

Global Energy Policy Group Paper

Forgetting What You Know About Natural Gas:

Future Trends and Transitions

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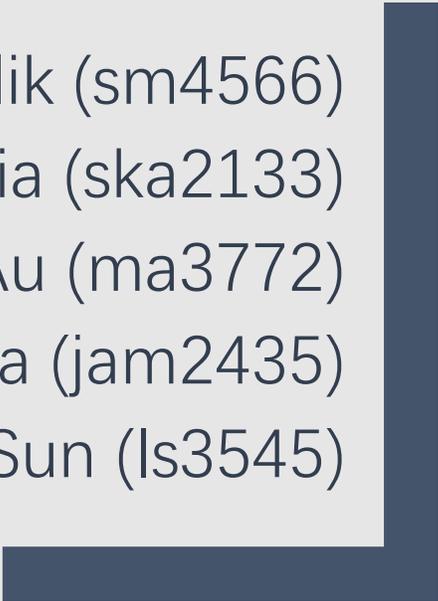


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Introduction

This paper seeks to explore the various factors affecting natural gas demand and supply at both the global and regional levels. This paper highlights historical and current trends in both consumption and production before investigating factors that we believe can sway future trends. Examining the underpinnings of natural gas demand and supply are important as these can be used to unpack variability in natural gas prices across regions – an assumption we make here is that prices are a sound market signal for changes in demand and supply. Price changes will then dictate quantity demand and supplied of natural gas in both the short and long run.

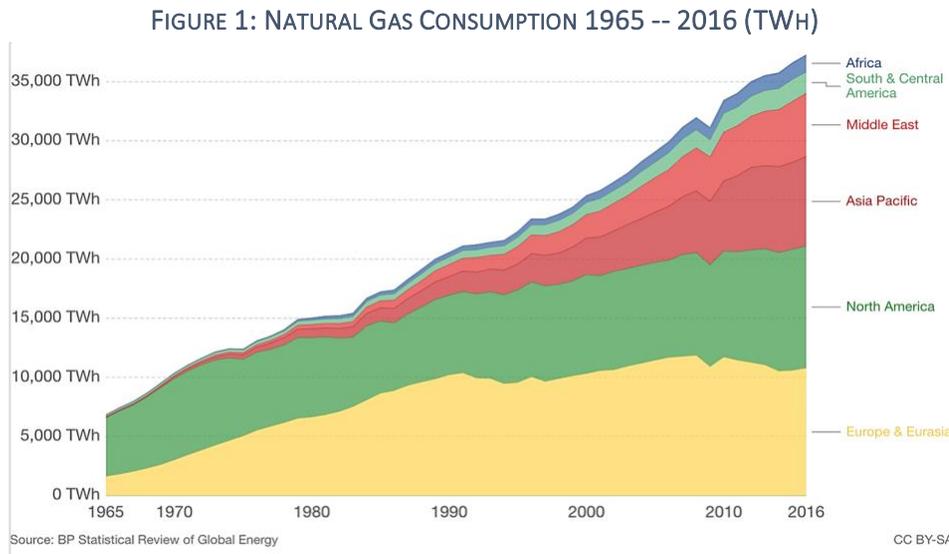
This paper heavily utilizes a country case-study approach, as we believe that similarities notwithstanding, countries have their own advantages and constraints when it comes to both the demand and supply sides of natural gas. A deep dive into both traditional and non-traditional players will allow us to highlight the physical, economic and socio-political characteristics that define each country's natural gas landscape.

The outline of this paper is as follows:

We begin with an introduction of historical and current trends in natural gas consumption at the global level, before zooming into a sub-set of natural gas consumption: trends in Liquefied Natural Gas (LNG) consumption and trade. The paper then pivots into analyzing supply-side characteristics by first exploring the existing trends in shale production and then introducing the role of the **United States** as a mover and shaker in the shale market. Continuing on the supply-side narrative, we analyze **Australia's** role as a traditional LNG producer and the potential entrance of **Argentina** as a budding LNG competitor. We then analyze the unique case of **China**, a country who not only exhibits large consumption potential, but production as well, highlighting the tensions between growing consumption and meeting that consumption with domestic production. We then wrap the paper up with a discussion on potential **Emerging Market** players, before concluding.

Natural Gas – Past and Present

Global natural gas consumption has been rapidly increasing, as seen from **Figure 1**.



Natural gas consumption grew by a Compound Annual Growth Rate (CAGR) of 4% from 1966 to 1991, which then slowed to 2% from 1991 to 2016. **Figure 1** shows an initial dominance of consumption from North America, Europe and Eurasia, which then was offset by consumption from rising players in the Middle East and Asia Pacific regions. Factors influencing this rise spanned rapid population growth, rising Gross Domestic Product (GDP) per capita and accelerating trends in urbanization and industrialization within these regional economies. Additionally, natural gas provided an affordable and dependable alternative relative to other fossil fuels, which these developing regions capitalized upon to drive their growth. Notably, from 1991 to 2016, Middle East growth in natural gas consumption comprised 6.5% CAGR, the highest growth rate across regions. This was followed by APAC growth, which comprised 6.0% CAGR.

Growth in natural gas consumption rates beyond 2016 will depend on the continuation of the above factors (population, GDP/capita and urbanization trend) while accounting for new and increasingly salient considerations. For instance, as developing economies such as China eases expansion in its manufacturing capabilities as part of a move towards a more service-based economy, natural gas consumption to fuel these capabilities will decline.¹ Other factors include the role of energy intensity, a key consideration affecting future demand in natural gas. Increasing uptake of new Energy Efficiency (EE) technologies, including Combined Heat and Power (CHP) technologies, will potentially stem growth in energy intensity and reduce natural gas consumption. The need to mitigate the adverse environmental impact of coal consumption have led developing regions to adopt coal-to-gas substitution policies. Nonetheless, from an environmental

¹ Sara Hsu, "China Takes Another Step Towards A Service Economy," Forbes, February 21, 2017, <https://www.forbes.com/sites/sarahsu/2017/02/21/china-takes-another-step-towards-a-service-economy/#67e3a9ab28c1>.

perspective, it must be acknowledged that natural gas itself comes with its own impediments. Our country case studies explore the intricacies and tensions between driving domestic natural gas production and answering calls to minimize harm to the environment.

LNG Consumption and Trade

This section focuses on a subset of natural gas consumption: LNG trade flows. LNG trade is a vital vehicle to which countries with shortfalls of domestic production capabilities can meet their demand for natural gas. **Figure 2** presents a snapshot of existing LNG trade flows by region:

FIGURE 2: GLOBAL LNG FLOWS (%)

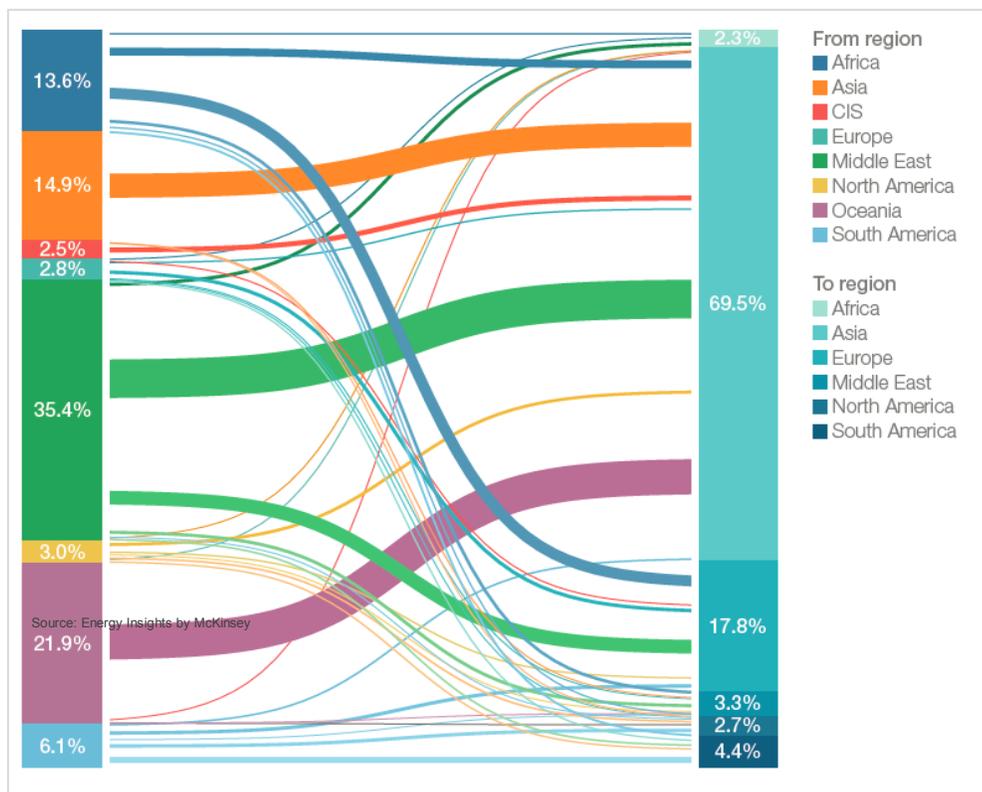
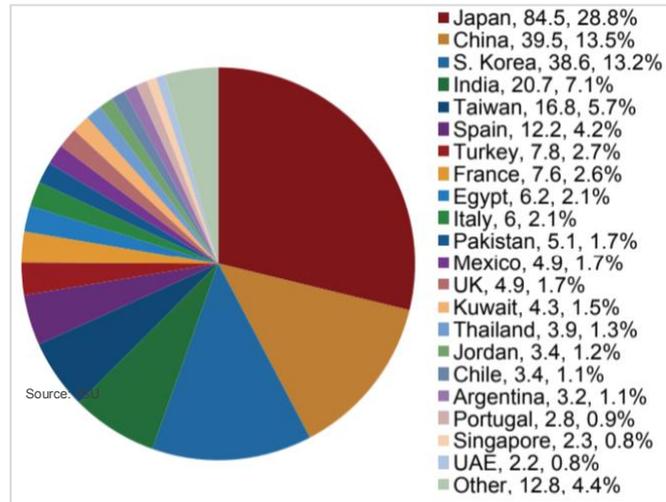


Figure 2 highlights the composition of LNG imports, with an approximate 70% of imports stemming from the Asian region, followed by Europe and South America at 17.8% and 4.4% respectively. **Figure 3** below breaks down the Asian import demand further.

FIGURE 3: LNG IMPORTS AND MARKET SHARE (2017)



Asia dominates LNG import figures in 2017, as can be seen from **Figure 3**, with Japan, China and South Korea collectively make up 55.5% of total LNG imports and market share. The reason for such high levels of import demand derives from domestic production constraints that each country faces. Japan, for instance, has faced uncertainties concerning its nuclear power capabilities since the Fukushima disaster incident in 2011 and has instead turned to natural gas to provide for its energy demands. Nonetheless, natural gas demand might be offset in the future by the country’s determination to restart its nuclear sector following the Fukushima aftermath. The geographical concentration of natural gas import demand implies that geopolitical trends can also play a role in shaping LNG trade trends. More importantly, there has been a rise in intra-regional co-operation taking place between the three largest importers, at the firm-buyer level. In 2017, Japan’s JERA Co Inc, Korea Gas Corp (KOGAS) and China’s China National Offshore Oil Corp (CNOOC) signed a Memorandum of Understanding (MoU) to improve co-operation in navigating the LNG trade environment, an agreement reminiscent of the Organization of Petroleum Exporting Countries (OPEC).² The MoU aimed to shift the power balance from a producer-centric LNG market to a buyer-centric one, where the three companies were able to “extract concessions” that would allow the re-sale of import, reducing destination restrictions. Notably, an important factor that buttresses the buyers’ propositions is the rise of shale, an LNG substitute they are able to leverage upon to reduce dependence on LNG. Having explored the consumption side of natural gas, the following section explores trends on the supply side of the market, focusing on this exact rise in shale production and its implication on the global LNG market.

² Jane Chung, Yuka Obayashi and Oleg Vukmanovic, “World’s top LNG buyers form alliance to push for flexible contracts,” Reuters, March 23, 2017, <https://www.reuters.com/article/us-asia-lng-markets/worlds-top-lng-buyers-form-alliance-to-push-for-flexible-contracts-idUSKBN16U27X>.

Shale Gas – The Times Are Changing

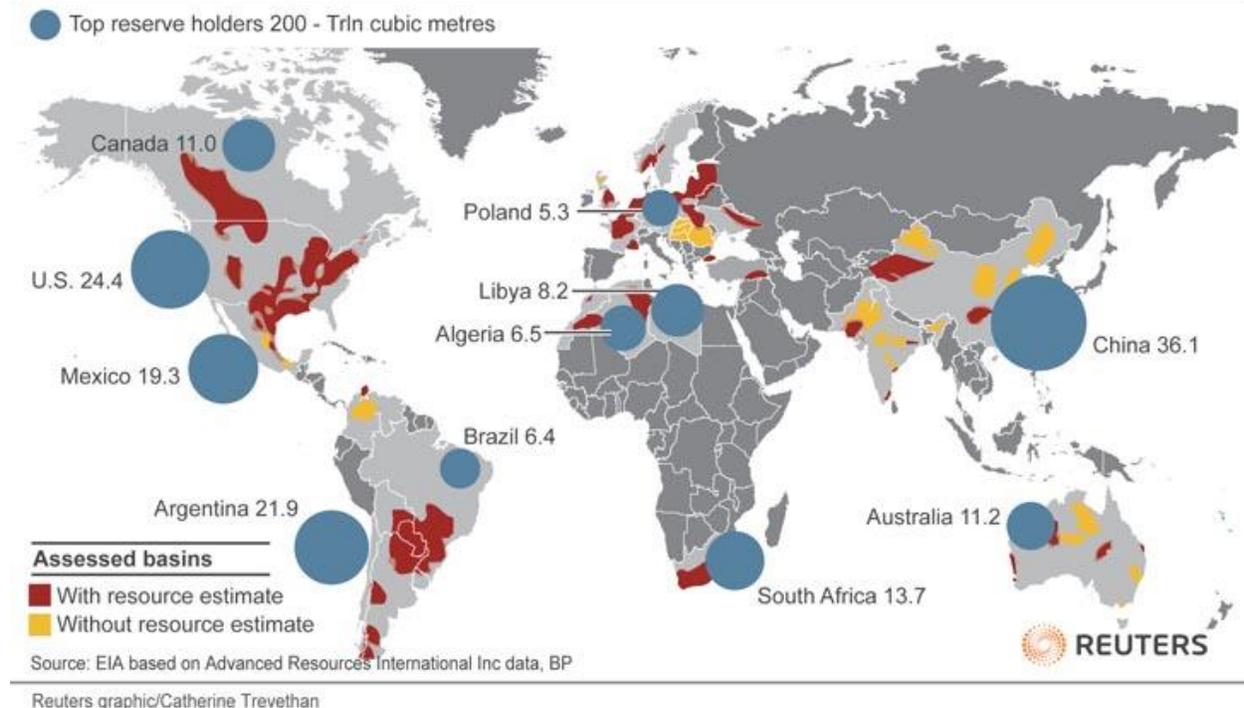
In 2005, Matt Simmons, an energy investment banker, published “Twilight in the Desert: The Coming Saudi Oil Shock and the World Economy”, which highlighted the idea of ‘peak oil’. The book gained traction especially when oil prices surged past \$100/bbl and, as some hypothesize, helped push the world into recession. This helped start a debate, not only politically, but from a corporate perspective, leading to refining extraction techniques that would, in time, severely disrupt the world energy markets.

With two technological breakthroughs, “Hydraulic Fracturing” and “Horizontal Drilling”, shale transformed the US economy by giving it a new life. Kristy Kramer, Wood Mackenzie’s Head of Americas Gas Research, is quoted to have said that “At the start of 2014, more than 50% of US gas production was from shale and today it has reached 65%. Wood Mackenzie forecasts continued production growth of 47% by 2035”. Once dependent on gas imports, the United States will now not only be self-sufficient, but become an exporter of gas.

Figure 4 below depicts the Shale Gas Basins. It can be seen that US stands second to China, and right ahead of Argentina with its reserves, and regardless of the 2007/2008 Great Recession, it was still able to persist with shale gas production.

FIGURE 4: GLOBAL SHALE BASINS

Global shale gas basins, top reserve holders

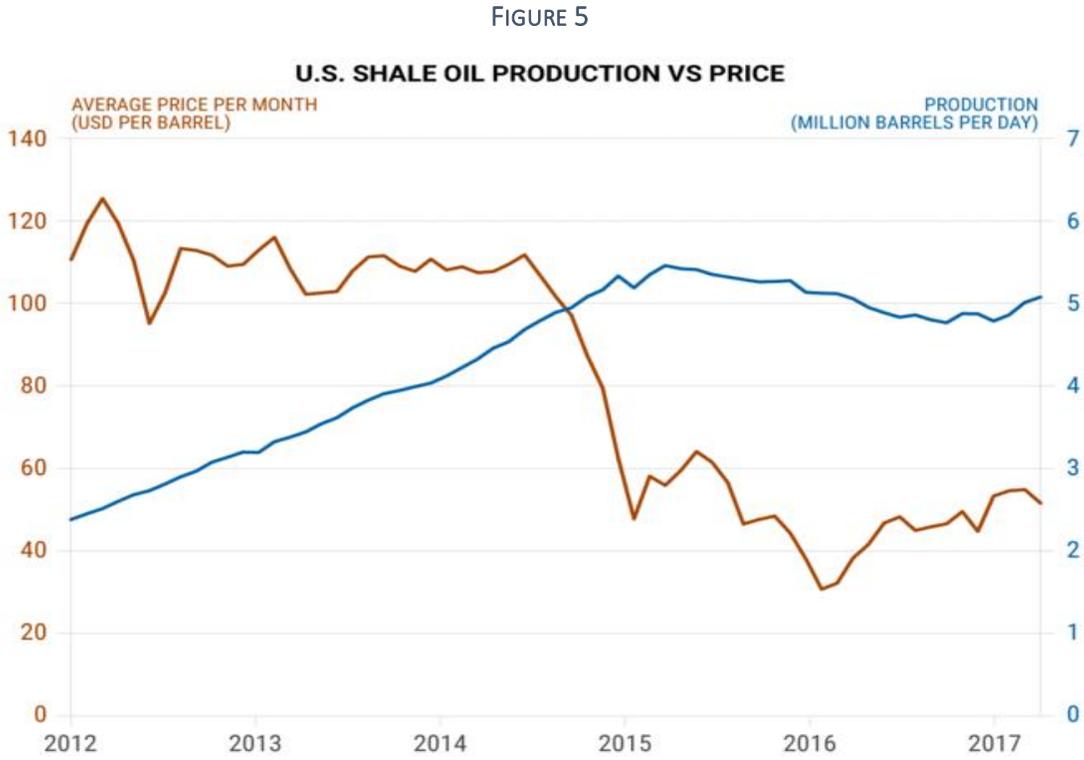


The Price Roller Coaster

September 15, 2008 witnessed the collapse of Lehman Brothers, marking the point of no return for the global financial crisis. However, this also precipitated “another crisis — a 4½-year surge in oil prices to all-time highs — to a screeching halt”.³ The 2007/09 crisis brought along with itself a negative impact on the oil and gas sector. Oil prices fell from a high of \$147 in July 2008 to a low of \$33 in February 2009. Over the same time period, gas prices fell from \$14 to \$4.⁴

With this, much of US shale production, which typically endures relatively higher costs due to the technology it employs, came under pressure. This pressure forced companies to again employ cost-efficient operations. Where many argued that shale would not be profitable, others rebutted by stating that with such low prices, companies need not drill but produce enough to fetch a sufficient return on invested capital.

Figure 5 below depicts the above and highlights how crude toppling did not upset the shale gas boom.



Source: U.S. Energy Information Administration

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³ Tom DiChristopher, “The financial crisis crushed record oil prices but the market is still gripped by boom and bust,” CNBC, September 12th 2018, <https://www.cnbc.com/2018/09/12/financial-crisis-crushed-record-oil-prices-but-another-boom-looms.html>.

⁴ “How did the financial crisis affect the oil and gas sector?” Investopedia, <https://www.investopedia.com/ask/answers/052715/how-did-financial-crisis-affect-oil-and-gas-sector.asp>.

USA – The Big Player

Faced with the ‘game changing’ potential of shale gas, countries having extensive shale gas estimates looked to follow the American experience and seriously considered the confirmation and potential exploitation of those resources.⁵

On another account, Edward Morse, head of commodity research at Citigroup, stipulated that this “shale revolution” would be the “most politically disruptive factor in the global oil market since the formation of OPEC in 1960”. Such statements lent weight to the idea that “shale gas has only starting to gain in momentum”. Moving forward from an import of LNG, the US now aims to become a long-term supplier of this resource. We now evaluate the implications of this US-led disruption for the LNG stream.

The LNG Wave – A Glut?

While the United States rode the wave of shale gas production, Australia shared a similar success story in becoming a large player in the international LNG Market. The following section outlines the strong export fundamentals of the Australia LNG market and then looks internally at issues that threaten its strong export position.

The huge potential of Australia

Australia is a resource rich country. Its natural gas portfolio consists of conventional natural gas in the form of LNG which represents two thirds of the portfolio. The remaining third consists of unconventional gas in the form coal seam gas and shale gas.

Over the past 5 years, Australia’s profile in the global LNG market has risen. Australia is the 2nd largest net exporter of LNG behind Qatar. Australia currently export 58 billion tonnes of LNG. That is forecast to increase by 24% to 77 million tonnes in 2019-2010 after the current wave of investment is complete.⁶

Japan has traditionally been the main destination for Australian LNG, however exports to China and South Korea have increased as Australia’s export capacity increased. Japan receives around 45 per cent of Australia’s exports, whilst China’s market share has risen to almost one third.⁷

⁵ US Energy Information Administration, 2013, *Technically Recoverable Shale Oil and Shale Gas Resources: An Assessment of 137 Shale Formations in 41 Countries Outside the United States*.

⁶ Office of the Chief Economist, Resources and Energy Quarterly – June 2018, <https://publications.industry.gov.au/publications/resourcesandenergyquarterlyjune2018/index.html>

⁷ Office of the Chief Economist, Resources and Energy Quarterly – June 2018, <https://publications.industry.gov.au/publications/resourcesandenergyquarterlyjune2018/index.html>

On the face of it, Australia looks well equipped to continue to be a large player in the Natural Gas market with many advantages. Australia has a large asset base, experience in the extraction and export of LNG and close proximity to Asia markets where there is strong demand growth forecast. On this basis of these strong fundamentals, you would expect a continuation of Australia's dominance in the Global LNG market.

Beneath these fundamentals lie many domestic challenges that have the potential to cause disruption to Australia's current position.

Challenges Ahead and Future Disruption

One of the domestic challenges is the mismatch between export volume and domestic supply. Looking at the natural gas market in Australia, natural gas can either be exported to Asia or used domestically for households and industrial customers. Currently, Australia's export volume is four times that of domestic supply requirements.⁸ This growing export demand represents a shift out of the natural gas demand curve. Following basic microeconomic principles, an increase in demand, results in a price increase. This has manifested in domestic markets as a substantial price increase to that of export parity. In real terms, this is a doubling of natural gas expenses for domestic and residential customers. This has resulted in large welfare concerns in terms of access and basic affordability, and productivity and competitiveness concerns for industrial customers. The Australia government has addressed these concerns by placing LNG export restrictions to guarantee domestic supply. This regulation has created uncertainty in future export volumes and therefore increased the risk of investment.

Australia needs clarity on its energy policy to address not only the natural gas supply imbalance, but also a clearer greenhouse gas emission policy is required as currently it lacks any policy induced mechanism to meet COP 21 targets. Cooperation and cohesion with State Government is also required to review the ban on coal seam gas and fracking and exploration of shale gas. Continual bans will result stranded and untapped assets. Failure by the Australia Government to resolve these domestic issues has the potential to cause large disruptions to Australia's role in the Global Natural Gas market.

Domestic issues notwithstanding, Australia continues to grapple with the need to maintain its competitive edge against both traditional and non-traditional players. The following section highlights a further extension of the supply-side story by introducing our assessment of a potential new player to the existing club of LNG producers.

⁸Fattouh, B, Adjustment in the Oil Market: Structural, Cyclical or Both? <https://www.oxfordenergy.org/wpcms/wp-content/uploads/2016/05/Adjustment-in-the-Oil-Market-Structural-Cyclical-or-Both.pdf>

Argentina – the next big export disruption

The Oxford Institute for Energy Studies identified Europe as a market of last resort based on the intensity of Asian LNG demand.⁹ However, if we extend this analysis to 2026, a new player from the Southern Cone might contribute significantly to the aggregate LNG supply.

As per the US Energy Information Administration¹⁰, Argentina's technically-recoverable shale gas resources are approximately 802 trillion cubic feet (tcf). This means that Argentina holds the second-largest reserves of shale gas following China.

Although discovered in 2011 by Repsol YPF, Argentina was not able to consolidate an exploitation strategy for its unconventional resources up until 2016, when the Macri administration set the development of "Vaca Muerta", one of the world's largest shale oil and gas deposits, as a main priority in its energy plan. The importance of this resource lies in it not only being a cleaner energy fuel supporting a more sustainable energy transition, but also as an instrument to revert the energy trade deficit. This fits with the government's goal of ensuring accessible energy supply from different sources at reasonable prices, while mitigating its impact on the environment.

Argentina was a net exporter of natural gas until the mid-2000s, when a series of political decisions based on widespread subsidies and artificial pricing in the energy sector ended this trend. These decisions disincentivized energy suppliers, reducing the production of hydrocarbons in Argentina. Since then, the country has been a net importer of hydrocarbons, particularly LNG, diesel and fuel oil, mostly required by the power sector.

Therefore, developing this source of unconventional resources liberated by fracking is a great opportunity to recover the country's self-sufficiency. In order to achieve this target, an incentive program has been set up through a stimulus price of US\$7.50/mcf for incremental unconventional gas production. This program notwithstanding, to keep improving production, productivity and investment, an off-season demand needs to be generated to avoid severe fluctuations in Argentina's consumption patterns along the year.

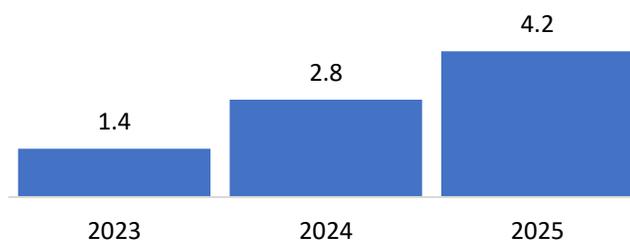
Although there are several ways to address this problem, from exporting gas to Brazil, Chile and Uruguay to thinking about underground storage, a new alternative has caught the attention of the national authorities: exporting LNG. According to recent forecasts conducted by the Secretary of Energy of Argentina¹¹, a project has now begun involving the building of 6 trains of 0.7 bcf/day each by 2025 in the south of Buenos Aires province. The gradual incorporation and the cumulative capacity of these liquefaction facilities are depicted in **Figure 6**.

⁹ The Oxford Institute for Energy Studies, 2017, *The Forthcoming LNG Supply Wave: A Case of 'Crying Wolf'?*

¹⁰ US Energy Information Administration, 2013, *Technically Recoverable Shale Oil and Shale Gas Resources: An Assessment of 137 Shale Formations in 41 Countries Outside the United States*.

¹¹ Secretary of Energy of Argentina, 2018. *Argentina Energy Plan – Guidelines*, conference presentation, Houston. For further details, see <https://www.argentina.gob.ar/noticias/iguacel-expuso-en-un-seminario-en-houston-sobre-inversiones-en-vaca-muerta>

FIGURE 6: TIMELINE AND AGGREGATE CAPACITY IN BCF/DAY



Source: Secretary of Energy of Argentina, 2018.

The estimated total cost of the project is approximately 18 billion dollars (600 usd/tpa) and the estimated liquefaction costs range from 2.5-3.6 usd/mmbtu depending on the incorporation point to the transmission system. Wood Mackenzie¹² estimates that adding to this price range the national cost and international transportation cost to Asia of approximately 1.6 USD/MMBTU, Argentina could be amongst the five main producers of LNG by 2026 (see **Figure 7**).

FIGURE 7: ESTIMATED RANKING: INSTALLED LIQUEFACTION CAPACITY IN 2026

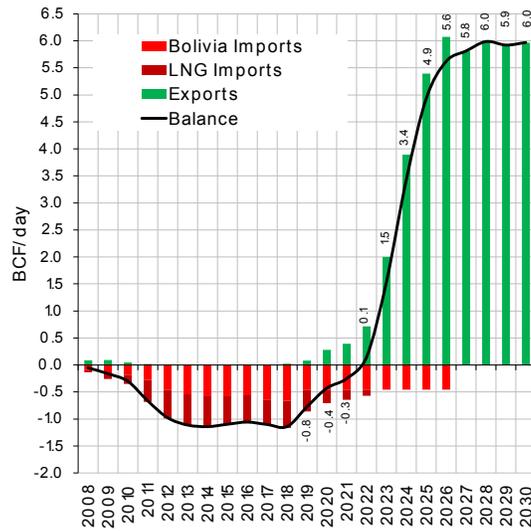
#	Country	BCF/day	%
1	USA	27.3	32%
2	Qatar	13.3	15%
3	Australia	10.8	13%
4	Russia	5.4	6%
5	Argentina	4.2	5%

Source: Wood Mackenzie (2018)

These preliminary estimations induced the government to believe that the country could be again a net exporter, not only at a gas level, but also throughout the whole energy trade balance. Thus, energy self-sufficiency might be achievable in the mid-term. **Figure 8** shows the evolution of the physical natural gas international trade for the period 2008-2030.

¹² Wood Mackenzie, 2018, *Game on for Argentina's Vaca Muerta – outlook for the play*.

FIGURE 8: PHYSICAL NATURAL GAS INTERNATIONAL EXCHANGE 2008-2030



Source: Secretary of Energy of Argentina, 2018.

Despite the unprecedented efforts that the government is undertaking to achieve such a goal, there are still many constraints requiring immediate attention that must be addressed in the short-term if the government wants to keep this timeline.

From a physical perspective, the country suffers from inadequate infrastructure. This issue has incentivized the improvement of the existing transmission system as well as the planning of the construction of new pipelines that will increase transmission capacity from the exploitation area (Neuquen province) to the GNL terminals' location.

At a human resource level, Argentina presents high labor cost. The number of workers assigned to this type of project is higher than in US and are protected by powerful trade unions. With the intention of reducing cost, the government has signed productivity agreements between companies, trade unions and provincial authorities.

From a financing point of view, Argentina's capital market is underdeveloped. This means that it cannot secure the financial resources needed to develop such a significant project. Because of this, the policies intended to reduce cost are a priority for the administration. This is a possible way to assure the profitability and accelerated rate of return international investors seek in order to invest.

Environmental issues concerning methane leaks is another constraint that has yet to be solved. Although environmental concerns were one of the key issues that makes gas the elected fossil fuel for Argentina's energy transition, there is still much resistance amongst environmentalists against fully developing Vaca Muerta, as the amount of methane emissions released could seriously jeopardize Argentina's commitments to the United Nations Paris Agreement on Climate Change in 2016.

In terms of urban planning, the influx of a growing labor force will require a local urban strategy plan in order to satisfy the worker's social needs.

Finally, it must be acknowledged that the country's existing macroeconomic instability poses a serious constraint to the potential development of these unconventional resources. Recently, Argentina's economic performance has been affected by constant currency depreciation, high interest rates and sluggish economic growth. All of these indicators contribute negatively to the national economic situation by increasing uncertainty among foreign investors.

China – The Asian Dragon

Having addressed the demand and supply sides of natural gas production, this paper now turns to a case study that balances both. We assess the Chinese case and the critical role it will play in shaping the global natural gas market from both production and consumption perspectives. This section specifically asks the question: with strong projected energy demand, coupled with massive structural change in the country's energy sector, how much natural gas will China actually need in the future?

Firstly, we use China's energy consumption in 2020 as a benchmark, the amount of which is 146.42 quadrillion btu equivalent.¹³

Secondly, we estimate an annual growth rate for the next 20 years. There are various predictions concerning the annual energy consumption increase in China. On one hand, there is consensus that China's energy consumption will continue to grow in the next decade due to continued growth in urbanization rates and energy intensity. On the other hand, there are discrepancies in growth rates. Among those, we believe that the IEA's estimation of 1% CAGR is more reasonable.¹⁴ This is a more moderate growth rate compared to the past 10 years because of the following reasons:

- The Chinese economy is shifting from export-leading to consumption-leading and from industry-oriented to service-oriented. This change will lead to less energy consumption.
- Strong energy efficiency policies: the Chinese government has issued output restrictions in high energy consumption industries such as cement, steel, electrolytic aluminum. It has also shut down factories with high energy cost, which will reduce energy intensity growth rates.
- China's population growth is slated to reduce, which will result in less energy consumption.

Based on these assertions, we estimate that in 2040, China's energy demand will be 179.02 quadrillion btu equivalent.

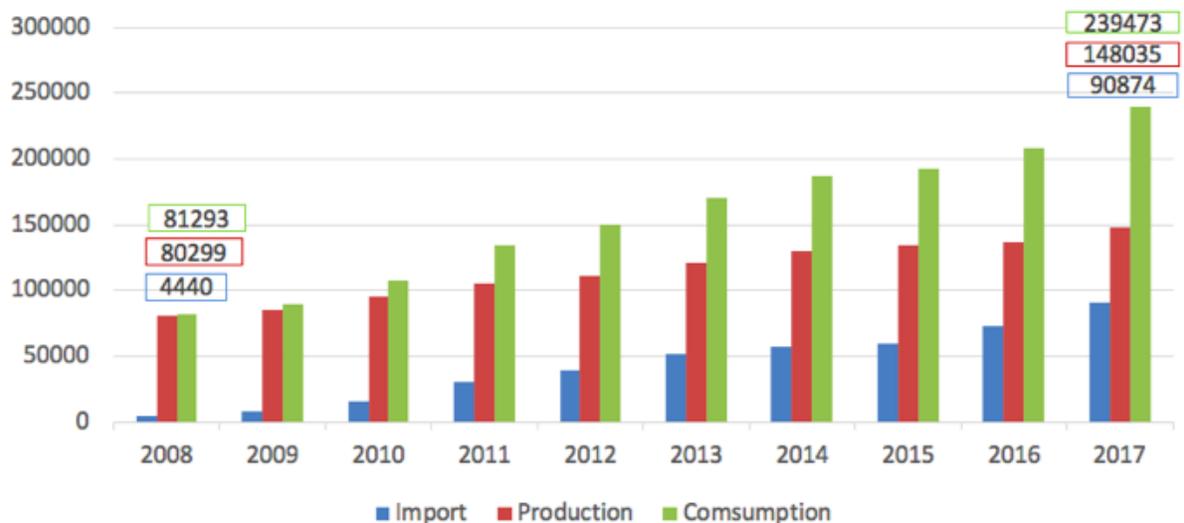
¹³ U.S. Energy Information Administration.

¹⁴ IEA, "World Energy Outlook 2017: China" Last modified: 14 November 2017. <https://www.iea.org/weo/china/>

Meanwhile, China’s energy structure will change dramatically, too. According to a report by the Chinese National Bureau of Energy, China will increase the proportion of natural gas out of total energy consumption from 6.2% (2017) to 18% (2030). If we are conservative about the structural change in the following decade and assume the number will be 20% in 2040, the total demand for natural gas will be 24.70 quadrillion btu equivalent, or 704,300 million m³ in 2040.

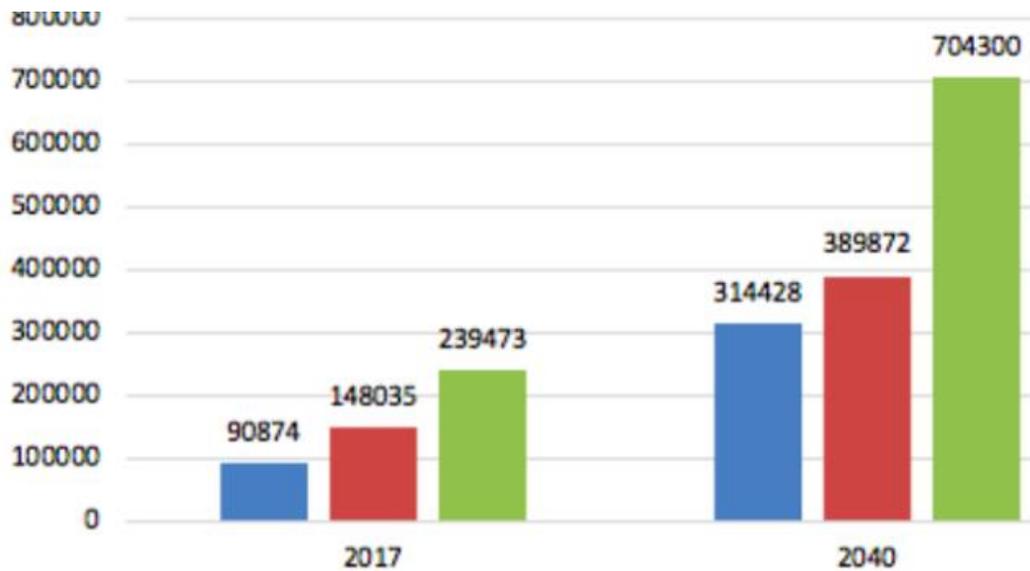
On the supply side, China is changing from a natural gas self-sufficient country into a country which is highly reliant on natural gas imports. We can see from Figure 1¹⁵ that in the past decade, natural gas consumption increased by 195%, while production only increased by 84%, causing import increased by 1947%. And due to less increases in natural gas production compared to natural gas demand, natural gas external dependence will continue to increase. Our prediction is from in 2017 to 44.6% in 2040, based on the total natural gas demand predicted above and production rate grow at 4.5% annually till 2040, as it is illustrated in **Figure 9**. Most research institutions estimate this number to be between 40% to 50% in 2040.

FIGURE 9: 10-YEAR CHANGE IN CHINESE NATURAL GAS MARKET (MILLIONS M³)



¹⁵ CEIC dataset: OPEC and National Bureau of Statistics of China

FIGURE 10: STRUCTURAL ESTIMATION IN 2040 (MILLIONS M³)



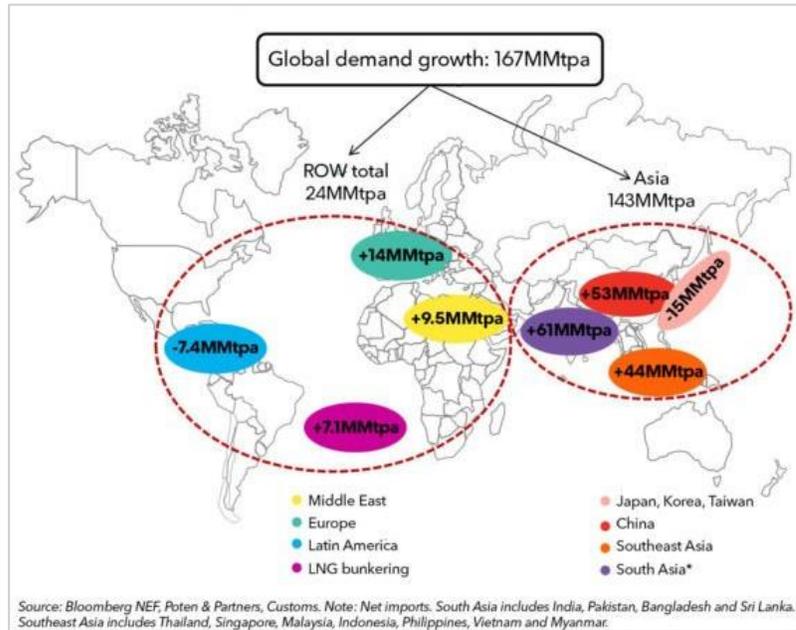
There will be more natural gas demand fulfilled by imports, as current and planned gas pipeline capacity cannot meet the fast-growing import demand. China will have to import more LNG in the future. On one hand, huge infrastructure investment for LNG storage and processing is needed in the coastal areas. On the other hand, with more importers competing in the Chinese natural gas market, China is gaining pricing power on natural gas import and lowering supply risks by diversification from only middle Asia to the whole world. This expansion will certainly increase China's national energy security level.

Emerging Markets – The LNG Revolution

For many years, the lack of infrastructure availability made consumers hesitant towards gas. However, it was a new wave of LNG, dubbed “waterborne markets” by Teddy Kott and Akos Losz¹⁶ that saw the rise of emerging market players as new drivers of demand. **Figure 11** depicts the gulf between LNG demand from the Rest of the World (ROW) and Asia.

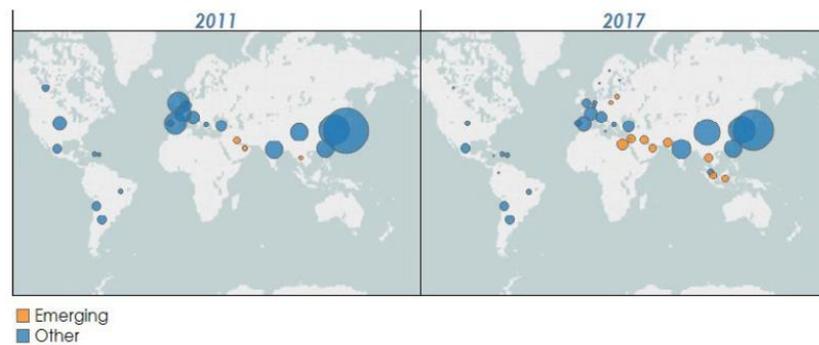
¹⁶ Teddy Kott and Akos Losz are energy experts housed at the Center on Global Energy Policy.

FIGURE 11: GLOBAL LNG DEMAND GROWTH



The figure below presents a snapshot of how new and emerging LNG importers are reshaping the waterborne gas market¹⁷. When analyzed over a 6-year period – we see from **Figure 12** that growth in demand from these new markets has surpassed growth from China, India, and Taiwan combined.

FIGURE 12: LNG IMPORTS BY COUNTRY (FULL YEAR) VS 2017 (THROUGH SEPTEMBER)



Source: Kpler, CGEP.

¹⁷ Teddy Kott and Akos Losz's report "THEY MIGHT BE GIANTS: How New and Emerging LNG Importers Are Reshaping the Waterborne Gas Market" - NOVEMBER 2017 Center on Global Energy Policy | Columbia University.

Conclusion

We began this paper by exploring the demand side of natural gas through a brief study on historical and current trends in natural gas consumption. We believe that this demand in natural gas will continue to grow, comprising a “quarter of global energy demand... by 2040”, making natural gas the second-largest fuel in the global mix after oil.¹⁸ Developing economies will account for much of this projected growth, led by China alongside various other emerging market players.

On the production side, we reiterate that shale gas will likely play a greater role in rebalancing global natural gas markets. Led by the US, natural gas will present a greater competitor to traditional oil markets due to their low-cost nature. Nonetheless, this low cost can present a challenge. Shale prices must still be high enough to attract investment, yet not too high to deter consumers. Furthermore, commercial viability needs to be weighed against environmental considerations brought about by fracking.

The US notwithstanding, this paper also assesses another dominant player in natural gas production: Australia. We note, however, that for Australia to continue capitalizing on its natural endowment and hold its position as a large LNG exporter, it needs to ensure the security of its domestic supply. This will allow it to refocus on consolidating LNG exports in the North-West and extraction of shale and coal seam gas in the Eastern markets, which are currently environmentally and economically challenge propositions.

Asides from traditional players, this paper also examines the rise of new producers in the gas market. Argentina has an unprecedented opportunity to become the world’s LNG supplier in the medium term, yet continues to be held back by severe constraints. For instance, Argentina has to prioritize economic stabilization in order to reduce uncertainty and secure a more conducive environment for investment.

We note that China, as a country, holds much promise for both natural gas production and consumption. Nonetheless, China’s future consumption will inevitably dwarf its natural gas production capabilities. China’s rich shale gas reserves are not as suitable for exploration as those in the US, and the former’s rate of production falls far below that of the latter. Thus, we predict a scenario where China continues to rely on natural gas imports. As we computed, corroborating predictions from other research institutions, China’s natural gas external dependence rate will hover around 45%. Such import demand can be supported by pipeline gas and LNG imports.

Lastly, we propose a short thesis on the role of “waterborne markets” as a latent influence on global natural gas markets. This can be used as a stepping stone for further research, especially to quantify and forecast the role of these new and niche markets in shaping natural gas trends in the future.

¹⁸ OECD/IEA, 2018 International Energy Agency:
https://www.iea.org/publications/freepublications/publication/WEO2017Excerpt_Outlook_for_Natural_Gas.pdf