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Panama Canal and LNG: Congestion Ahead?

Background and Introduction

With the ongoing expansion of US LNG exports from projects under construction and a long list of new US projects (yet to receive FID) potentially onstream in the early 2020s - the US could approach and perhaps exceed LNG output levels from Qatar and Australia. With no destination restrictions on US LNG cargoes, they are free to flow to importing markets which offer the best 'netback' whether on a spot, short term or medium term contractual basis.

The wide spread between Asian LNG spot price and European hub prices seen in (northern hemisphere) winter 2016/2017, and more especially winter 2017/2018, is a clear signal that new US LNG output will likely seek Asian markets. Not all US LNG will be destined for Asia however. Australia and Russia have LNG projects nearing completion which will also compete for incremental Asian demand growth. The balance of LNG supply after meeting Asian (and other market demand) will flow to Europe, some of which volume will inevitably be US-sourced LNG.

Clearly for Asia-bound US LNG cargoes, transiting the Panama Canal reduces voyage time and hence charter and fuel costs. The resulting savings are greater than the Panama Canal fee (discussed later). The recent expansion of the Canal capacity has not been without problems and LNG carriers are but one of many vessel types using the facility. The prospect of the Panama Canal becoming a 'bottleneck' for LNG supply from Atlantic basin to Asian markets is therefore a very real possibility.

This Energy Insight briefly reviews the history and characteristics of the Panama Canal and, using the output of a global LNG supply and demand balance model, addresses the following questions:

- What is the current capacity for LNG transit through the Panama Canal and what is the reasonable expectation of increased capacity in the next 5 years?
- What are the additional costs incurred for LNG carriers from the US to Asian markets if they have to seek alternative routes?
- If there is a future bottleneck to LNG tradeflows via the Panama Canal, when is this likely to occur and what might be the consequences in terms of pricing?

A Brief History of the Panama Canal

The Panama Canal was completed under US auspices in 1914 after an earlier failed attempt by Ferdinand de Lesseps (who built the Suez Canal). The French venture began in 1880 but went bankrupt nine years

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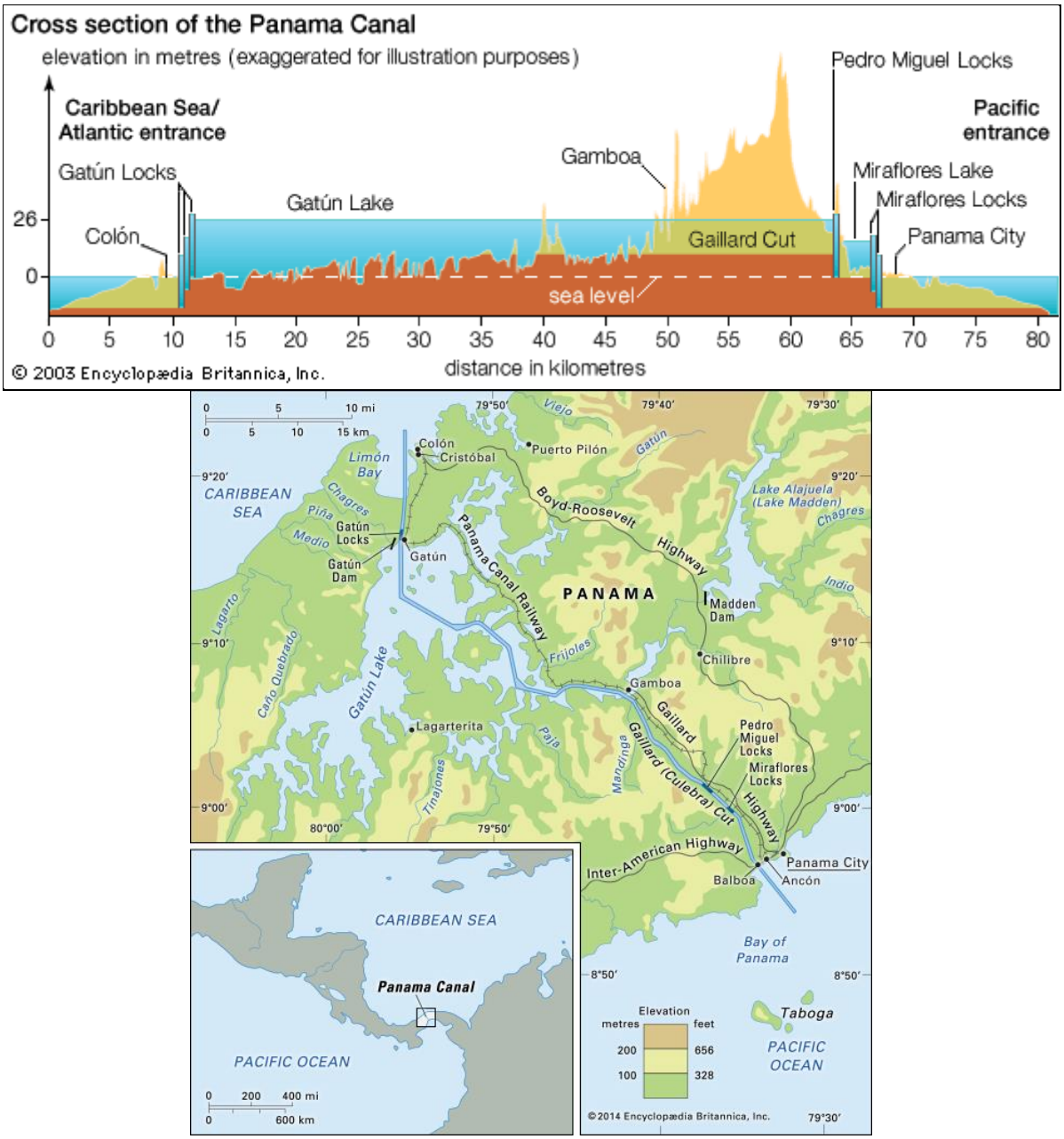
later with a loss of some 20,000 lives to Malaria, Yellow Fever and other tropical diseases[1]. From its opening in 1914, the Panama Canal was controlled by the United States. In 1979, control of the canal passed to the Panama Canal Commission, a joint agency of the United States and the Republic of Panama, and complete control passed to Panama on December 31, 1999. Administration of the Canal is the responsibility of the Panama Canal Authority[2].

Figure 1: Cross Section and Map of the Panama Canal



Source: Encyclopaedia Britannica

[1] 'Building the Panama Canal', Office of the Historian, US Department of State, https://history.state.gov/milestones/1899-1913/panama-canal
[2] 'Panama Canal', Encyclopaedia Britannica, https://www.britannica.com/topic/Panama-Canal

The Panama Canal Expansion, inaugurated in June 2016, was the largest infrastructure project in Latin America and the Caribbean since the Canal's opening in 1914. The Expansion included the construction of a new set of locks on the Atlantic and Pacific sides, creating a third lane of traffic and doubling the cargo capacity of the waterway. In this regard 'capacity' is difficult to define. The limiting factor is the number of 'transits' per day – this being the total in both directions – that the Canal locks, tugboats and other infrastructure can cope with. In 2017 the total number of transits was 13,548 (an average of 37 per day). This is irrespective of the size of vessel[3]. The expansion also included the creation of the Pacific Access Channel, improvement to the navigational channels, and improvements to the water supply. While the expanded locks are 70 feet wider and 18 feet deeper than those in the original Canal, they use less water due to water-saving basins that recycle 60% of the water used per transit[4].

Expansion Completed but Problems Persist

In 2017 media reports focussed on the claimed delays suffered by LNG tankers wishing to transit the Panama Canal. Specific problems cited were: getting the new lock to operate smoothly, too few tugboats to escort ships through the enhanced waterway, and the availability of just one transit slot per day for LNG vessels. The Panama Canal Authority refutes these claims[5]. The natural gas industry blames the Panama Canal Authority (PCA) for holdups, and PCA blames the industry for being 'lackadaisical' about transit timetables. Jorge Quijano, CEO of the PCA, states there are no plans to boost reservations for LNG tankers until they 'prove themselves worthy'. "We can focus on giving them a second slot when they start to behave with a more contract-like pattern with their suppliers and buyers". With container ships, "if they request a transit tomorrow, they'll be there tomorrow." LNG tankers, he said, "are a maybe."[6]

Nevertheless, by the end of 2017, Platts reported that the PCA was working with LNG shippers towards doubling the capacity set aside for LNG vessels by October 2018."Currently all LNG transits are limited to daylight hours. We are working towards lifting some transit restrictions by the third quarter of next year," the PCA said in a statement, adding that there are currently no transit delays.

In a more recent report the PCA, after a meeting with Cheniere executives said "As exports from the US increase, LNG transits could increase by 50% by as early as September," The PCA is also looking at ways to make using the canal more flexible in a bid to adapt to global LNG trading patterns. It stressed that "two-LNG-transit days have become more and more frequent as the result of the optimisation achieved by traffic scheduling and close co-ordination with Canal customers." The PCA is also offering more flexibility for LNG bookings so that LNG shippers can opt for the Panama Canal route even if that was not the original plan. It should be emphasised that the return 'ballast' voyage leg also counts towards the 'slots' available for LNG, as made clear in an IHS article in relation to LPG vessels[7]. This has an important bearing on the capacity of the Panama Canal to handle future US LNG export volumes. A single LNG slot per day (with half of these being return (empty) ballast voyages) would equate to 19.2 bcma of LNG flow from the US to Asia; two slots/day 38.3 bcma.

[3] Panama Canal Authority - https://www.pancanal.com/eng/op/transit-stats/2017/Table02.pdf
[4] 'The Expanded Panama Canal', Canal De Panama, http://micanaldepanama.com/expansion/
[5] 'The Facts about Transits at the Panama Canal', Huffpost, December 19th 2017, https://www.huffingtonpost.com/entry/the-facts-about-transits-at-the-panama-canal_us_5a382d13e4b0cebf48e9f652
[6] 'The Panama Canal is now a major problem for US Shale', Bloomberg, December 8th, 2017, https://www.bloomberg.com/news/articles/2017-12-08/u-s-shale-has-a-panama-canal-problem-that-s-got-no-easy-fix
[7] 'Panama Canal eyes more transit slots as demand escalates', IHS Fairplay, 6th June 2017, https://fairplay.ihs.com/commerce/article/4287441/panama-canal-eyes-more-transit-slots-as-demand-escalates (free registration).

Analysis of the potential future requirement for LNG transit through the Panama Canal

The following analysis leans heavily on the Author's model of past and future regional LNG supply and demand balances as referenced in past papers[8] and updated as market conditions and supply prospects evolve. The model is generally used to explore the impact of low and high Asian LNG demand cases on the balance and disposition of global LNG supply. Given that the 'nexus' for balancing the global market is Europe; and that in Europe LNG is potentially in competition with Russian pipeline supplies, there is the potential for a 'glut' of LNG in the period 2019 to 2022 – which would be cleared by a combination of fuel switching from coal to gas in European power generation, additional low spot price-induced LNG demand in Asia and, through the narrowing of spreads between Henry Hub and European hub prices, a reduction in US LNG exports. These factors are accounted for in the following outlooks for LNG demand and supply to 2035 shown in Figures 2 and 3.

Having defined supply sources and demand markets for LNG in the two cases shown in Figures 2 and 3, we now require a means by which to determine which volumes would, as a preference, seek transit via the Panama Canal. Such problems are normally addressed by complex modelling with the objective function of a 'lowest cost solution' for the system in question, resulting in an 'optimised' trade-flow pattern. In this paper a less complex, more pragmatic approach is taken.

Firstly, the LNG importing countries are grouped regionally, these categories being: Asia, MENA, South America, North America, Europe, Africa & Other and Bunkers[9]. Appendix 1 shows these groupings. The supplier countries are grouped in terms of the demand region (or regions) they would most likely serve based broadly on location and past destination markets. They are grouped on a loose geographical basis. The categories are: ASIA, ASIA MENA, EU, EU MENA, SWING, US. Appendix 2 lists which supplier countries fit within each of the above categories.

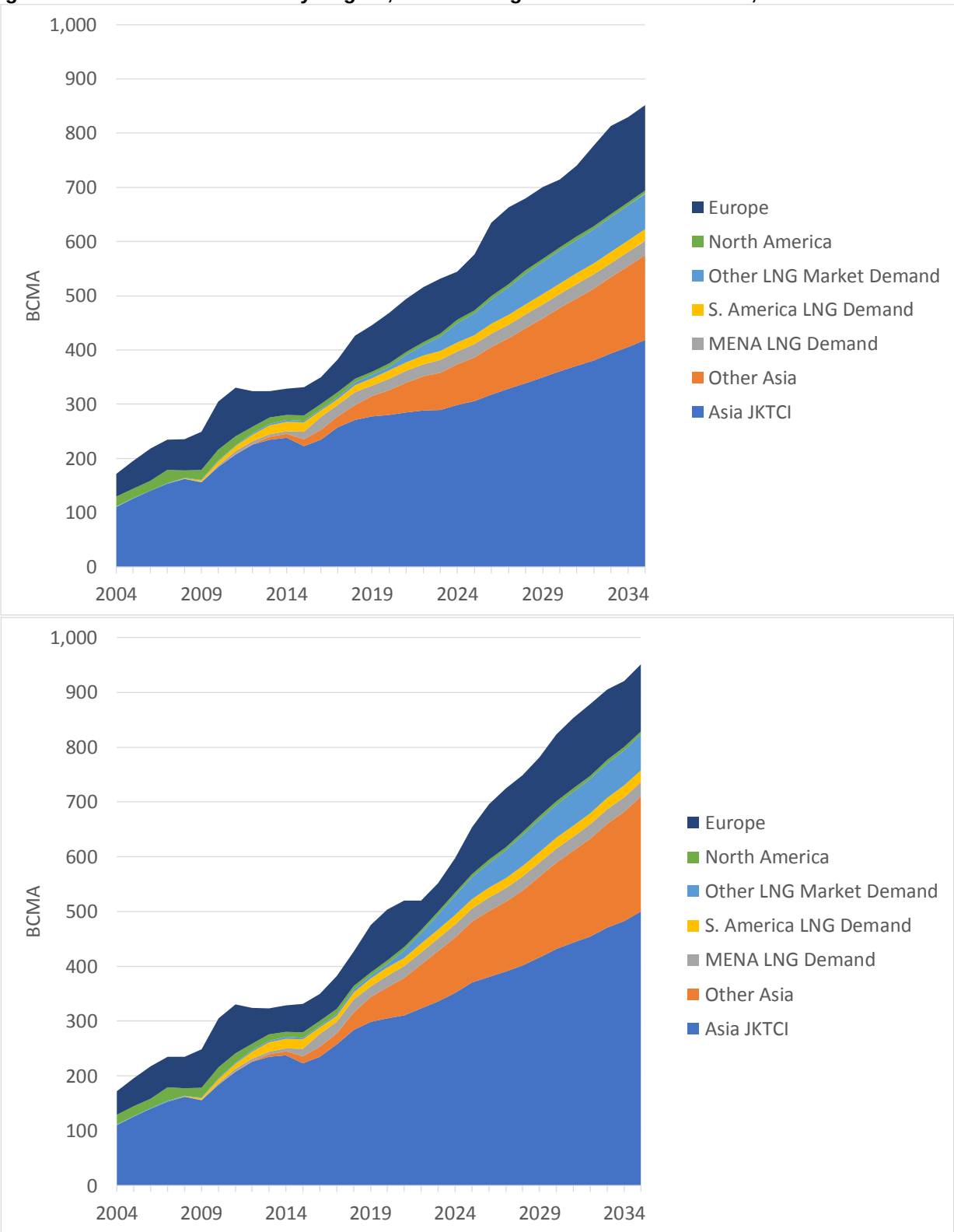
The second stage involves matching supplier flows with import regions in one of two cases:

- SWING supplies (dominated by Qatar) target Asian markets (leaving US exports to initially serve European LNG demand)
- SWING supplies (dominated by Qatar) target Europe (leaving US exports to serve residual Asian LNG demand).

[8] See for example: 'The Impact of Lower Gas and Oil Prices on Global Gas and LNG Markets', H. Rogers, OIES, July 2015, https://www.oxfordenergy.org/publications/the-impact-of-lower-gas-and-oil-prices-on-global-gas-and-lng-markets-2/; and 'The Forthcoming LNG Supply Wave: A Case of 'Crying Wolf?'', H. Rogers, OIES, February 2017, https://www.oxfordenergy.org/publications/forthcoming-lng-supply-wave-case-crying-wolf/

[9] 'Bunkers' encompasses the use of LNG as a marine fuel.

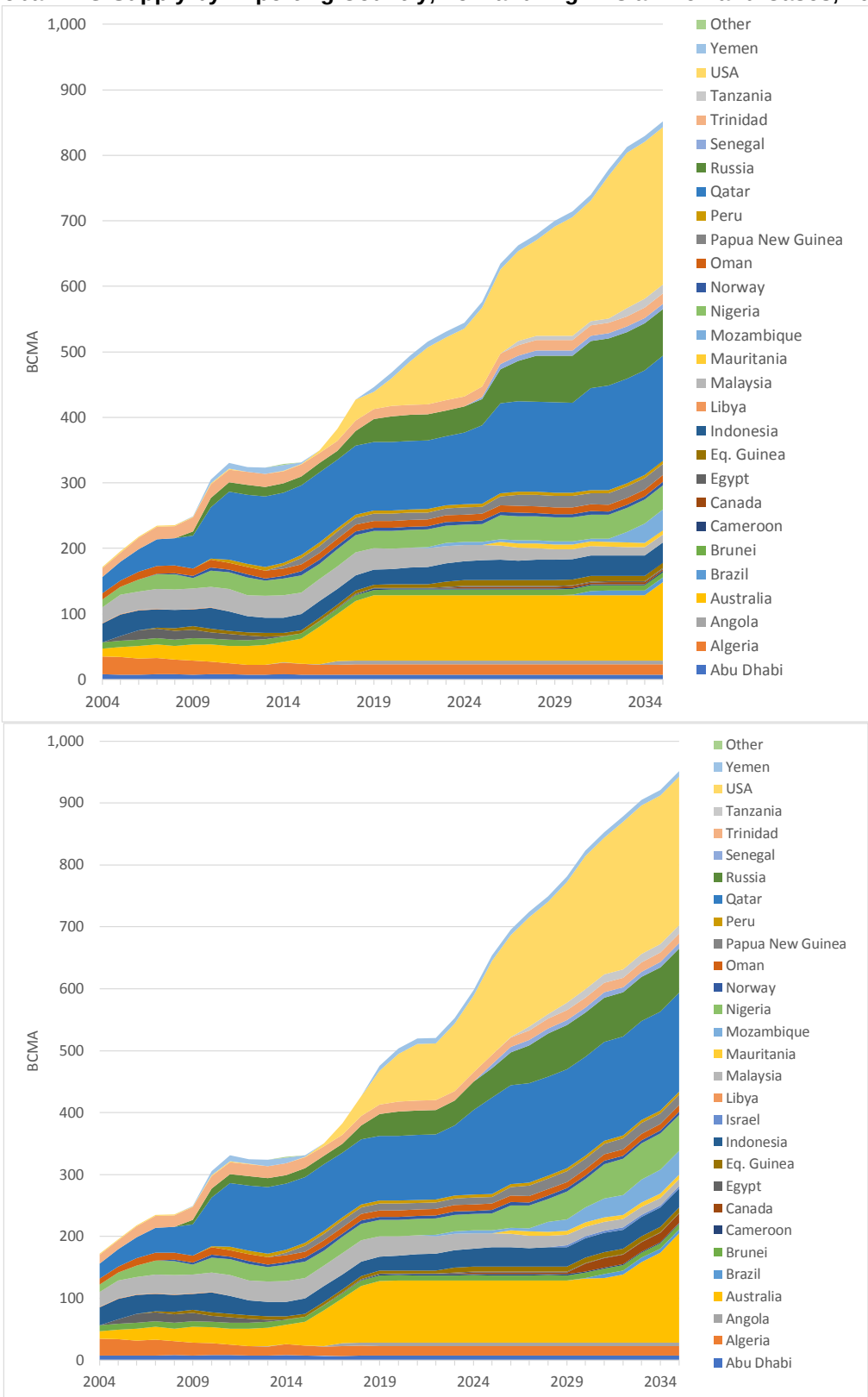
Figure 2: Global LNG Demand by Region, Low and High Asian Demand Cases, 2004 to 2035



Source: Platts, Author's Analysis

Note: JKTCI refers to Japan, Korea, Taiwan, China, India; MENA = Middle East and North Africa.

Figure 3: Global LNG Supply by Exporting Country, Low and High Asian Demand Cases, 2004 to 2035

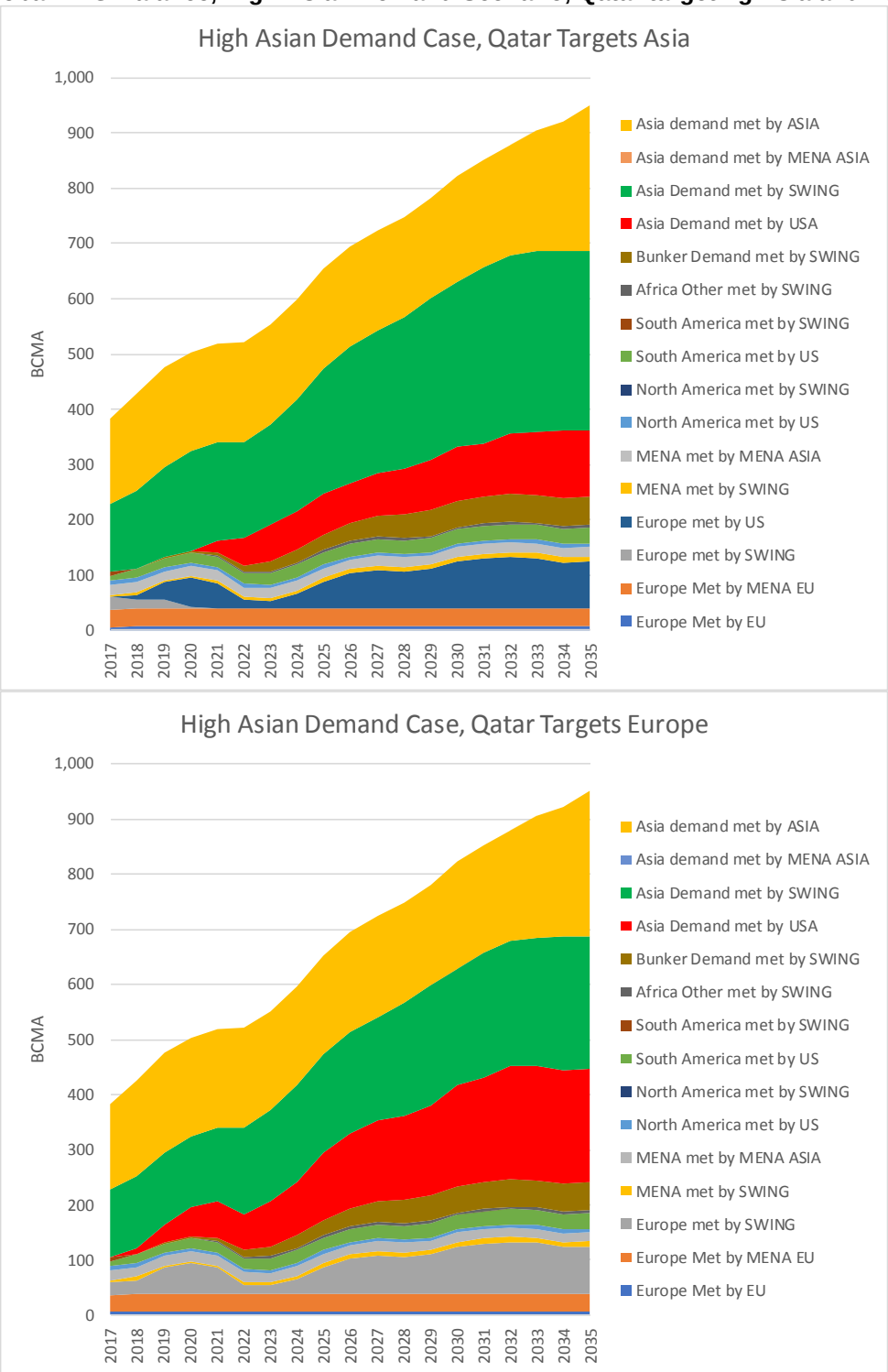


Source: Platts, Author's Analysis

The LNG regional balances under these two overriding 'rules' are derived for Low and High Asian LNG Demand scenarios described earlier.

The outcome of this exercise for the High Asian LNG Demand Case is shown in Figure 4.

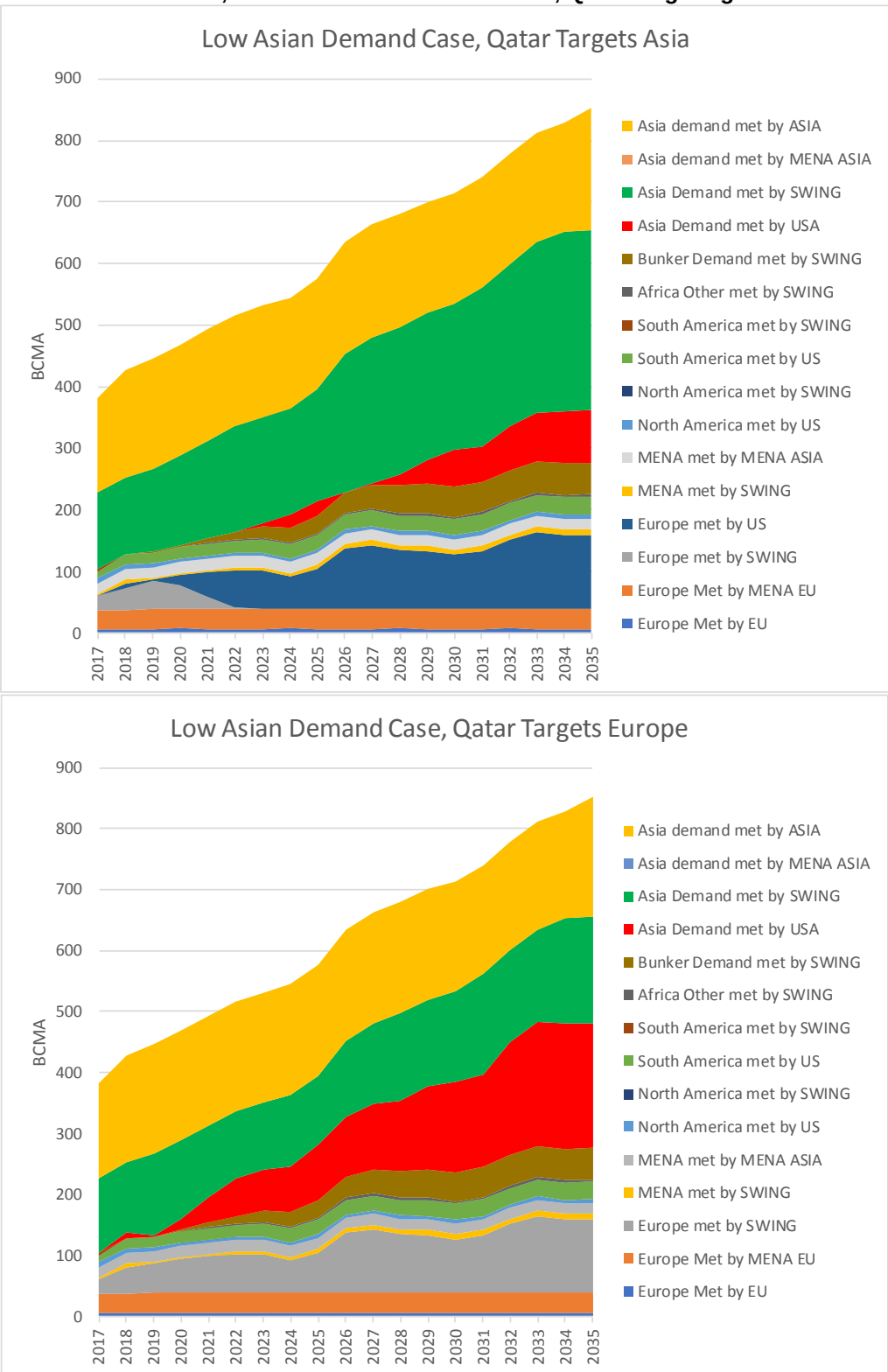
Figure 4: Global LNG Balance, High Asian Demand Scenario, Qatar targeting Asia and Europe



Source: Author's Analysis

For the Low Asian LNG Demand Case, comparable results are shown in Figure 5.

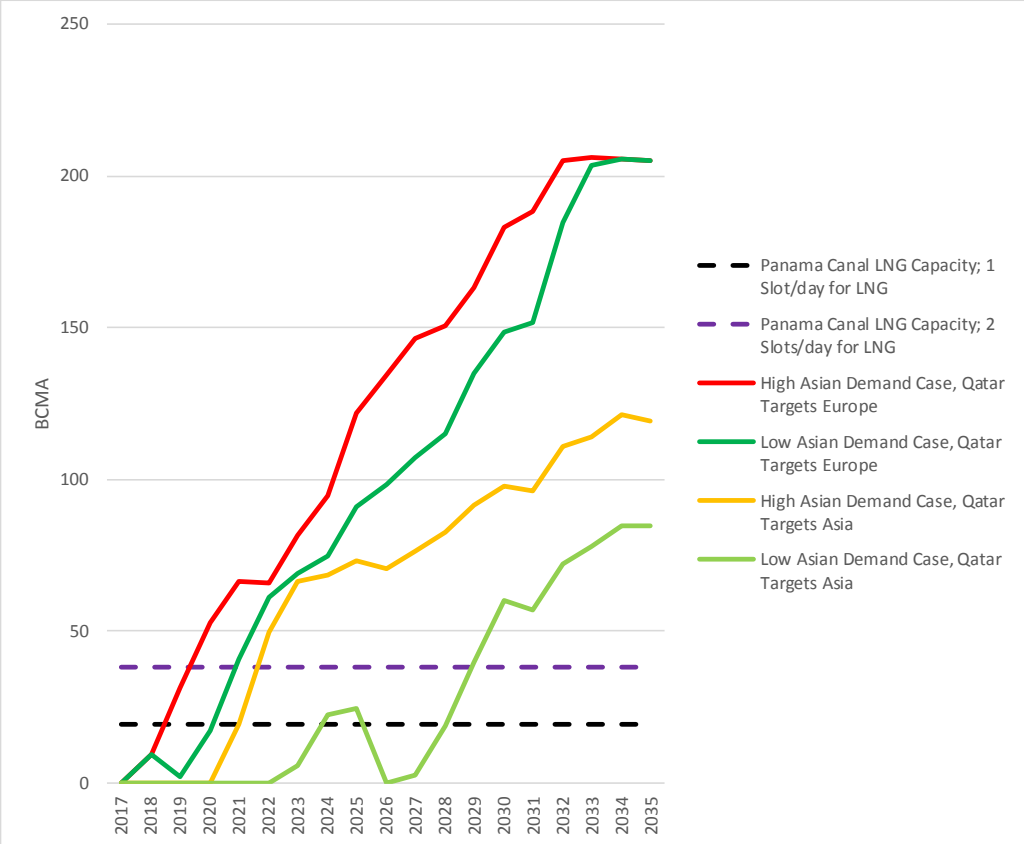
Figure 5: Global LNG Balance, Low Asian Demand Scenario, Qatar targeting Asia and Europe



Source: Author's Analysis

In each of the four cases shown in Figures 4 and 5, the US to Asia LNG flows are shown in red. These are compared to Panama Canal LNG transit capacities in Figure 6.

Figure 6: US to Asia LNG flows compared with Panama Canal LNG Transit Capacities



Source: Author's Analysis

Given that future LNG demand in Asian is uncertain and that the future disposition of US and Qatari LNG to Asia is likely to fall between the cases presented here, there is considerable uncertainty as to the volumes of US LNG exports likely to flow to Asian destination markets. This uncertainty is represented in Figure 6, however the results of the analysis suggest strongly that the Panama Canal, even with two slots per day available for LNG (one outbound, laden; one ballast (empty) return), is likely to become a bottleneck at some point in the early 2020s. On three of the four trajectories it would appear that even a doubling of intended slot allocation (from 2 to 4 per day) would only defer the bottleneck for a few years.

Consequences of a future bottleneck

In a paper assessing LNG shipping costs[10] the author derived a quantitative model for estimating shipping costs for a range of LNG shipping routes. Using this model we can assess the increased cost of LNG exports from the US Gulf Coast to Shanghai as a consequence of a future Panama Canal bottleneck. Assumptions and results are shown in Table 1. The shipping costs for LNG in Table 1 are shown for a range of charter rates – from $55,000 to $75,000/day.

[10] 'The LNG Shipping Forecast: costs rebounding, outlook uncertain', H Rogers, February 2018, OIES, https://www.oxfordenergy.org/wpcms/wp-content/uploads/2018/02/The-LNG-Shipping-Forecast-costs-rebounding-outlook-uncertain-Insight-27.pdf

Table 1: LNG Shipping Distances and Costs (Round Trip) from US Gulf Coat to Shanghai, China

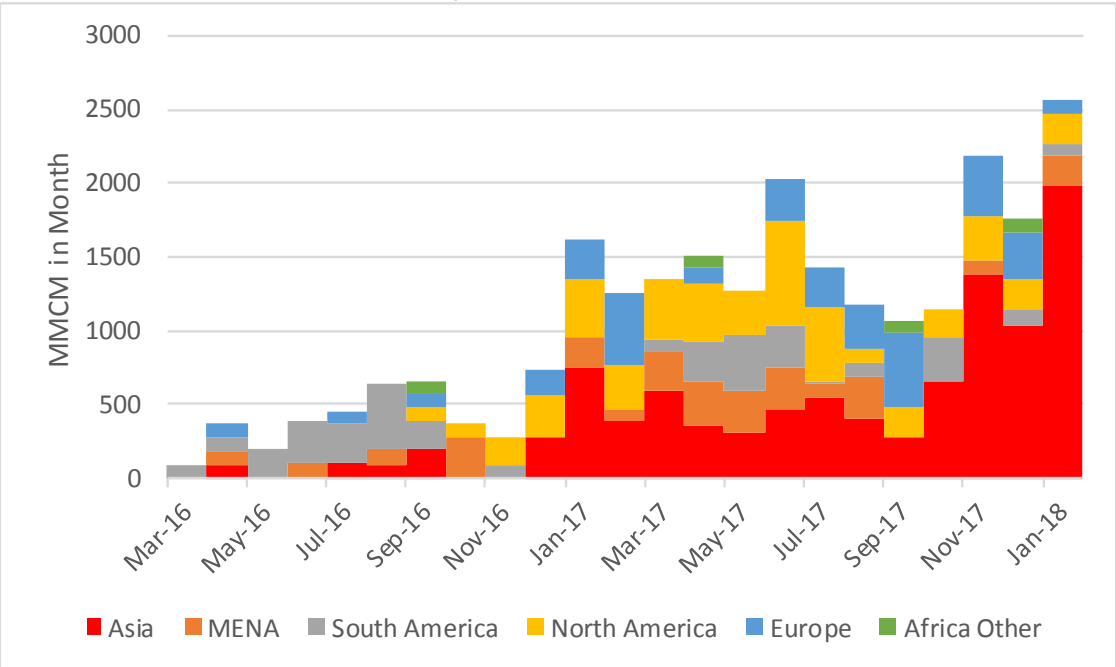
	Distance (one way) Nautical Miles	Charter Cost at $55,000/day - $/mmbtu	Fuel Cost - LNG boil off at $8/mmbtu	Canal Costs - $/mmbtu	Other Costs - $/m btu	Total Costs - $/mmbtu
Sabine Pass to Shanghai via Panama Canal	10,081	0.78	0.39	0.20	0.14	1.52
Sabine Pass to Shanghai via Cape of Good Hope	15,098	1.18	0.60	-	0.17	1.95
Sabine Pass to Shanghai via Suez Canal	13,854	1.08	0.16	0.25	0.16	2.04
	Distance (one way) Nautical Miles	Charter Cost at $75,000/day - $/mmbtu	Fuel Cost - LNG boil off at $8/mmbtu	Canal Costs - $/mmbtu	Other Costs - $/m btu	Total Costs - $/mmbtu
Sabine Pass to Shanghai via Panama Canal	10,081	1.07	0.39	0.20	0.15	1.81
Sabine Pass to Shanghai via Cape of Good Hope	15,098	1.60	0.60	-	0.18	2.39
Sabine Pass to Shanghai via Suez Canal	13,854	1.47	0.55	0.25	0.17	2.43

Source: Author's Calculations

From Table 1, based on future LNG carrier charter rate and fuel cost assumptions, the additional cost of having to send US LNG cargoes by alternate routes as a consequence of a Panama Canal bottleneck ranges from $0.43/mmbtu to $0.63/mmbtu.

In Figure 6 the 2017 flows of US LNG to Asia were zero, on the basis that all other things being equal, it made most sense (from a transport cost perspective) for US LNG to meet North and South American demand. If this was the case there would have been no remaining 2017 supply to meet demand further afield. Clearly in reality US LNG cargoes actively sought higher priced opportunities in opaque non-liquid markets. In 2017 US LNG satisfied 7.2 bcm of Asian demand. 2017 US LNG destination markets by month are shown in Figure 7.

Figure 7: Destination markets for US LNG, 2016 and 2017



Source: Platts Monthly LNG Data Service

Conclusions

The recent capacity expansion of the Panama Canal, coinciding with the ongoing rapid expansion of US LNG export capacity appeared to be a fortuitous co-incidence, allowing increased trade-flows of US LNG to reach the fast-growing Asian LNG markets via the shortest and most cost-effective route. Despite early teething troubles post the Panama Canal expansion, it appears likely that LNG vessels will secure two transit slots per day within the next year or so. Allowing for half these slots being return (ballast) transits, two slots per day represents just 38.3 bcma of US LNG exports to Asian markets. In three out of four scenarios analysed in this Insight, such a level is rapidly exceeded by the early 2020s; satisfying the subsequent potential Panama Transit LNG demand appears unlikely given the potential growth trajectories (see Figure 6).

US LNG exports to Asia, in excess of Panama Canal transit capacity, would take alternative routes costing some $0.4/MMBtu to $0.63/MMBtu more than that via Panama. US LNG at the margin could influence the Asian LNG spot price to this extent. In the Low Asian Demand scenario, it is possible that such an additional price premium could persuade Qatar to divert flexible LNG away from Europe to Asia and hence cause the market to re-balance by allowing US LNG to target Europe to a greater degree, reducing US LNG exports to Asia to a level within the Panama Canal capacity (at least to the mid-2020s). Alternatively, however, it may suit Qatar for the higher US LNG delivery costs to Asia, at the margin, to maintain an Asian premium – hence the degree of redirection by Qatar could be constrained.

Appendix 1: LNG Importing Country Groupings

Asian	Japan
	S Korea
	Taiwan
	China
	India
	Indonesia
	Malaysia
	Thailand
	Singapore
	Pakistan
	Bangladesh
	Vietnam
	Philippines
MENA	Kuwait
	Dubai & UAE
	Israel
	Egypt
	Jordan
	Bahrain
S. America	Argentina
	Brazil
	Chile
Other LNG Markets	Dominican Republic
	Puerto Rico
	South Africa
	Kenya
	Caribbean
	Malta
Bunkers	
North America	US
	Canada
	Mexico
Europe	Belgium
	France
	Greece
	Italy
	Portugal
	Spain
	Turkey
	UK
	Netherlands
	Lithuania
	Sweden
	Norway
	Poland

Appendix 2: Demand Node Groupings

Grouping	Supplier
ASIA MENA	Abu Dhabi
EU MENA	Algeria
SWING	Angola
ASIA	Australia
SWING	Brazil
ASIA	Brunei
EU	Cameroon
ASIA	Canada
SWING	Egypt
SWING	Eq. Guinea
ASIA	Indonesia
SWING	Israel
SWING	Libya
ASIA	Malaysia
SWING	Mauritania
SWING	Mozambique
SWING	Nigeria
EU	Norway
ASIA MENA	Oman
ASIA	Papua New Guinea
ASIA	Peru
SWING	Qatar
SWING	Russia
SWING	Senegal
EU MENA	Trinidad
SWING	Tanzania
US	USA
SWING	Yemen
EU	Other