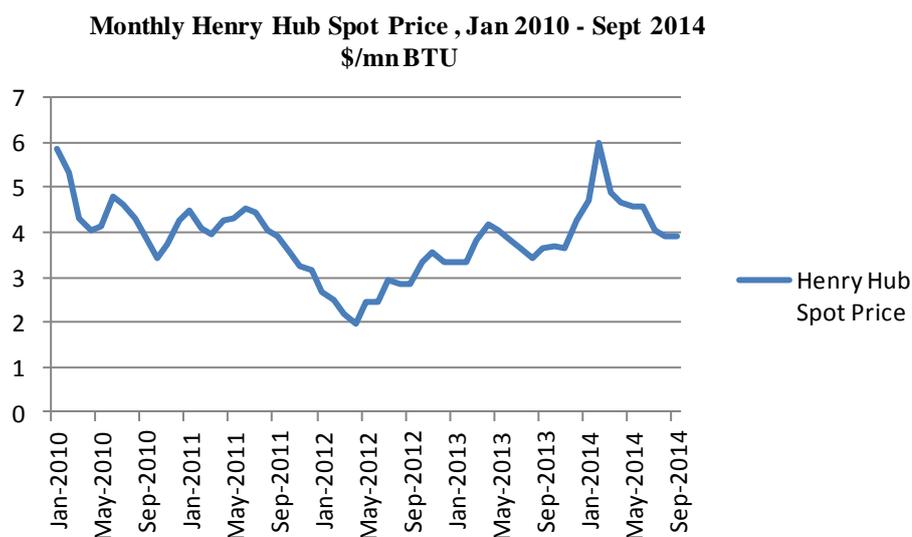


Fig. 3.10: Monthly Henry Hub Spot Price, January 2010 – September 2014 (\$/mn BTU)<sup>48</sup>

Since Henry Hub prices have mostly hovered between \$3-4/mn BTU since 2011 (see figure 3.10), a level significantly lower than the prices observed in key demand centers in Asia and Europe, a clear opportunity has emerged for LNG exports from the United States.

<sup>47</sup> “Natural Gas Information 2014.” International Energy Agency. Paris, France. 2014.

<sup>48</sup> Henry Hub Natural Gas Spot Price. U.S. Energy Information Administration . <http://www.eia.gov/dnav/ng/hist/rngwhhdm.htm>

According to Moryadee, et al. (2014), “the substantial price differences create arbitrage opportunities for natural gas exporters.”<sup>49</sup> LNG buyers, meanwhile, are eager to secure lower cost LNG and to diversify sources of supply, and Henry Hub-linked LNG satisfies both requirements.

The following is the pricing mechanism typical of the Henry Hub-linked LNG contract: Henry Hub x 115% + \$2.50-3/mn BTU (liquefaction cost) + ~\$3/mn BTU (shipping cost to Asia from the US Gulf coast). The IEA estimated in its 2014 Medium Term Gas Market Report that, based on Henry Hub prices at the time of publication (spot prices were then around \$4.5/mn BTU), US LNG could be delivered to Asia, profitably, at about \$11/mn BTU – far lower than the average prices paid in the region for LNG in 2014. The IEA (2014) describes the Henry Hub-link as the “only credible alternative to change the pricing indexation over the medium term.”<sup>50</sup>

## **E. Pricing Projections**

Though oil-linked LNG was competitive with Henry Hub prices as recently as 2010, the shale gas revolution has unlocked a long-term, game-changing supply source that will likely keep US gas prices at a comparatively low level for years to come. Henry Hub-linked LNG will have a significant impact on the global LNG trade and is expected to put downward pressure on prices in Asia. Global LNG prices are expected to gradually align more closely, though not fully converge, in the years ahead as LNG markets react to the changes discussed in this chapter.

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<sup>49</sup> Moryadee, S.; Gabriel, S.; Avetisyan, H. “Investigating the Potential Effects of U.S. LNG Exports on Global Natural Gas Markets.” *Energy Strategy Reviews* 2 (2014) pg 273.

<http://www.sciencedirect.com/science/article/pii/S2211467X13001028>

<sup>50</sup> “2014 Medium Term Gas Market Report: Market Analysis and Forecasts to 2019.” International Energy Agency. Paris, June 2014. Pg 200.

The World Bank (2014) is among the most bullish in forecasting a strong market effect on world gas prices:

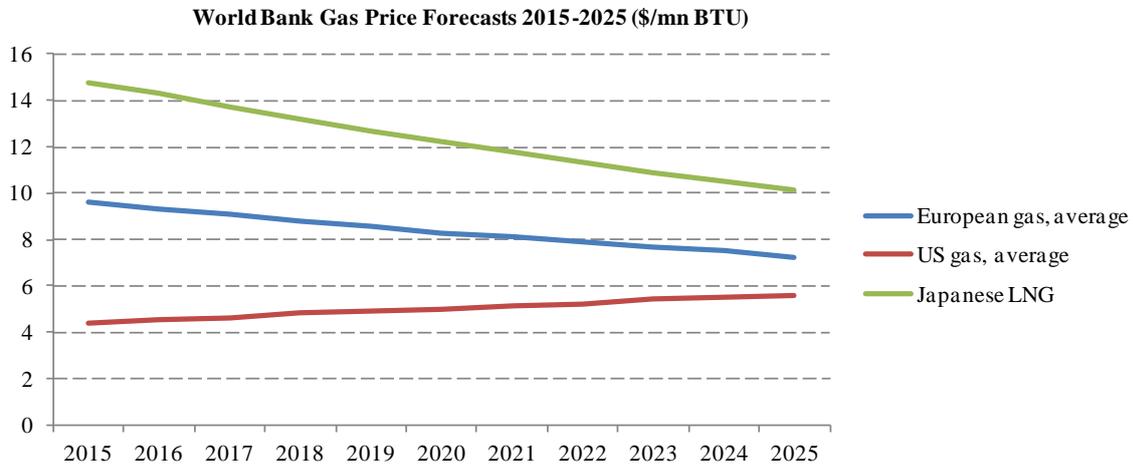
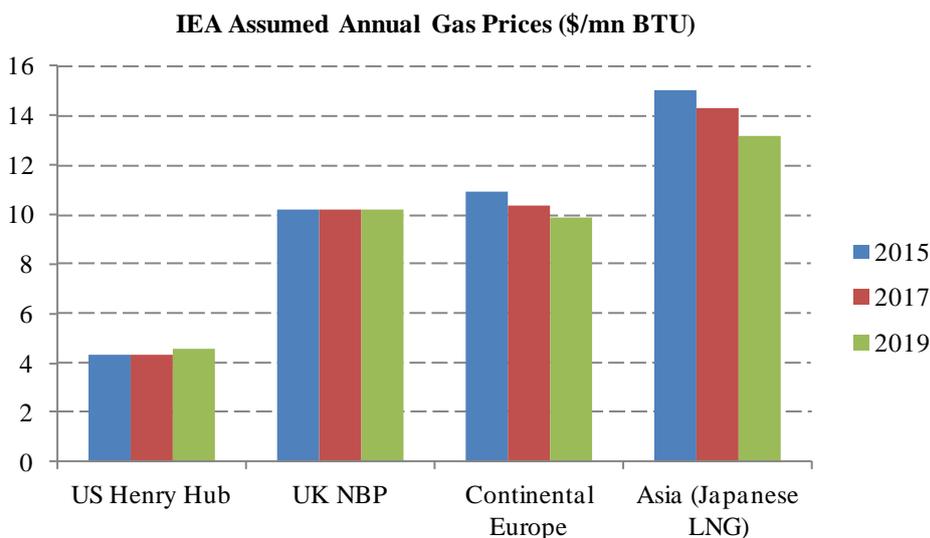


Fig. 3.11: World Bank Gas Price Forecasts, 2015 – 2025 (\$/mn BTU)<sup>51</sup>

While the IEA (2014) is more reserved in its forecast:



<sup>51</sup> “World Bank Commodities Price Forecast (Nominal US Dollars)” 16 October 2014. World Bank. Accessed 4 November 2014. [http://siteresources.worldbank.org/INTPROSPECTS/Resources/334934-1304428586133/Price\\_Forecast\\_20141016.pdf](http://siteresources.worldbank.org/INTPROSPECTS/Resources/334934-1304428586133/Price_Forecast_20141016.pdf)

Fig. 3.12: IEA Assumed Annual Gas Prices (\$/mn BTU) <sup>52</sup>

The United States Energy Information Administration (EIA - 2014) sees Henry Hub prices rising steadily by an average of approximately 3% per year through 2040:

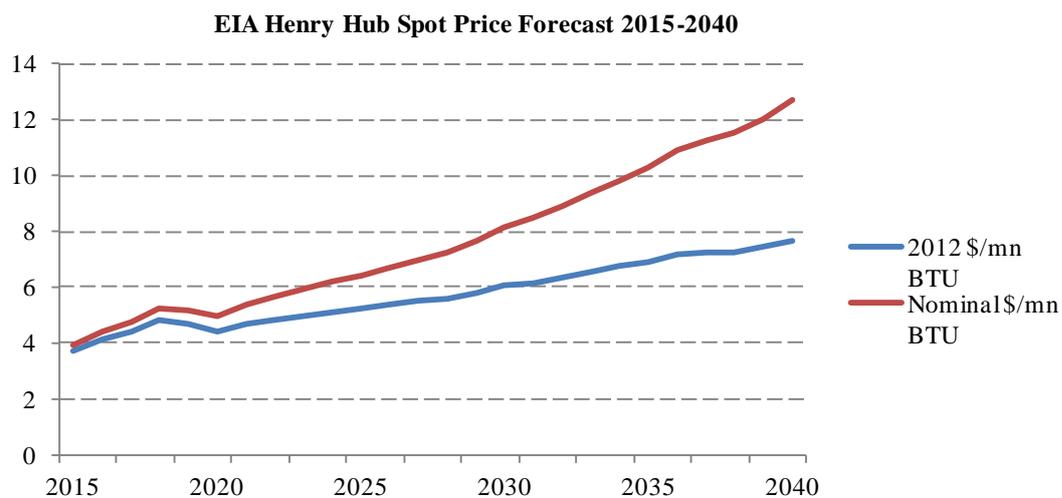


Fig. 3.13: EIA Henry Hub Spot Price Forecast 2015-2040<sup>53</sup>

## F. LNG Trading Hub?

As momentum grows in Asia behind the idea of launching an LNG trading hub, another disruptive force in the LNG market may yet emerge. Originally, Asian gas prices were oil-indexed because gas was seen as an alternative to oil in power generation – gas was therefore indexed to oil as it was seen as a competitor. However, as Kate, et al. (2013), note: “...natural gas also needs to be competitive with the end-user market. Oil is less and less the

<sup>52</sup> “2014 Medium Term Gas Market Report: Market Analysis and Forecasts to 2019.” International Energy Agency. Paris, June 2014. Pg 33.

<sup>53</sup> “Annual Energy Outlook 2014 With Projections to 2040.” U.S. Energy Information Administration . Washington, April 2014. Accessed 1 November 2014. [http://www.eia.gov/forecasts/aeo/pdf/0383\(2014\).pdf](http://www.eia.gov/forecasts/aeo/pdf/0383(2014).pdf)

primary competitor to natural gas in the Asia-Pacific region.”<sup>54</sup> In September 2014, Japan’s first over-the-counter (OTC) LNG exchange, Japan OTC Exchange (JOE), began operations in the hopes of gradually de-linking LNG prices from Japan Customs-cleared Crude (JCC) prices. JOE, which is owned by the Tokyo Commodity Exchange (TOCOM) and a subsidiary of Singapore’s Gingga Petroleum, handles non-deliverable forward trading of LNG. The exchange is relatively small scale, implemented in the run-up to deregulation of retail electricity in 2016; however, TOCOM plans an additional phase involving LNG futures trading.<sup>55</sup> JOE and the TOCOM’s planned futures trading will put downward pressure on prices, according to Kate, et al. (2013): “A wholesale LNG price reflecting supply/demand in a market the size of Japan’s would have considerable impact on natural gas pricing in the region.”<sup>56</sup>

Singapore is thought to be the most likely candidate, however, to launch a successful Asian LNG trading hub. Unlike its competitors for the role, Singapore meets a number of requirements for the role as Kate, et al. (2013), delineate: it has deregulated wholesale prices, a hands-off government approach, separation of transport and commercial activity, sufficient network capacity, a relatively competitive number of market participants and involvement of financial institutions.<sup>57</sup> Also, because Singapore is already a major oil-trading hub, its government has experience in managing commodities trading.<sup>58</sup> The LNG trading arm of Singapore’s Temasek bought a stake in an upstream gas and LNG project in Tanzania, which

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<sup>54</sup> Kate, W.; Varró, L.; Corbeau, A. “Developing a Natural Gas Trading Hub in Asia: Obstacles and Opportunities.” International Energy Agency. Paris, France. 2013. Accessed 1 November 2014. Pg 17. [http://www.iea.org/media/freepublications/AsianGasHub\\_WEB.pdf](http://www.iea.org/media/freepublications/AsianGasHub_WEB.pdf)

<sup>55</sup> “New Japan LNG Exchange May Prove Disruptive in Key Qatari Market.” Middle East Economic Survey. 3 October 2014. Volume 57, Issue 40. Accessed 1 November 2014. <http://archives.mees.com/issues/1551/articles/51985>

<sup>56</sup> Kate, W.; Varró, L.; Corbeau, A. “Developing a Natural Gas Trading Hub in Asia: Obstacles and Opportunities.” International Energy Agency. Paris, France. 2013. Accessed 1 November 2014. Pg 54. [http://www.iea.org/media/freepublications/AsianGasHub\\_WEB.pdf](http://www.iea.org/media/freepublications/AsianGasHub_WEB.pdf)

<sup>57</sup> Ibid, Pg 63.

<sup>58</sup> Ibid, Pg 63.

the IEA (2014) describes as “in line with Singapore’s ambition to become Asia’s LNG hub.”<sup>59</sup> Singapore completed an 8.3mn t/y regasification facility in 2013; importantly, this is the first regasification facility in Asia with reloading capabilities. The IEA (2014) says that Singapore is considering a second terminal as moves forward with plans to develop an LNG trading hub.<sup>60</sup> Again, the emergence of new forms of competition in the Asian LNG market erodes Qatar’s role as kingmaker.

## **G. Conclusion**

Qatar has a number of long-term SPAs set to expire over the coming decade and a half, as the full implications of LNG market changes are realized (see figure 3.14).

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<sup>59</sup> “2014 Medium Term Gas Market Report: Market Analysis and Forecasts to 2019.” International Energy Agency. Paris, June 2014. Pg 162.

<sup>60</sup> “2014 Medium Term Gas Market Report: Market Analysis and Forecasts to 2019.” International Energy Agency. Paris, June 2014. Pg 183.

**Qatar's Long- and Medium-term LNG Contracts by Expiration Date**

<b>Expiry Year</b>	<b>Start Year</b>	<b>Nominal Quantity (mn t/y)</b>	<b>Seller</b>	<b>Buyer</b>
2021	1997	4	Qatargas I	Chubu Electric
2021	1998	2	Qatargas I	Tohoku Electric, Tokyo Gas, Osaka Gas, etc
2021	2012	1	Qatargas I	TEPCO
2024	2005	0.75	Qatargas I	Gas Natural sdg
2024	1999	4.92	RasGas I	KOGAS
2025	2006	0.75	Qatargas I	Gas Natural sdg
2025	2005	0.74	RasGas II Train 2	Endesa
2026	2007	2.1	RasGas III Train 1	KOGAS
2027	2013	0.5	Qatargas III	Kansai Electric
2027	2007	3.4	RasGas II Train 3	EDF Trading
2027	2007	2.05	RasGas II Train 3	ENI
2028	2013	1	Qatargas III	Chubu Electric
2028	2004	5	RasGas II Train 1	Petronet LNG
2029	2009	2.5	RasGas III Train 1	Petronet LNG
2031	2011	1	Qatargas IV	Marubeni
2032	2008	3.08	RasGas II Train 3	CPC
2032	2012	2	RasGas III Train 1	KOGAS
2032	2013	1.5	RasGas IV	CPC
2034	2009	7.8	Qatargas II Train 1	ExxonMobil
2034	2009	2	Qatargas II Train 2	CNOOC
2034	2009	1.85	Qatargas II Train 2	Total
2034	2009	1.5	Qatargas II Train 2	Total
2034	2009	1.15	Qatargas II Train 2	Total
2034	2009	0.7	Qatargas II, Train 2	Total
2034	2009	4.6	RasGas II Train 2	Edison
2034	2009	7.8	RasGas III Train 1	ExxonMobil
2035	2010	7.8	Qatargas III	ConocoPhillips

2035	2010	7.8 RasGas III Train 2	ExxonMobil
2036	2011	3 Qatargas IV	Petrochina
2041	2011	3.8 Qatargas IV	Shell

Source: GIIGNL

Fig. 3.14: Qatar’s Long- and Medium-Term LNG Contracts by Expiration Date<sup>61</sup>

Of more immediate effect, buyers of Qatargas and RasGas LNG – keenly aware of these pressures – will find themselves in favorable positions in price review negotiations. Most long-term SPAs contain price review clauses, which are typically invoked at five-year intervals. Since a number of Qatargas and RasGas’ LNG supply agreements were signed with foundation buyers, the contracts likely contain “most favored customer” and “most favored supplier” clauses; however, favorability is trumped by the market parity clause of these contracts, which keeps prices somewhat in line with prevailing market prices. Again, the low cost of gas production in Qatar, coupled with the fact that its LNG infrastructure is already in place, suggest that Qatari LNG will remain profitable in nearly any foreseeable market scenario. However, lower margins affect the ability of the state to meet expansionary spending targets and may, to some extent, slow infrastructure development. Lower profitability of Qatargas and RasGas operations is also a concern for those IOC participants in the Qatari LNG sector, which includes supermajors Shell, Total and ExxonMobil.

Additionally, Qatar’s LNG contracts will gradually grow more flexible, forced into less seller-friendly terms by the changing market environment. US-sourced LNG contracts, for example, do not contain the “take-or-pay” clauses that helped previous liquefaction projects secure financing. As Jensen (2004) explains, the LNG industry’s Supply and Purchase Agreement (SPA) was originally rigid, with the take-or-pay clause obligating

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<sup>61</sup> “The LNG Industry in 2013.” Groupe International des Importateurs de Gaz Naturel Liquéfié (GIIGNL). Neuilly-sur-Seine, France.

buyers to take at least 90% of the annual contracted volume.<sup>62</sup> As a result, the LNG trade was traditionally seen as a bilateral relationship between buyer and seller. New SPA agreements signed between future US LNG exporters and their buyers do not contain take-or-pay or destination clauses, meaning that unwanted, yet contracted, volumes can be sold to other buyers. This has already impacted recent short-term contracts signed between Qatari LNG exporters and their buyers. Between 2013 and 2014, both Qatargas and RasGas signed short-term, flexible supply agreements with German utility, E.ON. The RasGas contract, inked in mid-2014, will see the firm supply 0.5mn t/y over three years to be regasified at the UK's Isle of Grain import terminal; Qatargas 4 (QP 70%, Shell 30%) agreed in 2013 to a flexible LNG supply agreement with E.ON to ship 1.5mn t/y over five years to the Gate LNG terminal in Rotterdam. Neither contract has a take-or-pay clause. Importantly, both contracts break with the traditional oil-linked pricing mechanism, as well (this is discussed in more detail in Chapter IV).<sup>63</sup> Qatar will have to adapt to the more flexible terms available to LNG buyers in today's market; however, while the spot market for LNG is growing, it is unclear how much spot LNG can be absorbed as contract terms grow increasingly flexible.

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<sup>62</sup> Jensen, James T. "The Development of a Global LNG Market: Is it Likely? If so When?" Oxford Institute for Energy Studies, 2004. Pg 17.

<sup>63</sup> "RasGas Breaks with Oil Link in E.ON LNG Deal." Middle East Economic Survey. 30 May 2014. Volume 57, Issue 22. Accessed 4 November 2014. <http://archives.mees.com/issues/1532/articles/51537>

## CHAPTER IV

### MONETIZING QATARI GAS

Long a hydrocarbons producing state, Qatar's role in the world energy market in the second half of the 20<sup>th</sup> century was primarily as a supplier of oil. Qatar joined the Organization of Petroleum Exporting Countries (OPEC) in 1961, just a year after the group was founded by key Gulf oil producers Kuwait, Iraq, Iran, Saudi Arabia – plus South American petrogiant, Venezuela; however, Qatar was always of secondary importance within the group, as it produced far less crude than many of its OPEC peers. Qatari oil output peaked in 2008, which is the same year that state revenues from gas surpassed those of oil.

#### **A. Background on Qatari LNG Development**

Founded in 1974, Qatar General Petroleum Corporation (QGPC) – renamed Qatar Petroleum (QP) in 2001 – was a natural extension of oil nationalization policies in the Gulf in the early 1970s; it was created at the direction of Amir Khalifa bin Hamad Al Thani, who deposed his cousin in 1972 and quickly worked to direct oil funds towards the development of state institutions. Oil revenues grew rapidly in this period, from \$300mn in 1971 to \$2bn in 1974, allowing Amir Khalifa to introduce consumer product price controls, begin a food subsidy program and build schools and healthcare facilities – thereby solidifying the Al Thani's position as steward of the newly formed modern state of Qatar.<sup>64</sup> As oil production took off in the 1970s, Qatar pursued a diverse approach to monetizing its hydrocarbons wealth. LNG would eventually become the pillar upon which Qatar's economy rests, yet the

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<sup>64</sup> Hashimoto, K.; Ellass, J.; Eller, S. "Liquefied Natural Gas From Qatar: The Qatargas Project." *Natural Gas and Geopolitics: From 1970 to 2040*. Eds. Victor, D. et al. Cambridge University Press. Cambridge, 2006. Pg 239.

process of developing more than 77mn t/y of LNG output capacity was expensive, time-consuming, and required the help of international oil company (IOC) partners as well as the close cooperation of end users of LNG.

Ten years after Qatar joined OPEC, Anglo-Dutch oil major, Shell, discovered the ultra-giant North Field – now thought to have about 900 tcf in reserves – which would eventually enable the level LNG output seen today. The North Field is the largest gas field in the world and, when converted to barrels of oil equivalent (boe), the field is the largest known conventional hydrocarbons reserve, exceeding even Saudi Arabia’s Ghawar oil field.<sup>65</sup> However, the North Field remained untapped for two decades. Though Shell and other foreign operators remained in Qatar as advisors, all oil and gas assets were transferred to the state, i.e., QGPC, by 1977. Even in these early years, Qatar approached its oil and gas production with an eye on industrialization, building fertilizer, steel and petrochemicals plants.<sup>66</sup> But several factors contributed to delays in North Field development. First, decision-making at all levels was concentrated solely in the hands of the Amir, who was exposed to a range of counselors offering competing opinions on development plans. Further complicating early plans to develop the North Field, oil revenues started to dwindle in the early 1980s and years of surpluses gave way to deficits; this led directly to delays in various development plans as government departments were forced to contract their operations.<sup>67</sup> Meanwhile, international oil companies like Shell were dissatisfied with the terms of technical service agreements on offer in Qatar at a time when it appeared that production from the country’s aging fields would soon decline.

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<sup>65</sup> Gray, Matthew. *Qatar: Politics and the Challenges of Development*. Lynne Rinner Publishers, Inc. Boulder, 2013. Page 94.

<sup>66</sup> Hashimoto, K.; Ellass, J.; Eller, S. “Liquefied Natural Gas From Qatar: The Qatargas Project.” *Natural Gas and Geopolitics: From 1970 to 2040*. Eds. Victor, D. et al. Cambridge University Press. Cambridge, 2006. Pg 240.

<sup>67</sup> *Ibid*, Pg 240-241.

In the very early stages after the discovery of the North Field, LNG was not seen as a viable option for Qatar. In part, this was because the full extent of North Field reserves was not fully understood at the time. Additionally, the realization costs of LNG were too high – while liquefaction technology was developed in the early 20<sup>th</sup> century, Qatar was considered too far from major demand centers for LNG to be economical as an option to monetize Qatar’s gas potential. Qatar also suffered from technical problems in its early efforts to develop the North Field.

But these calculations changed rapidly as a greater understanding of the scale of the North Field discovery was developed. By the late 1980s, work on Phase 1 of North Field development (fully-owned by QGPC) was under way, though first production from the North Field did not start up until mid-1991. The first phase production center, consisting of two wellhead platforms, had the capacity to produce 800mn cfd of wellhead gas and to strip 40,000 – 45,000 b/d of LPG and condensate; it was connected by pipeline to the burgeoning onshore industrial hub of Ras Laffan. From Ras Laffan, North Field phase 1 production was sent to a newly constructed processing plant at Umm Said, where 750mn cfd of lean sales gas and 1.6mn t/y of liquids were produced.<sup>68</sup>

Nearly a decade before first gas, however, Qatar had already begun discussing LNG as an option for monetizing expanded North Field production – and QGPC realized from an early stage that its inexperience in LNG, a technically complicated and inherently international business, meant that it would have to build partnerships with IOCs and LNG buyers to achieve its goals. Qatar’s relationship with Japan proved instrumental in realizing its LNG program. In 1984, Qatargas was established with the intention of promoting LNG exports. The original partnership structure consisted of QGPC, BP and Total; however, by the

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<sup>68</sup> “Prospects Improve for Future Qatar Gas Exports.” Middle East Economic Survey. 17 April 1989. Volume 32, Issue 28. Accessed 7 September 2014. <http://archives.mees.com/issues/1175/articles/41654>

end of 1985, one Japanese firm – Marubeni – had joined. In 1989, a second Japanese firm, Mitsui, joined Qatargas, leaving each foreign company with 7.5% stakes and QGPC with a 70% stake. As part of the negotiating process when joining the Qatargas partnership, the Japanese firms were expected to lobby Japanese power and industry to sign long-term LNG import contracts for Qatari supplies.<sup>69</sup> Even before phase 1 of North Field development, experts called for LNG as an option to target the emerging Japanese LNG market, though it appeared that the viability of the LNG option hinged on the expansion of the North Field beyond its first phase of development. The Middle East Economic Survey suggested in April 1989 that, while Japanese LNG importers were for the time being committed to other buyers, experts were beginning to forecast significant growth in Japan’s LNG demand over the coming decade. Demand in 1989 was about 30mn t/y, but Japanese industry officials saw that figure rising to some 50mn t/y by 2000, which would provide Qatar with the market necessary to justify its LNG plans.<sup>70</sup>

Japan’s post-war economic boom and resultant growth in energy demand, coupled by the fact that Japan is not an oil and gas producer, meant that the country swiftly grew into the world’s largest LNG market. A close relationship between the Japanese government and Japanese industry allowed private gas buyers and electricity providers to pursue LNG as a strategic element of state policy. However, this dynamic resulted in delays for Qatar’s LNG plans during the early years of the Qatargas project: Japanese interest in Qatari LNG waned significantly in the mid-1980s amid security concerns in the Gulf. Though no LNG tankers leaving Abu Dhabi, the Gulf’s sole LNG exporter during the Iran-Iraq war, for market were ever attacked, oil tankers traversing the Gulf near Qatar came under fire; Japan was simply

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<sup>69</sup> “Japanese Groups to Continue Talks on Equity Stake in Qatari LNG Project.” Middle East Economic Survey. 19 November 1984. Volume 28, Issue 06. Accessed 7 September 2014. <http://archives.mees.com/issues/1358/articles/46751>

<sup>70</sup> “Japanese Customers Show Signs of Interest in Qatar LNG.” Middle East Economic Survey. 18 December 1989. Volume 33, Issue 11. Accessed 6 October 2014. <http://archives.mees.com/issues/1107/articles/39766>

unwilling to take huge financial risks in Qatar at a time when supplies could be secured elsewhere. Instead, Japanese companies devoted resources to Australia's 6mn t/y North West Shelf LNG project: in 1985, eight Japanese firms signed long-term sales and purchase agreements with North West Shelf developers.<sup>71</sup>

But Japanese interest in Qatari LNG again shifted course as Qatargas' plans matured; the first LNG scheme called for two separate 2mn t/y trains to give Qatar an initial export capacity of 4mn t/y. One of Qatargas' early partners was Japanese firm, Marubeni, which planned to create a niche in Japan for Qatari LNG by the second half of the 1990s and lobbied other Japanese entities to support the Qatari LNG project. Marubeni argued that Qatar offered "an answer to Japan's main energy priorities: diversification of supply sources," the Middle East Economic Survey reported in 1989.<sup>72</sup> Supply diversification would prove a long-term challenge for Japan, as discussed later in this paper. Marubeni argued in the late-1980s that, for Qatari LNG to reach the Japanese market by 1997 as planned, supply agreements must be achieved in the first two years of the 1990s – given the significant lead time for LNG infrastructure projects. Qatari officials visited Japan's Ministry of International Trade and Industry (later redubbed the Ministry of Economy, Trade and Industry) in 1988 and the ministry reciprocated with a delegation to Qatar to investigate potential future LNG purchases.<sup>73</sup> By the end of 1989, Qatar had grown optimistic that it could become an LNG player: Japanese interest in Qatari LNG was finally solidifying, and new markets elsewhere in Asia – South Korea and Taiwan – were starting to import LNG. The Middle East Economic Survey reported in December that year that Japan's Chubu Electric Power

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<sup>71</sup> Hashimoto, K.; Elass, J.; Eller, S. "Liquefied Natural Gas From Qatar: The Qatargas Project." *Natural Gas and Geopolitics: From 1970 to 2040*. Eds. Victor, D. et al. Cambridge University Press. Cambridge, 2006. Pg 244.

<sup>72</sup> "Prospects Improve for Future Qatar Gas Exports." *Middle East Economic Survey*. 17 April 1989. Volume 32, Issue 28. Accessed 7 September 2014. <http://archives.mees.com/issues/1175/articles/41654>

<sup>73</sup> Ibid.

Company – which was then mostly burning coal for power generation (though it would eventually grow into a major importer of Qatari LNG) – had expressed direct interest to local officials in importing 4mn t/y of Qatari LNG over a twenty-year period.<sup>74</sup>

Hashimoto, et al. (2006), highlight Japan’s role in the success of the first phase of Qatar’s LNG program:

The important role of the trading companies (Sogo Shosha) and their relationship with Japanese buyers (in this case, Chubu Electric) can hardly be overstated. Japan’s public electric and gas utilities were the main buyers of LNG in the world at the time and thus had a commanding position in determining the success of any new LNG projects as Qatargas organizers were trying to get their project off the ground...Sogo Shosha played a decisive role in building Japanese buyers’ confidence, especially between long-term purchasers and investors in the Qatar greenfield project. In Qatargas and previous Japanese LNG import projects, Sogo Shosha acted as the “glue” to connect LNG users and the supplier as well as financial institutions, both official and private, to form the critical chain of actors.<sup>75</sup>

In March 1991, Qatar finally secured a supply commitment and appeared set to proceed with LNG development after Qatargas signed a 25-year agreement with Chubu Electric Power Company to supply the Japanese company with 4mn t/y of LNG starting in 1997, with an option to increase purchases to 6mn t/y. The deal was finalized in May 1992 after BP’s withdrawal from the Qatargas consortium resulted in a short delay. BP’s withdrawal led the remaining three foreign firms boost their shares in Qatargas to 10% each.<sup>76</sup> The Chubu deal represented the needed buyer commitment in order to move forward with initial plans to build 4mn t/y of export capacity and acquire seven 125,000 cubic meter LNG tankers.

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<sup>74</sup> “Japanese Customers Show Signs of Interest in Qatar LNG.” Middle East Economic Survey. 18 December 1989. Volume 33, Issue 11. Accessed 6 October 2014. <http://archives.mees.com/issues/1107/articles/39766>

<sup>75</sup> Hashimoto, K.; Elass, J.; Eller, S. “Liquefied Natural Gas From Qatar: The Qatargas Project.” Natural Gas and Geopolitics: From 1970 to 2040. Eds. Victor, D. et al. Cambridge University Press. Cambridge, 2006. Pg 246-247.

<sup>76</sup> “Chubu Signs LNG Deal With Qatargas.” Middle East Economic Survey. 18 May 1992. Volume 35, Issue 33. Accessed 7 September 2014. <http://archives.mees.com/issues/1025/articles/37505>

The first phase of North Field development was earmarked for use in domestic power and industry as well as reinjection into the Dukhan oilfield's Khuff reservoir, though the Dukhan volumes were later redirected for industrial use. To achieve the gas production necessary to proceed with LNG export plans, Qatar needed to secure about \$1.4bn in financing – a prospect given a significant boost by the supply agreement with Chubu. Additionally, at the time of the Chubu closing, Qatar expected to need to raise about \$2bn in capital to proceed with plans to build liquefaction trains, \$600mn in equity from the Qatargas partners and \$1.4bn from project finance – a nearly unprecedented sum for project finance in the Gulf at the time.<sup>77</sup>

After the Chubu deal, North Field development became inextricably linked to LNG plans. Recoverable reserve estimates for the North Field skyrocketed in the early 1990s from 150 tcf to 380 tcf by 1995, eventually settling at today's widely accepted figure of about 900 tcf. Growth in reserves estimates helped Qatar move towards a decision to focus on LNG as the primary means by which it would extract value from its North Field asset; meanwhile, the Gulf state's relationship with Japan enabled Qatar to realize its early LNG ambitions. Of Japan's role, the Middle East Economic Survey said: "When all is said and done, Qatargas has evolved as a fully dedicated Japanese project, in the sense that the contractors, the financiers and the lifters are mainly Japanese companies."<sup>78</sup> Japanese financing contributed to the success of Qatari LNG ambitions, according to Hashimoto, et al.: "The engagement of Japanese firms in every segment of the project—from investors to contracted construction firms to transporters to key buyers—enabled Japanese financial institutions to provide the

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<sup>77</sup> "Chubu Signing Will Boost Qatargas Plans, But Many Questions Remain Over Financing for Qatar's Industrialization Program." Middle East Economic Survey. 27 April 1992. Volume 35, Issue 30. Accessed 7 September 2014.

<http://archives.mees.com/issues/1022/articles/37437>

<sup>78</sup> "Qatar Launches LNG Industry With 10.8Mn Tons/Year Sales Contract to Japan and South Korea." Middle East Economic Survey. 3 March 1997. Volume 40, Issue 9. Accessed 7 September 2014. <http://archives.mees.com/issues/731/articles/28811>

vast bulk of financing...”<sup>79</sup> Much of the project’s financing was provided by the Japanese government: “The project represented a major commitment of the Japanese government to Qatar and the Middle East—through its support of the [Japan Export-Import Bank] loans.”<sup>80</sup>

Despite Japan-bankrolled successes, the exit of BP from the Qatargas project in 1992 left the consortium without the leadership of an IOC with experience in grassroots LNG developments. BP, which at the time was coping with internal cash flow problems, was dissatisfied with Qatargas terms. Hashimoto, et al. (2006), quote a BP manager: “Even with a \$0.50 per [mn BTU] into plant gas price (indexed to LNG), a 35% tax rate and a 10-year tax holiday the 4 [mn t/y] scheme was marginal.”<sup>81</sup> While BP’s withdrawal from the consortium left doubts about Qatargas’ ability to execute its plans, Qatargas quickly found a capable replacement.

The entry of another foreign player, Mobil, proved to be a tremendous boost for Qatar’s LNG ambitions. Mobil was an early entrant into the LNG industry, with a 35% stake in a project in Indonesia since 1978. It wanted access to what it saw as Qatar’s huge LNG potential; likewise, Qatar hoped to tap Mobil’s expertise in LNG. In August 1992, Mobil bought a 10% stake in the Qatargas consortium from the remaining foreign participants, thereby reducing their shares to 7.5%. At the start of 1993, QGPC (70%) and Mobil (30%)<sup>82</sup> finalized a second joint venture, Ras Laffan LNG – known today as RasGas, currently the world’s second largest supplier of LNG. The initial agreement between the two firms called for construction of just over 10mn t/y of LNG export capacity.

Mobil’s entry into Qatar – and the vast resource base and LNG expertise it brought with it – was a critical turning point for the future LNG sector. In an interview with the

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<sup>79</sup> Hashimoto, K.; Elass, J.; Eller, S. “Liquefied Natural Gas From Qatar: The Qatargas Project.” *Natural Gas and Geopolitics: From 1970 to 2040*. Eds. Victor, D. et al. Cambridge University Press. Cambridge, 2006. Pg 253.

<sup>80</sup> Ibid, Pg 253-254.

<sup>81</sup> Ibid, Pg 248.

<sup>82</sup> In 1998, Mobil merged with Exxon to form ExxonMobil.

Middle East Economic Survey in December 1992, Qatari Minister of Energy and Industry, ‘Abd Allah al-‘Attiyah, said that Mobil’s entry as a major participant, bringing with it the know-how to execute liquefaction plans, would allow Qatar to focus its efforts on securing long-term LNG supply contracts with east Asian buyers.<sup>83</sup> Ras Laffan LNG finalized its inaugural supply contract in 1995 when it agreed to sell Korea Gas Corporation 2.4mn t/y for 25 years beginning in 1999.

Qatargas exported its first shipment of LNG from the Ras Laffan export terminal in December 1996, the inaugural shipment of the Chubu contract; meanwhile, the second Qatargas train was inaugurated the next month (see figure 4.1). By the end of 1998, the first three Qatargas I trains were online, eventually yielding about 9.6mn t/y of LNG following debottlenecking in 2002. In 1999, RasGas I’s first 3.3mn t/y train come online, backed by long-term sales and purchase agreements with South Korean firms; in fact, a subsidiary of South Korea’s KOGAS was granted a 5% stake in the RasGas I joint venture in 2005.

It was from this base of LNG production that Qatar was able to eventually push further phases of North Field development and the LNG facilities to move gas production to market. In 2002, the Qatargas 2 joint venture was established – pairing QP with ExxonMobil to build three additional trains (Total eventually joined the project with a 16.7% stake in Qatargas’ train 5 in 2005). Just a year after Qatargas 2’s establishment, Qatargas 3 was founded with the intention of building one additional train (QP 68.5%, ConocoPhillips 30%, Mitsui 1.5%). QP and Shell agreed on Qatargas 4 (one train) in 2005. The second wave of Qatargas projects came online between 2009 and 2011.<sup>84</sup> Meanwhile, RasGas also expanded its capabilities in this period: RasGas 2 was set in motion in early 2002 with plans for three

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<sup>83</sup> “Qatar and Mobil Sign for 10mn T/Y LNG Joint Venture.” Middle East Economic Survey. 28 December 1992. Volume 36, Issue 13. Accessed 7 September 2014.

<http://archives.mees.com/issues/954/articles/35410>

<sup>84</sup> Gray, Matthew. Qatar: Politics and the Challenges of Development. Lynne Rinner Publishers, Inc. Boulder, 2013. Page 95.

additional trains. RasGas 3 was backed by long-term sales agreement with United States buyers in 2005; its two trains came online in 2010.<sup>85</sup> In 2006, Qatar surpassed Indonesia as the world's largest supplier of LNG. By 2011, Qatar's overall production capacity between Qatargas and Rasgas facilities topped out at around 77mn t/y.

### Qatar's Gas Liquefaction Assets

Project	Capacity (tons/year)	Year Online	Current Partners
Qatargas I (Train 1)	3.2	1996	Qatar Petroleum (65%), ExxonMobil (10%), Total (10%), Marubeni (7.5%), Mitsui (7.5%)
Qatargas I (Train 2)	3.2	1997	Qatar Petroleum (65%), ExxonMobil (10%), Total (10%), Marubeni (7.5%), Mitsui (7.5%)
Qatargas I (Train 3)	3.2	1998	Qatar Petroleum (65%), ExxonMobil (10%), Total (10%), Marubeni (7.5%), Mitsui (7.5%)
RasGas I (Train 1)	3.3	1999	Qatar Petroleum (63%), ExxonMobil (25%), KOGAS (5%), Itochu (4%), LNG Japan (3%)
RasGas I (Train 2)	3.3	2000	Qatar Petroleum (63%), ExxonMobil (25%), KOGAS (5%), Itochu (4%), LNG Japan (3%)
RasGas II	4.7	2004	Qatar Petroleum (70%), ExxonMobil (30%)
RasGas II	4.7	2005	Qatar Petroleum (70%), ExxonMobil (30%)
RasGas II	4.7	2007	Qatar Petroleum (70%), ExxonMobil (30%)
Qatargas II	7.8	2009	Qatar Petroleum (70%), ExxonMobil (30%)
Qatargas II	7.8	2009	Qatar Petroleum (65%), ExxonMobil (18.3%),
RasGas III	7.8	2009	Qatar Petroleum (70%), ExxonMobil (30%)
Qatargas III	7.8	2010	Qatar Petroleum (68.5%), ConocoPhillips (30%), Mitsui (1.5%)
RasGas III	7.8	2010	Qatar Petroleum (70%), ExxonMobil (30%)
Qatargas IV	7.8	2011	Qatar Petroleum (70%), Shell (30%)
<b>Qatargas Total</b>	<b>40.8</b>		
<b>RasGas Total</b>	<b>36.3</b>		
<b>Total</b>	<b>77.1</b>		

Source: Qatargas and RasGas

Fig. 4.1: Qatar's Gas Liquefaction Assets

Source: Qatargas and RasGas

## B. Contracts and Pricing

Long-term sales and purchase agreements (SPAs) underpinned the development of LNG infrastructure in Qatar and continue to play an important role in allowing LNG projects around the world to break ground. Indeed, the first SPA with Chubu Electric Power proved to be a crystallizing moment for the first Qatargas project, allowing Qatargas to overcome years

<sup>85</sup> Ibid, Pg. 97.

of delay and indecision. However, the contract itself reflected Japan's energy interests over the interests of Qatar's nascent LNG industry, according to Hashimoto, et al. (2006): "The structure of the contract was designed to emphasize security of supply over price and lifting flexibility."<sup>86</sup> Additionally, while the Chubu Electric contract assured Qatargas that much of its LNG volumes would reach a market through the take-or-pay terms, "...the buyers for the last 2 [mn t/y] could not agree to a pricing formula for Qatargas deliveries."<sup>87</sup> This pushed "Mobil and project lenders" to seek "financial security in the form of a guaranteed minimum floor price for offtake." Hashimoto, et al. (2006), said that the price floor was at the time unprecedented in the Japanese LNG market and was rejected by other Japanese buyers.<sup>88</sup>

But by the mid-1990s, new supplies had hit the waters from Yemen, Oman and elsewhere, rendering Qatar's project just one of many options for Japanese and South Korean buyers seeking supply security – therefore providing buyers leverage in price negotiations with Qatar. In fact, the first Qatargas cargoes arrived in Japan with only a provisional agreement on price. Qatargas and Japanese buyers led by Chubu Electric agreed to two three-month interim prices agreements of \$4.10/mn BTU upon first delivery in January 1997. When the interim price was agreed, the Middle East Economic Survey noted: "In the meantime, Qatargas is unlikely to suffer under the interim pricing mechanism given that the fixed rate of \$4.10/mn BTU (which is equivalent to \$24/B crude) is in line with current market prices and potentially much higher."<sup>89</sup> Indeed, the Japanese Customs-cleared Crude (JCC) price fell to \$17/B by mid-1997, resulting in a fall in oil-linked LNG prices in Japan to

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<sup>86</sup> Hashimoto, K.; Elass, J.; Eller, S. "Liquefied Natural Gas From Qatar: The Qatargas Project." *Natural Gas and Geopolitics: From 1970 to 2040*. Eds. Victor, D. et al. Cambridge University Press. Cambridge, 2006. Pg 251.

<sup>87</sup> Ibid, Pg 252.

<sup>88</sup> Ibid, Pg 252.

<sup>89</sup> "Qatargas Agrees Three-Month Interim Price With Japanese LNG Buyers." *Middle East Economic Survey*. 13 January 1997. Volume 40, Issue 02. Accessed 27 September 2014. <http://archives.mees.com/issues/724/articles/28588>

\$3.50/mn BTU.<sup>90</sup> After six months of deliveries based on the interim price, Qatargas and Chubu Electric agreed to a new regime that saw the LNG price revised to a level equal to the average price paid by Japanese buyers for LNG (other SPAs were oil-linked).<sup>91</sup> Japanese buyers preferred to sign contracts similar to those it had developed with other LNG exporters, which saw the market-price mn BTU equivalent of JCC prices adjusted by a premium (with the premium renegotiated every four to five years); however, Qatargas wanted prices based on JCC “escalated at an agreed-upon rate for the life of the 25-year contract.”<sup>92</sup> RasGas secured this formula from KOGAS and Japan’s Osaka Gas in its early contracts. Oil indexation is not renegotiable during the life of these contracts.

Qatargas’ price stalemate persisted until April 2001. The final agreement saw the following price formula adopted between Qatargas and buyers Chubu Electric and seven other Japanese LNG importers:

The market price is indexed to the average price of crude oil imported into Japan – the Japan Crude Cocktail (JCC) – which becomes  $(0.1485 \times \text{JCC})$  in the formula. A second element is the Beta factor, which is subject to periodic renegotiation. In this instance the Beta factor is 86.75 cents/mn BTU, matching that of Australia’s North West Shelf until its expiry at end-March 2002. A further factor is an S-curve to allow adjustments to be made, depending whether this is the maximum, middle or minimum band – once again matching the North West Shelf arrangement:

1. Maximum JCC (\$23.50-29.00/B):  $S = (\text{JCC} \text{ minus } \$23.50) \text{ divided by } (\$23.50 \text{ minus } \$29.00)$
2. Middle JCC (\$16.50-23.50/B):  $S = 0$
3. Minimum JCC (\$11.00-16.50/B):  $S = (\$16.50 \text{ minus } \text{JCC}) \text{ divided by } (\$16.50 \text{ minus } \$11.00)$

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<sup>90</sup> Hashimoto, K.; Elass, J.; Eller, S. “Liquefied Natural Gas From Qatar: The Qatargas Project.” *Natural Gas and Geopolitics: From 1970 to 2040*. Eds. Victor, D. et al. Cambridge University Press. Cambridge, 2006. Pg 256.

<sup>91</sup> “Japan’s Chubu Electric Applies New Provisional Price to Qatargas LNG Deliveries From July.” *Middle East Economic Survey*. 1 September 1997. Volume 40, Issue 35. Accessed 27 September 2014. <http://archives.mees.com/issues/757/29639>

<sup>92</sup> “LNG Sellers Face Downward Price Pressure Amid Growing Competition.” *Middle East Economic Survey*. 16 February 1998. Volume 41, Issue 7. Accessed 27 September 2014. <http://archives.mees.com/issues/677/articles/26992>

The following, then, is the new Qatargas/Chubu LNG price formula:  $0.1485 \times \text{JCC} + \text{Beta} (86.75 \text{ cents}) + S$ .<sup>93</sup>

The formula was applied to 4mn t/y of sales to Chubu Electric as well as 120,000 t/y to Chugoku Electric, 290,000 t/y to Kansai Electric, 350,000 t/y to Osaka Gas, 170,000 t/y to Toho Gas, 520,000 t/y to Tohoku Electric, 200,000 t/y to Tokyo Electric Power and 350,000 t/y to Tokyo Gas for a total of 6mn t/y contracted under the pricing formula.

This type of oil-indexed LNG price is standard across much of the LNG industry (see Chapter III) and Qatar has long since insisted on oil-linked LNG pricing mechanisms. But with cracks now appearing in the pricing system (also see Chapter III), Qatar has been forced to adapt. One strategy Qatar has employed in an effort to appease the market: signing SPAs of shorter duration, most of which have maintained the oil-link pricing mechanism. While 20- and 25-year supply deals helped Qatargas and RasGas secure financing for their LNG trains, the two producers found themselves freer to respond to market pressures once their respective liquefaction trains were online. This resulted in a wave of 2-6 year sales and purchase agreements over the past several years.

Qatar has also long played a role in the flexible and spot LNG markets. Qatargas and RasGas actively pursued spot sales from the early stages of their presence on the market, though Qatargas was particularly aggressive in approaching the spot market: in 1998 and 1999, it sold spot cargoes to Turkey's Botas, Spain's Enagas, Gaz de France, as well as US firms CMS Energy and Duke Energy – Qatar's first forays into what was at the time a growing US market for LNG. Additionally, Qatargas filled a hole left by Abu Dhabi's Adgas in 1999 when the latter was unable to meet a contractual delivery: Qatargas sent a single cargo to Italy's Edison Gas.

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<sup>93</sup> “Details of Qatargas/Chubu Long-Term LNG Price Formula.” Middle East Economic Survey. 8 October 2001. Volume 44, Issue 41. Accessed 27 September 2014. <http://archives.mees.com/issues/555/articles/23070>

In his keynote address to GASTECH98 in Dubai, Qatar's Energy and Industry Minister, 'Abd Allah al-'Attiyah, admitted that even during the early phases of Qatari LNG production, spot and flexible sales were important to the success of the country's LNG projects and key to addressing the needs of emerging LNG importers:

Having excess uncommitted capacity is probably the most important element in growing our customer base via spot sales. Qatar is presently selling spot cargoes to new customers in Spain, Turkey, and the US. Spare capacity also provides smaller aggregate sales quantities or build-up volumes to provide both the timing and financial flexibility to capture new long-term sales. In addition, we believe excess capacity is the key to success in expanding LNG sales in emerging markets...RasGas was recently awarded the Petronet tender to supply 7.5mn t/y of LNG to India: 5mn t/y to Gujarat and 2.5mn t/y to Cochin. India, like other emerging markets, clearly has the economic need for cost competitive and environmentally favorable LNG fuel. A hurdle we face in India is the lack of necessary infrastructure to receive the LNG. The LNG supply and related infrastructure development in a typical new emerging market can require a total of \$5bn in capital investment. Our approach for Petronet will be to match Qatar's existing LNG supply flexibility with Gujarat's existing demand to minimize our financing hurdle. Our excess capacity, combined with appropriate transportation arrangements could reduce the initial cost significantly. Once the LNG project has successfully cleared the initial financing hurdle and the gas is flowing, the new emerging market has become a reality and financeability can be established. Qatar will then continue to grow in the market by providing competitive LNG supply from expansion volumes. We believe this is the most effective way to succeed in emerging markets.<sup>94</sup>

Qatar has since grown into the largest single player in the spot and flexible LNG market, though most of its LNG is tied up in long-term deals.

Yet the spot and short term market represents another aspect of the LNG industry in which Qatar's position may come under pressure. According to energy-focused consulting firm, Wood Mackenzie, Malaysia's Petronas has emerged as a threat to Qatar's dominance of the spot and LNG market. By 2022, it says, Petronas will be able to supply 26mn t/y of

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<sup>94</sup> "'Attiyah Highlights Qatar's LNG Strategy.'" Middle East Economic Survey. 14 December 1998. Volume 41, Issue 50. Accessed 10 September 2014. <http://archives.mees.com/issues/720/articles/28471>

flexible LNG; the firm says that Qatar supplied 20mn tons in 2013,<sup>95</sup> though, as noted below, figures vary for this market category. Qatar, of course, is not expected to see a boost to its domestic LNG production capacity in the interim; however, at least some volumes from the planned 18mn t/y Golden Pass LNG export facility in Texas (in which QP has a 70% stake – see Chapter V) will be flexible and therefore allow Qatar to potentially expand its presence in the spot and LNG market. It is unclear if the Wood Mackenzie report takes Golden Pass into account. Also, since a number of Qatargas and RasGas SPAs will expire in the coming years, it is possible that Qatar’s strategy in renegotiating or signing new SPAs will free up larger volumes for the spot and flexible LNG markets.

The spot and short term LNG market, as a percentage of total LNG trade, continues to grow at a rapid pace. Qatar’s role in that market, according to the Groupe International des Importateurs de Gaz Naturel Liquéfié (GIIGNL – 2014, 2012), is also on the rise: in 2013, Qatar’s share of the spot and short-term LNG market reached 38.6%, rising from about 32.9% in 2011.<sup>96</sup> GIIGNL’s statistics suggest that Qatar’s role in this growing segment is proportionally larger than its role in the overall LNG market: while Qatar controls about a third of the overall LNG market at this stage, its short-term and spot trade is more significant as a percentage of the segment. Qatargas and RasGas will have several options ahead as long-term SPA expiry dates approach, one of which will be to direct higher volumes to the spot, short-term and flexible LNG markets where it is often able to fetch a premium. The growth of spot and short-term LNG likely strengthens Qatar’s position in the LNG market as an existing, established player because its market share allows it to influence contracts across the industry. It may therefore become more difficult for new and proposed projects to secure the

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<sup>95</sup> “Will Malaysia Emerge as the New Qatar of LNG?” Wood Mackenzie. News Release, 26 August 2014. Accessed 27 September 2014. <http://public.woodmac.com/public/media-centre/content/12318486>

<sup>96</sup> “The LNG Industry in 2013” and “The LNG Industry in 2011.” Groupe International des Importateurs de Gaz Naturel Liquéfié (GIIGNL). Neuilly-sur-Seine, France.

long-term supply deals that have historically benefitted large-scale LNG projects at the planning stage – which will complicate efforts to secure financing for proposed export facilities if project participants struggle to sign long-term supply deals. This is doubly concerning for projects in North America that are not backed by players with prior LNG experience. It may also prove problematic for smaller firms with liquefaction proposals, as these companies often do not have the financial base of their larger, more experienced competitors. However, the United States offers several competitive advantages from the perspective of Asian LNG buyers that mitigate, and sometimes negate, the above effect. As discussed in Chapter II, a number of planned US LNG exporters have secured long-term SPAs: first, the Henry Hub-based pricing mechanism is very attractive to Asian LNG buyers as US gas prices have for a number of years remained at a level lower than prices seen in most other gas markets. Second, US exporters are offering contracts without a destination and take-or-pay clauses. The high number of SPAs signed between US and Canadian LNG hopefuls and buyers in Asia and elsewhere will have a profound effect on Qatargas and RasGas contracts in the coming years – the first wave of North American LNG hits the waters just as some of Qatar’s largest long-term SPAs are set to expire. The effect on renegotiation of supply agreements between Qatar and its buyers is amplified by the fact that far larger volumes of Australian LNG will enter the market between 2015 and 2020.

The International Energy Agency (IEA) suggests that GIIGNL overstates the size of the spot and short-term market, since GIIGNL includes in its definition of “short-term” all contracts lasting four years or less. GIIGNL says that this segment represented 27% of total LNG trade in 2013. In a discussion of ways in which alternative supplies of gas can reach European markets, the IEA says that diverting LNG cargoes is one potential option, though the small size of the spot market leads to competition between European, Asian and Latin American buyers. Additionally, contract terms limit the size of this market: “While diversions

of cargoes can and do happen, their availability will continue to be hostage to market rigidities, such as destination clauses.”<sup>97</sup> This estimation may not take fully into account the ways in which the market will shift in the years ahead as a result of changing contract terms, led by North American exporters.

### **C. Other Methods of Monetizing Qatari Gas**

Two personalities drove Qatar’s LNG quest: Shaikh Hamad bin Khalifah Al Thani and ‘Abd Allah al-‘Attiyah. Even before Shaikh Hamad overthrew his father to become Amir in 1996, his efforts were directed towards making Qatar an LNG exporter.<sup>98</sup> But the most central figure in pushing Qatar towards a successful, world-leading LNG export program and a diversified approach to monetizing gas assets was long-serving Minister of Energy & Industry, ‘Abd Allah al-‘Attiyah. On 22 September 1997, ‘Attiyah outlined Qatar’s strategy in a prescient address to the Baker Institute at Rice University:

The strategy of Qatar in the hydrocarbon sector has two main objectives, namely maintaining and expanding sustainable oil production capacity on one hand, and maximizing the production and utilization of our huge gas reserves, which are estimated to be 50 times that of our recoverable oil reserves, on the other. Hence, after many years of relatively quiet upstream activity, the state-owned Qatar General Petroleum Corporation (QGPC) has embarked on an aggressive policy to enhance E&P development during the last few years.<sup>99</sup>

In the Baker Institute speech, ‘Attiyah also outlined in detail the various ways in which Qatar planned to monetize its gas assets. Though certain plans fell through – including a planned LNG export facility with the participation of now-defunct US firm, Enron, and a pipeline connecting Qatari gas to the Pakistani market – much of ‘Attiyah’s strategy was

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<sup>97</sup> “Medium-Term Gas Market Report 2014.” International Energy Agency. Paris, France. Page 142.

<sup>98</sup> Gray, Matthew. Qatar: Politics and the Challenges of Development. Lynne Rinner Publishers, Inc. Boulder, 2013. Page 94.

<sup>99</sup> “Qatar’s Energy Policy and Future Trends.” Middle East Economic Survey. 29 September 1997. Volume 40, Issue 39. Accessed 10 September 2014. <http://archives.mees.com/issues/761/articles/29791>

implemented: a pipeline now connects Qatari gas to the UAE, Qatar has expanded its petrochemicals output exponentially and plans further growth in the sector, and Qatar has since built condensate splitters to add value to the huge volumes of condensate produced alongside the North Field's wet gas.

'Attiyah was the metaphorical champion of Qatar's gas project, and his efforts were crucial in pushing beyond the initial LNG phases after rising to the energy and industry ministry post in 1999 – a position he held until 2011, the year that Qatar's final LNG train came online. As quoted by Gray (2013), 'Attiyah told the Middle East Economic Digest (MEED) that Qatar hoped to diversify within its energy portfolio to create a "basket": "We don't want to be only an LNG producer, a GTL producer, a petrochemical producer or a piped gas supplier. We have to create a basket of all four. This is the way to spread the risk and to avoid fluctuations in price."<sup>100</sup>

Qatar has employed a diverse approach to the problem of monetizing its gas assets. However, it is set to reach maximum gas output in 2015 unless it lifts the moratorium on North Field developments or if a substantial discovery is made in the pre-Khuff; both prospects appear unlikely, at least over the medium term.

### ***1. No Major Gas Supply Boosts Ahead***

When Qatar launched a moratorium on North Field production in 2005, it appeared initially that the moratorium would be a temporary measure used to give Qatar Petroleum time to study reservoir depletion. However, nearly a decade later, the moratorium is still in place; in 2015, the 1.4bn cfd Barzan gas project is set to come online – the last North Field development approved before the moratorium was announced. Barzan's gas is earmarked for

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<sup>100</sup> Gray, Matthew. *Qatar: Politics and the Challenges of Development*. Lynne Rinner Publishers, Inc. Boulder, 2013. Page 100.

domestic use in power and petrochemicals and is the last major gas increment for the foreseeable future. The development will be operated by RasGas (QP 70%, ExxonMobil 30%), though it is under development by a joint venture of a different structure (QP 93%, ExxonMobil 7%). The first train is expected online in March 2015 and the second by the end of 1H15, though full output is not expected until late 2015 or early 2016. In addition to representing the last major gas increment until after moratorium is lifted, Barzan's wet gas will yield the final expected increment of condensate and NGLs through the end of the decade. Barzan will yield 22,000 b/d of field condensate, 6,000 b/d of plant condensate, 34,000 b/d of ethane, 10,500 b/d of propane and 7,500 b/d of butane; additionally, the development will yield 4,000 tons/day of sulfur.<sup>101</sup> The project economics are boosted by the condensate and NGLs yield, which makes ExxonMobil's small stake worthwhile – despite poor terms for gas sold into the domestic market.

Meanwhile, the prospect of lifting the moratorium on North Field development hinges on the results of a study into reservoir depletion. Qatar Petroleum will have a fuller picture of reservoir dynamics once Barzan ramps up to full output, but there are serious questions that remain unanswered even a decade into the study: first, Qatar Petroleum's study is complicated by the fact that it must include at least some data from the Iranian side of the shared field, where it is known as South Pars. The National Iranian Oil Company (NIOC) often announces new phases of South Pars development but only rarely implements its plans. NIOC, the Iranian parliament and other government officials announce varying production figures for South Pars; indeed, the level of production Iran is capable of achieving at South Pars remains unclear. South Pars data must be taken into account in Qatar Petroleum's model for it to better understand the dynamics at play. QP is also disturbed by reports in 2011 of a

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<sup>101</sup> "Qatar's Barzan Gas Faces Delay." Middle East Economic Survey. Volume 57, Issue 36. 5 September 2014. Accessed 15 September 2014. <http://archives.mees.com/issues/1546/articles/51869>

dry hole drilled during one of the South Pars phases as well as reports of growing amounts of salt water entering wells on the Iranian side.<sup>102</sup> Additionally, worrying developments on the Qatari side were a primary motivation behind QP's implementation of the moratorium: pressure fell in some wells, allowing liquids to block gas flow. QP's study is also complicated by variations in North Field well dynamics, where the permeability, porosity and depths differ dramatically from well-to-well. There are also variations in gas wetness and acidity within the North Field.<sup>103</sup>

At the time of publication, QP had no plans to lift the moratorium – which is in place to secure Qatar's most valuable asset for future generations, as the field has enabled mass-scale development of LNG, petrochemicals and other associated industries and is the backbone of the Qatari economy. The possibility of a change in strategy was limited considerably by a shakeup in Qatar Petroleum's leadership structure in September 2014. In an effort to streamline decision-making, Qatar's overstretched Minister of Energy and Industry, Muhammad al-Sada, was stripped of his role as managing director of Qatar Petroleum. In his place is Qatar Petroleum's long-serving head of oil and gas ventures, Sa'd al-Ka'bi, who – while head of QP's gas division – led efforts to install the moratorium on North Field development and was known in the industry at the time as “Mr. Moratorium.” In order to issue the 2005 moratorium, Ka'bi had to overcome opposition within QP and the ministry of energy and industry; many Qatari oil and gas officials wanted to continue pushing North Field production beyond 2005 output and the development phases approved before the moratorium took effect. The moratorium forced Qatar into a gas production plateau that some believed had arrived too soon – particularly in the context of the enormous recoverable wet gas reserves in the North Field. But, aware of the centrality of the North Field to the

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<sup>102</sup> “Qatar Moratorium Continues As North Field Proves Challenging.” Middle East Economic Survey. Volume 54, Issue 50. 12 December 2011.

<http://archives.mees.com/issues/3/articles/78> Accessed 20 September 2014.

<sup>103</sup> Ibid.

economic wellbeing of the state and the repercussions of possible damage to the reservoir, Ka'bi pushed the moratorium past those more optimistic about the North Field's capabilities. In all likelihood, Ka'bi's cautious approach to developing Qatar's oil and gas resources will limit prospects for lifting the moratorium, unless the eventual results of the study into reservoir depletion show a clear path forward to expanded production.

With North Field production approaching its apex, Qatar hopes to discover sufficient gas reserves elsewhere is looking to deep gas, in the pre-Khuff formation, as a possible option to expand overall output. It has invited international oil companies to explore and possibly develop deep gas resources; however, the deep gas drive has been mostly a disappointment thus far. In July 2014, Shell announced that it did not discover commercial volumes of hydrocarbons in Block D (Shell 75%, PetroChina 25%).<sup>104</sup> One of the key problems that will hinder development of pre-Khuff gas is that it is dry gas, meaning that the IOCs involved in the deep gas drive are unlikely to commit resources unless large gas volumes are discovered. Without condensate and NGLs, it is difficult for IOCs to justify expensive developments, since gas is sold into the Qatari market at very low prices. Shell and PetroChina's unsuccessful drilling campaign may deter investment on the part of other IOC participants in the deep gas drive; it appears to have already contributed to delays in exploratory drilling at Block BC in the pre-Khuff (CNOOC 75%, Total 25%). In its 2013 Factbook, French major Total said that the partnership expected to drill its first well in the first half of 2014,<sup>105</sup> though this has yet to materialize at the time of publication. One possible source of at least modest additional gas volumes will come from a discovery made by Germany's Wintershall in the shallower Khuff formation at the 544 sq km Block 4N,

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<sup>104</sup> Harris, Paddy. "We are Committed to Qatar' – Shell." *Oil and Gas Technology*. 18 July 2014. <http://www.oilandgastechology.net/upstream-news/we-are-committed-qatar-shell>. Accessed 20 September 2014

<sup>105</sup> "Total Factbook 2013." Total. Courbevoie, France. Accessed 6 October 2014. pg. 92. [http://www.total.com/sites/default/files/atoms/files/total-factbook-2013\\_0.pdf](http://www.total.com/sites/default/files/atoms/files/total-factbook-2013_0.pdf)

adjacent to the North Field. In 2013, Wintershall (operator) discovered what has since been dubbed the al-Radeef field, which has an estimated 2.5 tcf in reserves (Wintershall 80%, Mitsui 20%). It was the first Qatari gas discovery in 40 years. Commenting on the discovery in March 2013, Minister of Energy and Industry al-Sada said: "We have been progressing exploration activities in Block 4 North with our partners, for the past few years as part of our strong exploration drive, which is in line with His Highness the Emir Sheikh Hamad Bin Khalifa Al Thani's vision to continue to prudently explore for and develop our natural resources and to increase Qatar's hydrocarbon reserves. We are very pleased that we have found a new gas discovery in Qatar."<sup>106</sup> However, Wintershall, Mitsui and Qatar Petroleum have since struggled to figure out how to best develop the al-Radeef field, and it is unclear when and if the German-led development will produce gas. Wintershall suggested to the Middle East Economic Survey that it will likely tie Radeef into existing infrastructure in order to cut costs,<sup>107</sup> though plans have yet to be finalized. If Wintershall and its partners find a cost-effective way to bring al-Radeef gas to market, the field may produce between 200-400mn cfd, according to the US Energy Information Agency.<sup>108</sup>

The bottom line is that Qatari gas production is rapidly approaching a plateau, absent a change in policy regarding the moratorium on North Field development. This reality leaves Qatar with little room to maneuver if it plans to respond to a changing LNG market by protecting its market share – there simply is not enough gas to dramatically boost LNG output. Al-Radeef's output potential is equivalent to just 1.5-3mn t/y, not nearly enough to

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<sup>106</sup> "Qatar Petroleum and Wintershall Discover Gas in Block 4 North in Qatar." Wintershall Press Release, 11 March 2013. <http://www.wintershall.com/en/press-news/detail/news/qatar-petroleum-and-wintershall-discover-gas-in-block-4-north-in-qatar.html>. Accessed 20 September 2014.

<sup>107</sup> "Wintershall Moves Forward in Gulf." Middle East Economic Survey. Volume 56, Issue 46. 15 November 2013. <http://archives.mees.com/issues/1504/articles/50824>. Accessed 20 September 2014.

<sup>108</sup> "Qatar" Analysis: Exploration and Production. U.S. Energy Information Agency. <http://www.eia.gov/countries/cab.cfm?fips=qa> Accessed 22 September 2014.

significantly impact the market. The argument is itself abstract because Qatar Petroleum has no plans to expand LNG output or to debottleneck existing facilities; however, the al-Radeef anecdote demonstrates the constraints facing Qatar at least within its domestic upstream gas industry. The fact that gas production is rapidly approaching its plateau will also affect Qatar's ability to respond to other gas market pressures.

## ***2. Other Gas Market Outlets***

### ***a. Gas-to-Liquids (GTL)***

While Qatar is currently the world's single largest LNG producer, controlling a third of the global LNG market in 2014, Qatar is also a major petrochemicals and gas-to-liquids (GTL) producer. Its gas is also very wet, meaning that Qatar is one of the world's largest condensate producers and has developed a central role in the global condensate and natural gas liquids (NGLs) trade – which, like LNG, is an Asia Pacific-focused market. Finally, Qatar exports some gas volumes by pipeline via Dolphin Energy's 3.2bn cfd line connecting Qatari resources to markets in the UAE and Oman.

One of the most innovative – and fiscally risky – approaches to extracting value from Qatari gas production was Qatar Petroleum's decision to pursue large-scale gas-to-liquids (GTL) plants. GTL technology has been a small component of the oil and gas industry since 1925, when the Fischer-Tropsch method was developed. Fischer-Tropsch sees gas converted to high-quality middle distillates, such as ultra-low sulfur diesel, and waxy raffinates. South Africa's Sasol was an early developer of GTL technology, but it was not until Qatar offered the company significant incentives to develop GTL on a commercial scale that the technology was viewed as a potential alternative for monetizing Qatari gas production. But there are still significant challenges to overcome if GTL is to grow in scale worldwide. In fact, no company has taken a final investment decision (FID) on a large-scale GTL project

without first receiving feedstock supply contracts at preferential prices; additionally, it remains unclear to industry experts which aspect of GTL product sales lends viability to such projects. GTL products typically sell at a premium over refined products due to their high quality, and some experts see this as vitally important to the success of GTL going forward. Others, however, believe that GTL's long-term viability will be contingent on the spread between oil and gas feedstock;<sup>109</sup> as shown above, however, the spread is not necessarily stable.

The first of Qatar's two commercial scale GTL projects was a 34,000 b/d joint venture between QP (51%) and Sasol (49%), Oryx GTL. While Oryx was built essentially on budget at a cost of about \$1.2-1.5bn,<sup>110</sup> it demonstrated some of the major risks associated with implementing large-scale GTL technology, for the most part unproven at commercial scale, during commissioning and ramp up. Despite the fact that Sasol was already a global leader in GTL technology and implementation of GTL technology, Oryx's partners encountered severe difficulties and were not able to stabilize production at a level near maximum capacity until 2013. In its first seven years online, the plant never saw 12 months of continuous production without shutdowns.<sup>111</sup>

Meanwhile, the costs of Shell and QP's Pearl GTL plant, the world's largest GTL project with a capacity of 140,000 b/d of GTL and 120,000 b/d of NGLs, skyrocketed to approximately \$20bn by the time it was completed from original estimates of approximately \$5bn. The final cost translates to a capital expenditure of about \$77,000 per b/d of

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<sup>109</sup> "Qatar Nears Full GTL Output, Eyes Competitors' Projects." Middle East Economic Survey. Volume 56, Issue 33. 16 August 2013. Accessed 31 August 2014.  
<http://archives.mees.com/issues/1491/articles/50497>

<sup>110</sup> Salehi, E; Nel, W; Save, S; "Viability of GTL for the North American Gas Market." Hatch Ltd. Calgary, Canada. Accessed 31 August 2014:  
[http://www.hatch.ca/oil\\_gas/articles/Viability\\_GTL\\_NA\\_Gas\\_Market.pdf](http://www.hatch.ca/oil_gas/articles/Viability_GTL_NA_Gas_Market.pdf)

<sup>111</sup> "Oryx GTL: Sasol Cautiously Optimistic." Middle East Economic Survey. 13 September 2013. Volume 56, Issue 37. Accessed 27 September 2014.  
<http://archives.mees.com/issues/1495/articles/50583>

capacity.<sup>112</sup> Cost escalation is a serious concern for GTL projects, thus far limiting IOC interest in the technology.

While Pearl and Oryx are now widely considered to be success stories for GTL, Qatar will not build additional GTL facilities or expand existing facilities. Debottlenecking, on the other hand, is feasible. Shell officials told the Middle East Economic Survey in 2014 that it has no plans to debottleneck or expand its Pearl facility;<sup>113</sup> however, Oryx may proceed with plans to debottleneck units at Oryx, though this would boost capacity by just 10%. The Oryx partners will not move forward with any expansion of their facility until after the moratorium on North Field development is lifted.<sup>114</sup> But with no end in sight to the moratorium on North Field development and unanswered questions about the viability of large-scale GTL absent the types of incentives offered to QP's partners, it is difficult to imagine a scenario in which Qatar decides to expand GTL output in the years ahead. Meanwhile, IOCs have scaled back or cut GTL plans internationally in recent years. In 2007, ExxonMobil abandoned plans to build a 154,000 b/d facility, which would have become the world's largest GTL plant, in Qatar. Shell scrapped its plans to build a 140,000 b/d, \$20bn GTL plant in Louisiana in late 2013 – a facility that would match only the company's Pearl GTL in Qatar in scale. In a company statement, Shell said: "GTL is not a viable option for Shell in North America, at this time, due to the likely development cost of such a project, uncertainties on long-term oil and gas prices and differentials, and Shell's strict capital discipline."<sup>115</sup>

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<sup>112</sup> Salehi, E; Nel, W; Save, S; "Viability of GTL for the North American Gas Market." Hatch Ltd. Calgary, Canada. Accessed 31 August 2014:

[http://www.hatch.ca/oil\\_gas/articles/Viability\\_GTL\\_NA\\_Gas\\_Market.pdf](http://www.hatch.ca/oil_gas/articles/Viability_GTL_NA_Gas_Market.pdf)

<sup>113</sup> "Qatar Searches For New Gas As North Field Moratorium Set To Continue." Middle East Economic Survey. Volume 57, Issue 15. 11 April 2014. Accessed 31 August 2014.

<http://archives.mees.com/issues/1525/articles/51343>

<sup>114</sup> "Oryx GTL Awaits North Field Decision." *MEED: Middle East Economic Digest* 58.12 (2014): 9. *Business Source Complete*. Web. 1 Sept. 2014.

<sup>115</sup> "Shell Will Not Pursue US Gulf Coast GTL Project." Press release issued on 5 December 2013. Accessed 30 August 2014. <http://www.shell.com/global/aboutshell/media/news-and-media-releases/2013/shell-will-not-pursue-us-gulf-coast-gtl-project.html>

Cost cutting is a major feature of IOC behavior over the past couple of years, with super-majors like Shell and Chevron hoping to cut back on capital expenditure to deliver value to shareholders. The US Energy Information Administration (EIA) does not foresee large-scale GTL plants built in the United States through 2040 due to the “risks associated with high capital costs,” and “long construction leadtimes,”<sup>116</sup> despite the fact that US gas production is booming and gas prices remain lower in the US market than in most other global gas markets; if pricing trends were to persist and future GTL plants were to rely on market-priced feedstock, potential future US GTL production would enjoy a competitive advantage due to lower feedstock costs.

#### b. Petrochemicals

Since the early years of hydrocarbons production in Qatar, the state has pursued petrochemicals production as a means of monetizing NGLs and associated gas production and diversifying state interests beyond upstream oil and gas. The first program was initiated in 1969 when the Qatar Fertilizer Company (QAFCO) was formed. QAFCO produces urea and ammonia and has expanded significantly since the first phase came online in 1973, growing into the world’s largest producer of these two products in 2010. The most recent phase, QAFCO-6, was brought online in 2011. Many other petrochemicals ventures were formed in Qatar in the years since QAFCO’s formation and further expansion of output is expected in the years ahead (see figure 4.2).

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<sup>116</sup> *Annual Energy Outlook 2014 With Projections to 2040*. U.S. Energy Information Administration (EIA). Office of Integrated and International Energy Analysis, U.S. Department of Energy, Washington, DC. Page MT-27. [www.eia.gov/forecasts/aeo](http://www.eia.gov/forecasts/aeo)

### Qatar Petrochemicals Capacity & Future Plans

Company	Product	'000 tons/year	Start
QAFCO	Ammonia	3,400	1973
	Urea	5,400	
QAPCO	Ethylene	800	1981
	LDPE	700	
	Propane/Butane	55	
	Pyrolysis Gasoline	45	
QAFAC	Methanol	910	1999
	MTBE	670	
QVC	Ethylene Dichloride	175	2001
	Vinyl Chloride	230	
Q-Chem	Ethylene	500	2003
	HDPE/MDPE	453	
	1-Hexene	47	
Qatofin	LLDPE	450	2009
RLOC	Ethylene	1,300	2010
Q-Chem II	HDPE	350	2010
	Linear a-Olefins	345	
<b>Total 2014</b>		<b>15,830</b>	
<b>Planned:</b>			
QAPCO	Ethylene	400	2016
Al-Karaana	Ethylene Glycol	1,500	2017
	Linear a-Olefins	300	
	Oxo-Alcohols	250	
Qatofin	LLDPE (expansion)	150	Study
<b>Total 2020</b>		<b>18,430</b>	
<b>Shelved:</b>			
Al-Sejeel	Ethylene	1,400	
	Polymers (total)	2,200	
	-HDPE	850	
	-LLDPE	430	
	-PP	760	
	-Butadiene	83	
	-Pyrolysis Gasoline	77	

Fig. 4.2: Qatar Petrochemicals Capacity and Future Plans  
Source: Middle East Economic Survey

<sup>117</sup> "Key Project Shelved As Qatar Shifts Petchems Strategy." Middle East Economic Survey. 26 September 2014. Volume 57, Issue 39. Accessed 5 October 2014. <http://archives.mees.com/issues/1550/articles/51966>

As Gulf petrochemicals producers move away from ethane feedstock due to a widening gas crunch – particularly in the UAE, Saudi Arabia and Kuwait – Qatar stands apart in its ability to direct ethane production to the petrochemicals sector due to its enormous NGLs output. The Barzan wet gas project is the last foreseeable NGLs increment and will yield 34,000 b/d of ethane, 10,500 b/d of propane and 7,500 b/d of butane (the latter two products commonly referred to collectively as LPG).<sup>118</sup> Yet the shale revolution has also led to a boom in ethane-based petrochemicals production in the United States, where feedstock is inexpensive. This development is an emerging threat to Middle East Gulf petrochemicals producers, Qatar included. First, with ethane supplies already tied up and no prospects for further ethane production, naphtha is seen as a possible choice for Gulf producers if they pursue further expansion of petrochemicals production. Gulf oil and gas producers traditionally view petrochemicals as a value-added method of moving further downstream and “diversifying” their hydrocarbons-dependent economies; several Gulf States attracted significant investment in petrochemicals with subsidized feedstock. The focus of global petrochemicals production was therefore briefly centered on the Gulf, according to Troner (2013): “The past decade has seen base petrochemicals production in North America and Europe shifting to the Mideast Gulf and East Asia. Saudi Arabia, Qatar, the UAE and Kuwait offered discounted feedstock to lure investment...”<sup>119</sup> Now, naphtha is the only feedstock available in quantities that would allow large-scale growth of Gulf petrochemicals production; however, McKinsey & Company (2014) notes: “If the only feedstock available is market-priced naphtha, the only new production that could compete on costs with other regions would be plants that supply the immediate region – a very limited opportunity. But if

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<sup>118</sup> “Historic Barzan Gas Project’s Train 1 More Than 95% Complete.” RasGas Press Release, 3 September 2014. Accessed 11 October 2014.

[http://www.rasgas.com/media/press\\_rasgas\\_barzan95percernintranets.html](http://www.rasgas.com/media/press_rasgas_barzan95percernintranets.html)

<sup>119</sup> Troner, Al. “Natural Gas Liquids in the Shale Revolution.” James A. Baker III Institute for Public Policy, Rice University. 2013. Pg. 63

the region's governments decide that they want to expand petrochemical production in order to diversify and grow their economies, then one option could be to make naphtha available at a cost advantage relative to global prices. This could make Middle East production competitive again, and large-scale expansion could continue."<sup>120</sup>

The boom in shale production has pushed the center of gravity in the petrochemicals industry back towards North America, according to Troner (2013): "The Shale Revolution will be a game-changer, because the prospect of discounted feedstock, coupled with the sector's technological prowess and operational flexibility will increase greatly the competitive strength of US firms...Most US based companies have already put into motion plans for expanding ethylene capacity, and international American petrochemical companies such as Dow are hedging their investment bets in Saudi Arabia and China, by undertaking large scale projects also in the US."<sup>121</sup> However, the rapid growth of ethane-based petrochemicals at the expense of naphtha-based petrochemicals in the United States has led to a reduced propylene yield. About 15% of product yield in naphtha cracking is propylene; this number is reduced to 1% in ethane-based petrochemicals production. To make up for the shortfall, propane-fed propane dehydrogenation (PDH) plants – which produce propylene directly – are in demand; US-based petrochemicals producers plan three PDH plants, which will result in a 120,000 b/d (approximately 11%) increase in US propane demand, according to an Oxford Institute for Energy Studies report.<sup>122</sup>

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<sup>120</sup> Budde, Florian; Günther, Christian; Shah, Mihin. "When Gas Gets Tight: Next Steps for the Middle East Petrochemical Industry." McKinsey & Company. April 2014. [http://www.mckinsey.com/insights/energy\\_resources\\_materials/when\\_gas\\_gets\\_tight\\_next\\_steps\\_for\\_the\\_middle\\_east\\_petrochemical\\_industry](http://www.mckinsey.com/insights/energy_resources_materials/when_gas_gets_tight_next_steps_for_the_middle_east_petrochemical_industry) Accessed 3 October.

<sup>121</sup> Troner, Al. "Natural Gas Liquids in the Shale Revolution." James A. Baker III Institute for Public Policy, Rice University. 2013. Pg. 63

<sup>122</sup> Fattouh, Bassam. "The US Shale Revolution and the Changes in LPG Trade Dynamics: A Threat to the GCC?" Oxford Energy Comment. The Oxford Institute for Energy Studies, July 2014. Page 6-7.

Despite the high likelihood that that US propane demand will expand rapidly in the years ahead, the shale revolution has led to levels of growth in LPG production that enable booming export volumes in spite of robust domestic demand; indeed, expanded LPG production in the US has already altered the LPG market and threatens Qatar's position. Middle East LPG production has grown significantly since 2002 and now represents about 40% of the international LPG trade. However, US LPG production has expanded rapidly in tandem with the shale gas revolution and is expected to continue to grow into the next decade. This development has enabled ever-rising volumes of US LPG exports and will affect Qatar's targeted market in Asia Pacific, where demand for LPG in the domestic sector continues to grow rapidly. According to Fattouh (2014): "First, as Asian consumers increase their purchase of US LPG in an attempt to diversify their sources of supply and gain access to cheaper LPG, GCC's share of LPG exports to Asia is expected to fall. Second, LPG prices and the existing pricing mechanism may come under pressure from intense competition from US supplies."<sup>123</sup> US LPG exports have risen from 67,000 b/d in 2008 to 332,000 b/d in 2013. A Baker Institute report says that Qatar sold about 700,000-730,000 b/d of LPG, mostly to Asian buyers, in 2012; meanwhile, "Texas alone will add half as much export capacity...by 2015..."<sup>124</sup> In a more recent Baker Institute report, Troner (2014) suggests that the surge in US LPG production will threaten Qatar's position sooner than anticipated by his report published in 2013: "Texas alone will have LPG export capacity equal to that of Qatar and Saudi Arabia by no later than 2016, and possibly by [2015]."<sup>125</sup>

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<sup>123</sup> Fattouh, Bassam. "The US Shale Revolution and the Changes in LPG Trade Dynamics: A Threat to the GCC?" Oxford Energy Comment. The Oxford Institute for Energy Studies, July 2014. Page 2.

<sup>124</sup> Troner, Al. "Natural Gas Liquids in the Shale Revolution." James A. Baker III Institute for Public Policy, Rice University. 2013. pg. 72.

<sup>125</sup> Troner, Al. "Shale Gas and Tight Oil." James A Baker III Institute for Public Policy. Rice University, 7 October 2014. Accessed 11 October 2014. <http://bakerinstitute.org/media/files/files/47ee20e6/Pub-CES-Troner-100714.pdf>

Though the shelving of the Al-Sejeel petrochemicals project in September 2014 may free some LPG volumes for export that would have been converted in Qatar, QP still plans to expand petrochemicals production in the years ahead – which will inevitably constrain Qatar’s ability to respond to a changing LPG market in Asia. Additionally, Al-Sejeel plans may be reconfigured to allow the plant to produce higher value products, so the project should not be considered abandoned entirely. Qatar is now the GCC’s largest LPG exporter, but its production will plateau, at least temporarily, once Barzan comes online in 2015 – with total LPG output reaching 11.5mn t/y.<sup>126</sup> QP’s \$11bn project aimed at boosting crude production at Bul Hanine from 45,000 b/d to 90,000 b/d will add further LPG volumes; it is unclear how much LPG the Bul Hanine development will yield – though certainly the level of NGLs production from the expansion will not be enough to greatly affect Qatar’s position in the LPG market. It is also possible that the high cost of the Bul Hanine development – which is higher per incremental barrel than some of the world’s most notoriously expensive projects, like Kashagan offshore Kazakhstan in the Caspian Sea – will lead QP to abandon its plans. Either way, Qatari LPG production has either reached – or is nearing – its plateau, while domestic LPG demand continues to expand as a result of growth in petrochemicals production. Fattouh (2014) said that while Qatari LPG exports are expected to remain stable at around 10-11mn t/y between 2014 and 2017, exports will start to fall by 2018: “Proposed domestic petrochemical projects such as Al Sejeel, Al Karaana, and Qapco project expansion will consume Qatari LPG volumes, cutting its exports to around 8-9 [mn t/y] in 2018.”<sup>127</sup>

Qatar and the rest of the Gulf will first feel the impact of the shale revolution in the LPG market, according to Troner’s report on NGLs (2013): LPG was the first product of the boom in US shale oil and gas production to reach global markets. US production has already

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<sup>126</sup> Fattouh, Bassam. “The US Shale Revolution and the Changes in LPG Trade Dynamics: A Threat to the GCC?” Oxford Energy Comment. The Oxford Institute for Energy Studies, July 2014. Page 11.

<sup>127</sup> Ibid, 11-12.

“flooded Latin America, West Africa and NW Europe [and] have begun to penetrate into the Mediterranean...”<sup>128</sup> Troner notes that the widening of the Panama Canal (see chapter III) will allow US LPG to better approach the Asian market so coveted by Qatar.

c. Condensate

While the LPG market in Asia will likely be among the first of Qatar’s key hydrocarbons markets to feel the effect of the North American shale revolution, its position in the condensate market in Asia will soon follow a similar path. Condensate production in the United States, much of which is produced by the three most prolific shale developments – Eagle Ford, Bakken, and the Permian Basin – is expected to grow significantly in the coming years (see figure 4.3). Just one shale play, Eagle Ford, produces as much field condensate as all of Qatar’s combined production in 2014. Already, some US condensate production is exported to markets in Asia and Europe.

**Asia Pacific Energy Consulting: Condensate Production & Forecast, Key US Shale Developments ('000 b/d)**

<b>Field</b>	<b>2011</b>	<b>2012</b>	<b>2014</b>	<b>2016</b>	<b>2018</b>	<b>2020</b>
<b>Eagle Ford</b>						
Field Condensate	143	265	820	968	968	1078
Plant Condensate	32	35	55	80	90	123
Total Condensate	175	300	875	1048	1058	1201
<b>Permian Basin</b>						
Field Condensate	90	125	176	256	330	329
Plant Condensate	20	34	59	99	110	141
Total Condensate	110	159	235	355	440	470
<b>Bakken</b>						
Field Condensate	44	67	106	174	223	232
Plant Condensate	12	24	38	63	93	97
Total Condensate	56	91	144	237	316	329 <sup>129</sup>

<sup>128</sup> Troner, Al. “Natural Gas Liquids in the Shale Revolution.” James A. Baker III Institute for Public Policy, Rice University. 2013. pg. 88.

<sup>129</sup> Troner, Al. “Natural Gas Liquids in the Shale Revolution.” James A. Baker III Institute for Public Policy, Rice University. 2013. pg. 16.

Fig. 4.3: Condensate Production & Forecast, Key US Shale Developments ('000 B/D)  
Source: James A. Baker II Institute for Public Policy

Since the 1970s, federal law has banned the export of crude oil from the United States. The US Department of Commerce enforces the ban through the Bureau of Industry and Security (BIS), which employs a broad definition of what constitutes crude oil banned for export: “‘Crude oil’ is defined as a mixture of hydrocarbons that existed in liquid phase in underground reservoirs and remains liquid at atmospheric pressure after passing through surface separating facilities and which has not been processed through a crude distillation tower.” However, an ambiguous reinterpretation of the law, issued by the Department of Commerce in 2014, has since enabled exports of lightly modified field condensate. A couple of US condensate producers filed an application to the BIS in the first half of 2014 for clarification of an existing rule: could the firms export condensate that had undergone basic processing? The BIS responded that “lightly processed” field condensate could indeed be exported to markets abroad even though condensate had previously been subject to the oil export ban. But the BIS has not since clarified what exactly it means by “lightly processed” condensate. Previously, oil could only be exported if it had been processed into at least two separate and distinct products; Troner (2014) says that the rule change allows export of condensate that has undergone one (ambiguous) step beyond stabilization.<sup>130</sup> Since the process is less expensive than building condensate splitters, a number of which are planned in the United States, companies will now likely opt to export condensate to market rather directly, rather than build splitters and sell products to either the domestic or foreign markets.

The first five cargoes of lightly modified Eagle Ford condensate were shipped to market from Texas in summer 2014. All five were handled by Japanese trading firms – three

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<sup>130</sup> Troner, Al. “Shale Gas and Tight Oil.” James A Baker III Institute for Public Policy. Rice University, 7 October 2014. Accessed 11 October 2014.  
<http://bakerinstitute.org/media/files/files/47ee20e6/Pub-CES-Troner-100714.pdf>

by Mitsubishi and two by Mitsui – and all five were shipped by US firm Enterprise after being produced from Eagle Ford by Pioneer and a subsidiary of BHP Billiton. The first cargo was shipped to GS Caltex in South Korea, the second to ExxonMobil in Rotterdam, the third to Cosmo Oil in Japan, the fourth to Koch Industries in Rotterdam and the fifth to SK Energy in South Korea.<sup>131</sup> As this development unfolds, it will put supply and price pressure on Qatar’s market outlet in Asia. Indeed, US condensate exports are already shaping the marketplace. In response to US condensate exports, price reporting agency, Argus, launched a condensate index in August 2014: “The Argus Condensate Index (ACI)...is a key indicator of value for participants in the emerging market to supply petrochemical feedstocks from the US and other producers to Asia-Pacific...The ACI will bring transparency to a market affected by diverse price signals, including the relative value of crude and naphtha.”<sup>132</sup> Argus (2014) says that the ACI is a reflection of the “lowest delivered price in southeast Asia of the two most traded condensate grades in the region – Qatari Deodorized Field Condensate (DFC) and Australian North West Shelf (NWS).”<sup>133</sup> Qatar currently exports 22 cargoes of DFC a month, mostly to Asia, while Australia sends five cargoes of NWS per month to Asia, according to Argus data.

Qatar is the Middle East’s largest field condensate producer: in 2013, field condensate production reached 780,000 b/d – some 50,000 b/d higher than crude output.<sup>134</sup> The IEA (2014) says that it expects 50,000 incremental barrels once Barzan has ramped up to full output by 2016,<sup>135</sup> though project operator, RasGas, says that Barzan will add just 22,000 b/d

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<sup>131</sup> “Qatar Faces US Condensate Challenge.” Middle East Economic Survey. 19 September 2014. Volume 57, Issue 38. Accessed 11 October 2014.

<http://archives.mees.com/issues/1548/articles/51943>

<sup>132</sup> “Argus Condensate Index Launched.” Argus Media, 15 August 2014. Accessed 12 October 2014. <http://www.argusmedia.com/News/Article?id=922106>

<sup>133</sup> Ibid.

<sup>134</sup> Ibid.

<sup>135</sup> “Medium-Term Oil Market Report, 2014.” International Energy Agency. Paris, France.

of field condensate and 6,000 b/d of plant condensate.<sup>136</sup> In either scenario, Barzan's condensate volumes should be viewed as the last foreseeable boost to Qatari condensate output given the constraints discussed above.

Near the end of 2013, Platts reported that "Qatar supplies one in every eight barrels of condensates produced in the world's 4 million b/d market, and accounts for an even bigger share of the internationally traded market – Qatari exports make up as much as a third of today's waterborne condensates market..."<sup>137</sup> Qatar's condensate volumes target the Asian market, where demand for condensate in splitters or in petrochemicals is robust.

But demand for condensate at home will limit Qatar's ability to respond to the coming changes in the condensate market. Qatargas processes condensate at its 146,000 b/d condensate splitter, which came online in 2009. The Laffan Refinery, as the condensate splitter is known, has a production capacity of 61,000 b/d of naphtha, 52,000 b/d of jet fuel, 24,000 b/d of gasoil that is then converted to ultra-low sulfur diesel, and 9,000 b/d of LPG. Importantly, Qatargas is building a second condensate splitter, also capable of processing 146,000 b/d, set for completion in 2016 – which means that Qatari condensate exports will fall by about a third that year after production is diverted to Qatargas' new splitter. Platts suggested that since DFC and LSC condensate are "two of the most visibly traded condensates in the world" the "30% predicted fall in exports of both grades could have a substantial impact on the spot market for both."<sup>138</sup> As seen in Asia Pacific Energy Consulting's forecast for US condensate production in 2016 (see above), this timeframe corresponds with an uptick in US condensate production that the US market won't be able to

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<sup>136</sup> "Historic Barzan Gas Project's Train 1 More Than 95% Complete." RasGas Press Release, 3 September 2014. Accessed 11 October 2014.

[http://www.rasgas.com/media/press\\_rasgas\\_barzan95percernintranets.html](http://www.rasgas.com/media/press_rasgas_barzan95percernintranets.html)

<sup>137</sup> Ernsberger, Dave. "Tasweeq Predicts Steep Fall in Qatar Condensate Exports from 2016." 14 November 2013. Accessed 11 October 2014. <http://russia.platts.com/latest-news/oil/bali-indonesia/tasweeq-predicts-steep-fall-in-qatar-condensate-27630186>

<sup>138</sup> Ibid.

absorb; the supply overhang will push US condensate to foreign markets, likely Asia Pacific. Yes, Qatar will extract higher value products from its condensate splitters, but it will have to resign itself to a lesser role in the global condensate trade once the second splitter is completed. It is possible, however, that the market will be balanced to some extent by the fact that Qatari barrels will be taken off the market just as US exports rise. The US, however, will be able to more than compensate for lost Qatari barrels: Troner, author of reports cited in this paper and President of Houston-based Asia Pacific Energy Consulting, told the Middle East Economic Survey in September 2014 that between just two shale developments in the United States, the Permian basin and Eagle Ford, the United States will have 1mn b/d of condensate available for export by 2020. As cited in the Middle East Economic Survey, Troner said: “Complementary to Asia’s desire to reduce its dependence on Middle East condensate, there’s an evolving structural supply overhang in the US, to be followed by Canada and Mexico. The very fact that there’s an alternative supplier who can supply in bulk, long-term on a different pricing basis, well that challenges the Gulf’s idea that Asia is its back yard.”<sup>139</sup> Qatar is a waning crescent in the condensate market and will have far less leverage in the market by 2016 – meaning that it will not be able to effectively defend either market share or price.

#### d. Piped Gas

Qatari gas production is also distributed to the regional market through the 3.2 bn cfd Dolphin pipeline, which connects Qatari resources to the booming demand centers of the UAE and Oman. Across the Gulf, subsidized gas prices are fueling very high gas demand growth rates and even major hydrocarbons producers are struggling to keep pace. Since the

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<sup>139</sup> “Qatar Faces US Condensate Challenge.” Middle East Economic Survey. 19 September 2014. Volume 57, Issue 38. Accessed 11 October 2014. <http://archives.mees.com/issues/1548/articles/51943>

discovery of the North Field in Qatar, several plans for intra-Gulf gas pipeline networks were mooted but subsequently abandoned; Dolphin is the only such plan brought fully to fruition. A gas pipeline connecting Iran to Sharjah in the UAE was indeed built by Emirati firm, Crescent Petroleum, following a 2001 agreement to export 5.2bn cm/y of Iranian gas from the Salman field; however, no gas has ever been delivered to the UAE by the line. Though the two sides agreed to a price of less than \$1/mn BTU, Iranian parliamentary opposition to the low price mechanism blocked gas sales.<sup>140</sup> Qatar and its gas consuming neighbors in the GCC failed to execute earlier plans to link producer and consumer in the region.

In the late-1980s and early-1990s, Qatar hoped to build a 10bn cm/y pipeline to the UAE and Oman and a 16.5bn cf/y pipeline connecting Qatari resources to Bahrain, Saudi Arabia and Kuwait. At the time, Qatar viewed piped exports as a cheaper alternative to LNG as a way of monetizing gas production – indeed, the capital costs of building the pipeline network would have been shared by the GCC consumers. However, a series of intra-GCC political conflicts delayed and, eventually, halted the pipeline plans, which at one point included an ambitious scheme to extend the network to Pakistan. Saudi Arabia was the first to back out of the pipeline plan: in 1990, a border dispute between Saudi Arabia and its longtime rival, Qatar, led Saudi Arabia to cancel its plans to import Qatari gas and refuse transit rights that would have allowed the pipeline to reach Kuwait. A separate border dispute between Qatar and Bahrain torpedoed the planned pipeline section between the two. Finally, Qatar found it difficult to secure a favorable pricing scheme for its gas.<sup>141</sup> The GCC regional gas pipeline was to be tied to Phase 2 of North Field development. Meanwhile, Qatar and Israel held an initial round of talks in 1996 in an effort to reach an agreement on a gas

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<sup>140</sup> Jalilvand, David R. “Iran’s Gas Exports: Can Past Failure Become Future Success?” The Oxford Institute for Energy Studies, June 2013. Page 8.

<sup>141</sup> Krane, J.; Wright, S. “Qatar ‘Rises Above’ Its Region: Geopolitics and the Rejection of the GCC Gas Market.” London School of Economics and Political Science. The Kuwait Programme on Development, Governance and Globalisation in the Gulf States. Number 35, 2014. Pg 10-11.

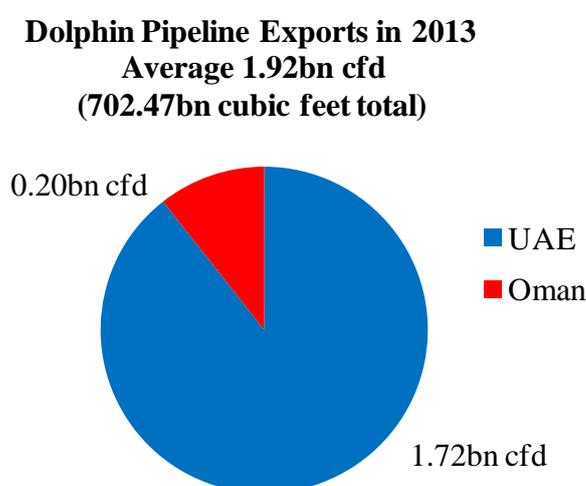
pipeline to the East Mediterranean energy importer; however, the discussion remained stalled for several years before ultimately reaching a political impasse in the wake of the second Palestinian intifada in 2000.<sup>142</sup> Changes in the regional energy scene have since precluded the development of the Qatar-Israel gas pipeline, as the latter has since discovered significant offshore gas resources of its own. After the collapse of the GCC gas pipeline plan, Qatar instead opted to pursue LNG as the primary means of monetizing its gas production – a move that proved prescient as LNG has since enabled massive expansion of the country’s economy. With a bit of retrospect, Saudi Arabia, Kuwait and Bahrain likely regret letting politics get in the way of plans to secure Qatari gas. All three face a gas crunch; Kuwait already imports LNG and is considering larger volumes of LNG imports and Bahrain also plans to install a floating storage and regasification unit (FSRU) in the coming few years as gas demand quickly approaches production levels. Qatar did, however, continue talks with the UAE and Oman and eventually built a pipeline connecting these two markets to North Field production.

Dolphin Energy, a joint venture of state-owned UAE firm Mubadala Petroleum (51%), France’s Total and US mini-major Occidental Petroleum (24.5% each), produces wet gas from its upstream assets in the North Field, which is then stripped into sales gas at the Ras Laffan processing center onshore Qatar. Concrete plans for the pipeline began to take shape in 1999, when UAE Offsets Group, the project’s original sponsor, signed a memorandum of understanding with the Dubai Supply Authority (DUSUP) for the delivery of between 200-700mn cfd of gas. Finally, after years of negotiations, a sales agreement was signed in 2005 between Dolphin and DUSUP – signaling that the project would move forward. Gas deliveries would begin at a price of just \$1.30/mn BTU and would increase at a

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<sup>142</sup> Hashimoto, K.; Ellass, J.; Eller, S. “Liquefied Natural Gas From Qatar: The Qatargas Project.” *Natural Gas and Geopolitics: From 1970 to 2040*. Eds. Victor, D. et al. Cambridge University Press. Cambridge, 2006. Pg 261-262.

rate of about 1.5% annually.<sup>143</sup> The pipeline began gas exports to the UAE in 2007 and Oman the following year. Since deliveries began in 2007, extrapolating prices from that point suggests that prices likely reached just \$1.45/mn BTU in 2014, though some reports indicate that prices have risen to about \$1.50/mn BTU.<sup>144</sup> Because production costs are so low at the North Field, Qatar and Dolphin’s partners are still able to turn a profit on Dolphin gas despite the very low sales price paid by Emirati and Omani consumers.



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Fig. 4.4: Dolphin Pipeline Exports in 2013  
Source: BP Statistical Review of World Energy, 2014

While Dolphin is currently unable to push gas at its nameplate 3.2bn cfd capacity, the company is in the process of installing three additional compressors (to reach a total of nine

<sup>143</sup> “Dolphin Project Clears Final Hurdle After Dubai Gas Sales Breakthrough.” Middle East Economic Survey. 9 May 2005. Volume 48, Issue 19. Accessed 5 October 2014.

<http://archives.mees.com/issues/326/articles/13403>

<sup>144</sup> “Oxy Sticks to Mideast Divestment Plan.” Middle East Economic Survey. 8 August 2014. Volume 57, Issue 32. Accessed 5 October 2014.

<http://archives.mees.com/issues/1542/articles/51790>

<sup>145</sup> BP Statistical Review of World Energy, 2014.

<http://www.bp.com/en/global/corporate/about-bp/energy-economics/statistical-review-of-world-energy.html>

compressors) that will enable the pipeline to transport gas at capacity. The high cost of installing the additional compressors, \$370mn, suggests that Dolphin expects to be able to secure additional supplies; however, there are several issues complicating the company's drive to boost sales volumes. First, Qatar, the UAE and Oman are unable to agree on a pricing mechanism for any additional gas sales above the current level. While about 2bn cfd are contracted to buyers in Abu Dhabi, Dubai and Oman, occasional sales of small additional volumes are significantly more costly than contracted volumes: according to Krane and Wright (2014), "Recent sales provide further information on the value of gas in the Persian Gulf. First among them is the so-called 'interruptible supply' of between 1.2 bcm and 3 bcm/year of Qatari gas sold to Abu Dhabi via the spare capacity in the Dolphin Pipeline. That gas is reportedly priced near US\$5/MMBtu. In 2011, Dolphin Energy resold Qatari gas in the UAE for between US\$7 and US\$10/MMBtu."<sup>146</sup>

There is also uncertainty surrounding the shareholder structure at Dolphin Energy, which may affect the company's ability to secure additional gas volumes from Qatar Petroleum and strike sales deals with Emirati and Omani buyers. Shareholder pressure in early 2013 compelled Occidental Petroleum to adjust its exposure to the Middle East, and it has since tried and failed to offload various regional assets. One such asset appears to be its stake in Dolphin Energy, with Mubadala Petroleum expected to pick up Occidental's stake.<sup>147</sup> But political tension between Qatar and the UAE, which boiled to the surface in early 2014 when the UAE, Saudi Arabia and Bahrain pulled their ambassadors from Doha due to Qatar's support for the Muslim Brotherhood in Egypt, may complicate Occidental's ability to sell its

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<sup>146</sup> Krane, J.; Wright, S. "Qatar 'Rises Above' Its Region: Geopolitics and the Rejection of the GCC Gas Market." London School of Economics and Political Science. The Kuwait Programme on Development, Governance and Globalisation in the Gulf States. Number 35, 2014. Pg 6.

<sup>147</sup> "Mubadala's Star Rises as Oxy's Middle East Asset Sale Shifts Course." Middle East Economic Survey. 29 August 2014. Volume 57, Issue 35. Accessed 5 October 2014. <http://archives.mees.com/issues/1545/articles/51856>

stake in Dolphin. Likewise, political tension between Qatar and the UAE makes it unlikely that Qatar will want, in essence, to commit to further subsidizing UAE industry through cheap piped gas exports.

There are also unanswered questions as to where additional volumes will be sourced, given that Dolphin's upstream assets are capped at about 2bn cfd and are subject to the moratorium on North Field development. One of the joint venture partners, Total, said in 2013 that additional volumes could be diverted from LNG plants as they undergo maintenance; however, there is no foreseeable scenario in which maintenance at liquefaction plants would free up 1.2bn cfd for Dolphin to boost throughput to its 3.2bn cfd capacity: 1.2bn cfd is equivalent to about 9.2mn t/y of LNG, about 12% of Qatar's total LNG production capacity. Any maintenance of LNG facilities would free much lower volumes for Dolphin export and only for relatively short periods. Another possible source of additional supply is a gas reservoir in the Khuff formation beneath the onshore Dukhan oil field, which QP uses as a 500mn cfd supply cushion for its LNG trains;<sup>148</sup> however, the reservoir is important to the much more lucrative LNG export facilities and it is unlikely that significant volumes would be diverted to Dolphin. Any surplus gas from the 1.4bn cfd Barzan project, discussed above, may provide Dolphin with additional gas volumes, though most of Barzan's future output is already set for use in power and water desalination plants.<sup>149</sup> Likewise, Khuff and pre-Khuff gas discoveries, also discussed above, represent a possible source of additional Dolphin exports. Even if no additional volumes are secured, upstream developments in Oman – which will bring online the 1bn cfd first phase of the BP-operated Khazzan tight gas project in 2018 – may allow the UAE to buy Oman's share of Dolphin gas. Khazzan will help Oman to meet its gas requirements. As quoted in the Middle East Economic Survey, undersecretary

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<sup>148</sup> "Dolphin Upgrade Scheduled for End-2014 Completion." Middle East Economic Survey. 9 May 2014. Volume 57, Issue 19. Accessed 5 October 2014.

<http://archives.mees.com/issues/1529/articles/51464>

<sup>149</sup> Ibid.

of Oman's Oil and Gas Ministry, Salim al-Aufi said in early 2014: "The import of gas from Dolphin is very small. These imports will be phase out as soon as we get more local gas."<sup>150</sup>

Of course, both the UAE and Oman want to avoid paying a price up to seven times higher than what is currently paid for Dolphin's piped gas, while Qatar and Dolphin's partners hope to secure higher prices for any additional volumes sold. However, there is reason to believe that the UAE, in particular, would accept significant price increases if additional Dolphin volumes are secured: already, Dubai imports LNG, and the UAE plans to build a second, larger, import facility in Fujairah on the Gulf of Oman – which will be capable of importing the regasified equivalent of 1.2bn cfd (though some reports suggest that the Fujairah facility will eventually be capable of regasifying up to 15mn t/y of LNG, the equivalent of about 1.97bn cfd).<sup>151</sup> There would be clear cost savings if the UAE buys a further 1.2bn cfd of Dolphin volumes, rather than opt for greater levels of LNG imports – the cost of which is compounded by the high capital costs of building regasification facilities.

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<sup>150</sup> "Petrofac Bags \$1.2bn Oman Gas Deal." Middle East Economic Survey. 28 February 2014. Volume 57, Issue 9. Accessed 5 October 2014. <http://archives.mees.com/issues/1519/articles/51201>

<sup>151</sup> "Emirates LNG Assessing Fujairah Terminal Bids." MEED. 24 September 2014. Accessed 5 October 2015. <http://www.meed.com/sectors/oil-and-gas/gas/emirates-lng-assessing-fujairah-terminal-bids/3195650.article>

## CHAPTER V

### DISCUSSION: QATAR'S RESPONSES TO THE EVOLVING LNG MARKET

The LNG market is set to undergo a long-term structural shift, one that is unfavorable to Qatar both in terms of price fetched for LNG and LNG market share. Qatar Petroleum and its LNG subsidiaries, Qatargas and RasGas, are thought to understand fully the implications of the changing LNG marketplace; the problem, however, is that it is less clear if Qatar is taking the necessary steps to prepare for a reduced role in the LNG market. In the current LNG market, Qatar is king: indeed, its market share eclipses that of Saudi Arabia's respective role in the global oil market. While Saudi Arabia's importance in the world oil market is due, in large part, to the fact that it is the only major "swing producer," with some 3mn b/d of spare capacity, it produced just over 13% of total world oil production in 2013. As discussed above, Qatar currently supplies more than a third of world LNG. It is, of course, an imprecise comparison since oil is an inherently global commodity while gas is mostly a local and regional product; oil is also in far greater demand than LNG and there are far fewer LNG producers than there are oil producers. However, with demand for LNG on the rise, gas is gradually evolving into a global commodity, as well.

As discussed in Chapter III, Australian and North American LNG – among other new sources – will inherently reduce Qatar's ability to defend both market share and price in the years ahead. While Qatar comes to terms with this reality, it is less clear if the Gulf LNG giant is prepared to take the necessary steps to secure its future in the LNG industry – though massive state LNG revenues and expansive budget surpluses enable a multi-tiered response.

## A. The International Push

It is highly unlikely that Qatar views itself as a waning crescent within the global LNG industry, and – while it remains unclear if it will respond aggressively to a changing marketplace – Qatar has already taken several steps to better position itself in the evolving LNG market. Qatar Petroleum’s international expansion, part of a wider trend among Gulf NOCs to grow into “international national oil companies,” is the clearest example yet of the country proactively addressing its predicament. Indeed, Qatar’s global push may be the most effective way to address questions of market share and influence in future LNG pricing dynamics.

When Qatar Petroleum International (QPI) was founded in 2005, it appeared that the wholly-owned QP subsidiary would focus on oil investments abroad, particularly downstream oil projects. QPI entered the Gulf energy scene just as its peers were also developing international proxies and buying up stakes in refineries around the world. Like Saudi Aramco and its subsidiaries, as well as Kuwait Petroleum Corporation and its subsidiaries before it, QPI has cultivated relationships with companies and governments that have strong energy ties with Qatar – in particular, those that Qatar deem important to the future energy market. Qatar’s international energy strategy has several benefits for the state: it secures markets for Qatari LNG and creates interdependencies of value to Qatar both economically and politically. As Gray (2013) noted: “This is likely to have a positive impact on QP’s image and bottom line, but also is part of the microstatism that characterizes Qatar’s approach to international economic relations and diplomacy...it is a deliberate strategy to develop relationships with key states and to see to it that they have an interest in Qatar’s stability and security.”<sup>152</sup>

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<sup>152</sup> Gray, Matthew. *Qatar: Politics and the Challenges of Development*. Lynne Rinner Publishers, Inc. Boulder, 2013. Page 91.

QPI's first foray into international energy projects failed: in the first two years after its founding, QPI was in talks with Lebanese authorities regarding plans to construct a 150,000 – 200,000 b/d export-oriented refinery near the coastal city of Sidon, Lebanon. However, talks were thrown off course by the July 2006 Israeli war on Lebanon, and, ultimately, the project failed to advance beyond abstract discussions. Arguably, QPI's interest in building a refinery in Lebanon was more aligned with Qatar's interest in supporting Lebanon from a political standpoint. QPI quickly reorganized itself, however, developing a vision for how to better align its interests with the international energy market and the economic needs of the state.

QPI's early investments focused on downstream refining and petrochemicals opportunities, often partnering with international oil companies with operations in Qatar – such as a petrochemicals joint venture with Shell in Singapore. Until recently, QPI pursued a more cautious approach to international investments than the international arms of other Gulf NOCs. Kuwait Petroleum International has several refining assets and a wide retail fuel network in Europe and is pursuing joint venture refineries in Asia as a means of securing long-term outlets for Kuwait's crude exports. Kuwait's overseas upstream arm, Kuwait Foreign Petroleum Exploration Company (KUFPEC) has a range of producing assets across a wide geographic spread. KUFPEC is also the second largest player in the Chevron-led Wheatstone LNG project in Australia and, in October 2014, teamed up with Chevron to develop shale assets in Canada – representing the first Gulf investment in North American shale. For its part, Saudi Aramco's international presence includes a range of refinery investments around the world, focused primarily on the United States, South Korea and Japan. By contrast, QPI's investment strategy has only gradually adopted the same level of assertiveness. In 2008, QPI said that it would produce the equivalent of some 10% of Qatar's

in-country oil production by 2012 through its foreign investments.<sup>153</sup> But it never fulfilled its promise: QPI instead made small “test” investments to gauge possible outcomes and better understand the role QPI can play as part of Qatar’s energy industry. For example, QPI bought a 20% stake in two of Total’s exploration assets in Mauritania. QPI’s strategy has shifted since 2013, however, and it is now approaching international energy opportunities more aggressively. Qatar has essentially reached peak oil and gas output at home, as discussed in Chapter IV, but its struggles in boosting oil output and in its deep gas drive – and, importantly, the moratorium on new developments at the North Field – do not deter Qatar from redirecting its revenues to oil and gas projects abroad. Through QPI, Qatar is able to boost “Qatari” oil and gas output even in the face of constraints facing oil production at home.

Between 2011 and 2014, QPI developed a partnership with UK firm, Centrica (a significant buyer of Qatari LNG), to jointly pursue oil and gas opportunities. While the relationship began as a mere memorandum of understanding to cooperate in the energy sector, QPI and Centrica finalized a deal in 2013 to develop conventional oil and gas assets in Canada; QPI expanded its share of Centrica’s Canadian upstream business in 2014.<sup>154</sup>

A core element of QPI’s logic is to secure Qatar’s position by investing across the gas value chain, linking Qatar’s LNG carriers (owned by Qatar Gas Transport Company, Nakilat, itself partially-owned by Qatar Petroleum) to QPI-owned (67.5% stake) 15.6mn t/y LNG receiving terminal at South Hook in the UK. QPI is also considering building a gas-fired power plant near South Hook. QPI also has a 22% stake in the Adriatic LNG Terminal in Italy, which has the capacity to meet some 10% of Italian gas demand. Additionally, the

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<sup>153</sup> “QP Looks Beyond Its Shores For Next Phase of Expansion.” Middle East Economic Survey. 28 April 2008. Volume 51, Issue 17. Accessed 26 October 2014.  
<http://archives.mees.com/issues/189/articles/7215>

<sup>154</sup> “QPI Makes Second Canada Move With UK’s Centrica.” Middle East Economic Survey. 9 May 2014. Volume 57, Issue 19. Accessed 26 October 2014.  
<http://archives.mees.com/issues/1529/articles/51465>

terminal has a contract with Italy's Edison for 80% of its imports to be sourced from RasGas II.<sup>155</sup> QPI will likely continue to pursue further opportunities across the gas and LNG value chain as it directs capital towards strengthening its position in the market.

QPI's single most telling investment is its planned \$10bn, 15.6mn t/y Golden Pass LNG export facility in Texas with ExxonMobil (QPI 70%, ExxonMobil 30%). In 2006, QPI (70%) initiated a plan to build a 15.6mn t/y LNG import facility in Texas with ExxonMobil (17.6%) and ConocoPhillips (12.4%),<sup>156</sup> which received its first cargo in 2010<sup>157</sup> – shortly before the full extent of the shale gas revolution was understood by the oil and gas industry. As a result of booming gas production in the United States, LNG imports quickly dried up, leaving Golden Pass idle and rendering the import project a failure. Though it briefly appeared that Golden Pass would essentially be nothing more than a write-off for its shareholders, booming gas output in the United States compelled QPI and ExxonMobil to instead opt to pursue an export facility using some of the existing terminal infrastructure. ConocoPhillips is not involved in the export project.

The Golden Pass LNG export facility will allow Qatar to grow its LNG portfolio by nearly 11mn t/y – QPI's equity share of LNG from Golden Pass. This represents a nearly 14% boost to Qatar's existing LNG export capacity of 77mn t/y, currently produced in Qatar itself. Qatar will likely wait to see how Golden Pass performs before risking further investments elsewhere, but the investment demonstrates the clearest way in which Qatar can respond to an evolving LNG market: when its market share comes under threat, Qatar can buy up LNG production assets internationally.

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<sup>155</sup> Adriatic LNG Terminal Website. Accessed 10 November 2014.  
<http://www.adriaticlng.com/wps/portal/alng/en/terminal>

<sup>156</sup> "QP Urges LNG Lenders to Accept More Risk as Pricing, Spot Sales Evolve." Middle East Economic Survey. 18 September 2006. Volume 49, Issue 38.  
<http://archives.mees.com/issues/271/articles/10991>

<sup>157</sup> "Golden Pass LNG Terminal Announces 1<sup>st</sup> Cargo for Commissioning." Press Release, 8 September 2010. Golden Pass LNG.  
<http://goldenpassterminal.com/index.cfm/newsroom/detail/1>

Between regulatory hurdles and long construction lead times for LNG infrastructure, it is unlikely that the Golden Pass LNG export facility will be operational before the end of the decade. However, regulatory developments in 2014 likely put Golden Pass ahead of a number of its potential future competitors in the process of receiving regulatory approval for LNG exports. In 2014, the United States Department of Energy changed the rules for applicants hoping to export LNG to countries with which the United States does not have free trade agreements (FTAs), like the key LNG markets of Japan and China. Previously, on a first-come, first-serve basis, companies applied for licenses from the Department of Energy – a relatively inexpensive process. However, companies would then undergo a time-consuming and costly licensing process with the Federal Energy Regulatory Commission (FERC); Golden Pass was ninth on a lengthy list of applicants before a rule change. The new Department of Energy rules stipulate that companies first receive FERC approval before approaching the Department of Energy for a license to export LNG to non-FTA countries. When the new set of rules came into effect in August 2014, companies like Golden Pass – i.e., those with strong financial backing – were able to bypass the queue; FERC approval costs firms up to \$100mn, immediately weeding out applicants who hoped to first secure licenses in order to then attract capital. With access to coffers as deep as those of QPI and ExxonMobil, Golden Pass will likely be among the early exporters of US LNG if the partnership receives approval. According to a Golden Pass press release, the “FERC permitting process will involve an Environmental Impact Study and multiple agency regulatory reviews, a public comment period and other public input opportunities.” The firm submitted its application in July 2014, and it appears that Golden Pass believes it will secure FERC approval by the end of 2015; indeed, given the fact that the facility will make use of an existing terminal, the environmental impact of the export facility will be far less than other proposed facilities across the United States, leaving fewer hurdles for Golden Pass to clear

before it is granted its FERC license. Golden Pass expects to take a final investment decision in 2015 and then intends to spend \$10bn over five years to construct the LNG export infrastructure. Further evidence of Golden Pass' growing confidence that it will receive regulatory approval, the firm awarded in July 2014 a Front-end Engineering and Design contract to Japan's Chiyoda Corporation, which has also helped Qatari firms in the design of export facilities in Qatar. Golden Pass says that "during the FEED stage of the project, Golden Pass and its contractors will further define the technical, design and cost components of the LNG liquefaction and export facilities."<sup>158</sup>

It is difficult to overstate the importance of this development for Qatar's position in the LNG industry. When Qatar surpassed Indonesia as the world's largest LNG supplier in 2008, it assumed a role in the industry that none of its predecessors matched: buyers now look to Qatar both for supply of LNG and for an understanding of the market in which they participate. Indeed, Qatar's leadership of the global LNG market takes many forms. But to maintain its current market share by 2020 given projects currently under construction, Qatar needs to buy significantly more LNG assets internationally – and the figure will continue to push upwards as planned projects receive final investment decisions in the coming year, boosting global LNG output capacity further by the end of the decade. North America is the most likely target given its low feedstock costs. Kuwait's KUFPEC, discussed above, has a 13.4% stake in the Chevron-led, 8.9mn t/y Wheatstone LNG project in northwestern Australia – giving KUFPEC an equity share of just 1.19mn t/y of LNG. As discussed in Chapter III, Australia will likely surpass Qatar in terms of its market share in the LNG industry, but the cost of feedstock is far higher than that available in the United States. However, Qatar can afford to absorb high feedstock and infrastructure costs – a comparatively small price to pay if Qatar can extend its role as LNG kingmaker and preserve

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<sup>158</sup> "Golden Pass Awards FEED Contract to Chiyoda and CB&I." Golden Pass Products press release. 30 July 2014. <http://goldenpassproducts.com/index.cfm/newsroom/detail/60>

its large voice in pricing dynamics. While it is unrealistic to expect Qatar to maintain control of a third of the LNG market, “Qatari” LNG output may very well grow in the years ahead as both supply of- and demand for- LNG expands across global markets.

## **B. Dominating Niche Markets**

Qatar can also use its deep pockets and its dominant position in the LNG market to corner some of the emerging micro-markets for LNG. A number of industry bodies, including OPEC and the IEA, forecast growing use of LNG as a bunker fuel in the years ahead. Long-haul shipping currently relies on heavy fuel oil as its primary bunker fuel; however, tightening carbon emissions standards issued by the International Maritime Organization (IMO) are forcing a rethink of fuel usage in seafaring vessels. The IMO has several Emissions Control Areas (ECAs), including along both coasts of North America and northern European waters, and plans more across a wider geographical spread. Australian, Japanese, Mediterranean as well as Dubai waters are all expected to be covered by IMO emissions controls in the years ahead. Effective January 2015, IMO rules require that bunker fuel burned in ECAs contain less than 0.1% sulfur; importantly, the IEA suggests that global refining capacity will not be able to meet the gap in ultra-low sulfur fuel oil. In response, shippers are increasingly looking to LNG as a bunker fuel, which – unlike heavy fuel oil – does not produce Sulfur Oxide or particulate matter and produces 80-90% less Nitrogen Oxide than heavy fuel oil, according to the IEA.<sup>159</sup> Already, a number of LNG import terminals have built LNG bunkering facilities and several of the world’s largest bunkering ports, including Rotterdam, have retrofitted their facilities to handle small volumes of LNG bunkering. Singapore, which supplies more bunker fuel than any other port, will launch a

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<sup>159</sup> “2014 Medium Term Gas Market Report: Market Analysis and Forecasts to 2019.” International Energy Agency. Paris, June 2014. Pg 45.

pilot LNG bunkering program in 2017 with a view to launch large-scale LNG bunkering by 2020.<sup>160</sup>

Qatar has already set itself apart as a leader in LNG bunkering. ‘Abd al-‘Aziz al-Muftah, director of Qatar Petroleum’s Industrial Cities program as well as chairman of the state firm’s Steering Committee on LNG as Fuel told OPEC’s July 2014 Bulletin: “Concrete initiatives will be taken by QP to build the first LNG-fuelled harbor tub for Ras Laffan port and the first two LNG-fuelled offshore service vessels for QP offshore fields.”<sup>161</sup> Additionally, Nakilat, RasGas and Qatargas agreed with German engine designer, MAN Diesel and Turbo to convert a 266,000 cubic meter Q-Max LNG carrier to use LNG as its bunker fuel in the main engines. Nakilat says that the LNG-burning Q-Max “will be the world’s first low-speed marine diesel engine to be converted to use LNG as a fuel.”<sup>162</sup> QPI is also involved in QENERGY Europe, which plans to import Qatari LNG and build LNG bunkering infrastructure at Croatian, Maltese, Greek, Cypriot, Bulgarian and Turkish ports. A Nakilat subsidiary will retrofit Greek ferries to burn LNG, an initial step in realizing QENERGY’s “Poseidon-Med” LNG bunkering program.<sup>163</sup>

Another potential growth market for LNG is in the road transport sector, where LNG may prove effective for use in long-haul trucking. Over time, LNG-fueled trucks will likely grow in number. The IEA says that, although, “first movers face higher than expected costs,

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<sup>160</sup> Xie, J.; Tan, F. “Singapore to Supply LNG to Ships by 2020 – Minister.” Reuters, 15 Oct. 2014. Accessed 10 November 2014.

<http://af.reuters.com/article/energyOilNews/idAFL3N0SA1E620141015>

<sup>161</sup> “Clean Ambitions: Qatar’s LNG Push as Marine Fuel Seen as Potential ‘Game Changer.’” OPEC Bulletin, July 2014. Vienna. Accessed 10 November 2014. Pg 15.

[http://www.opec.org/opec\\_web/static\\_files\\_project/media/downloads/publications/OB072014.pdf](http://www.opec.org/opec_web/static_files_project/media/downloads/publications/OB072014.pdf)

<sup>162</sup> “Qatar Champions LNG as Cleaner Marine Fuel.” Nakilat Press Release, 14 January 2014. Accessed 10 November 2014. [http://nakilat.com.qa/News/News\\_213](http://nakilat.com.qa/News/News_213)

<sup>163</sup> “Clean Ambitions: Qatar’s LNG Push as Marine Fuel Seen as Potential ‘Game Changer.’” OPEC Bulletin, July 2014. Vienna. Accessed 10 November 2014. Pg 15-16.

[http://www.opec.org/opec\\_web/static\\_files\\_project/media/downloads/publications/OB072014.pdf](http://www.opec.org/opec_web/static_files_project/media/downloads/publications/OB072014.pdf)

lack of training in truck service and maintenance shops, and some technical glitches with operation of the trucks...” the sector will grow “[a]s long as a significant gap remains between gas and diesel prices, switching is likely to occur.”<sup>164</sup> Thus far, there is scant evidence that Qatar is targeting this particular niche market for LNG, but it may well invest across the LNG trucking value chain in the future if the use of LNG-fueled vehicles grows in scale.

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<sup>164</sup> “2014 Medium Term Gas Market Report: Market Analysis and Forecasts to 2019.” International Energy Agency. Paris, June 2014. Pg 43.

## CHAPTER VI

### CONCLUSION

Though the international LNG market has experienced several years of tightness, very significant new volumes will reach the market starting in 2015. In the years ahead, Australia is expected to overtake Qatar as the world's largest supplier of LNG; the United States may soon follow in Australia's footsteps and surpass Qatari liquefaction capacity early next decade. New pricing mechanisms are on the way, as well, and global LNG prices will soon be exposed to comparatively low US Henry Hub gas prices. Henry Hub-linked LNG sales will put downward pressure on the price Qatar is able to fetch for its long-term contracted as well as short-term and spot LNG sales, particularly in its most important markets in Asia-Pacific, most notably Japan. Qatar has few options as it responds to unfavorable changes in the LNG market. The world's top LNG producer has no plans to build new export capacity, even as it watches its market share erode over the coming few years. Nearly a full decade since Qatar Petroleum issued a moratorium on new developments at the North Field, it appears that the state firm has no intention of lifting the restriction over the medium term. Once the 1.4bn cfd Barzan gas development – the last North Field development sanctioned before the moratorium was announced – is brought online in 2015, (and assuming Qatar continues to see poor results from its deep gas exploration program) Qatar will hit a gas production plateau and will have little room to maneuver in response to changing market dynamics; additionally, the plateau will affect other ways in which Qatar monetizes its gas output, such as condensate and LPG sales. Qatar can do little to defend its market share, which amounts to about a third of the total international trade of LNG; however, it can mitigate the impact of its waning position in the market over the medium term by buying into

foreign liquefaction projects. Qatar Petroleum International planted its flag in North American LNG, where it has a 70% stake in the planned 15.6mn t/y Golden Pass export project in Texas. An important question remains unanswered: to what extent will Qatar commit to defending its market share and to defending its preferred price? The answer will reveal itself in short order, as the Australian supply floodgates are set to open.

Meanwhile, the price of oil has fallen some 40% between mid-Summer 2014 and December when this thesis was completed. Since most LNG contracts still have pricing mechanisms linked to oil, LNG prices – particularly spot prices – are falling in tandem with oil prices. Lower LNG prices may delay final investment decisions at planned LNG export projects in North America and Australia. Additionally, LNG buyers will be less determined in their push to diversify pricing mechanisms if they are able to fetch relatively low oil-linked LNG prices. Indeed, lower LNG prices may postpone some of the market pressures discussed in the text of the thesis, perhaps allowing Qatar to maintain its market share for a bit longer than anticipated in the text; however, Qatar will have to contend with lower LNG prices in most foreseeable scenarios, and – inevitably – its status as LNG kingmaker will be eroded by new and expanded players.

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