

The Value of Integrating Saudi Arabia Into the Global Gas Market

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Key Points

The changing landscape in global liquefied natural gas (LNG) markets could make LNG imports a viable option for Saudi Arabia as it works to diversify its power mix away from an increased reliance on burning oil to generate electricity. In recent years a number of factors have come together in the LNG sector to create more value for both consumers and producers. These factors include lower supply costs, increased market liquidity, and innovative solutions for market accessibility.

Key findings from the workshop included:

- LNG contract tenures are getting shorter and thus more flexible for buyers. However, some LNG projects may still require long-term deals to support financing.
- Demand-side and supply-side innovations, such as floating storage and regasification units and modular, factory-built liquefaction units are contributing to making LNG a more cost-competitive option.
- There is a case for seasonal imports (i.e., during the northern hemisphere summer) for Saudi Arabia. However, other sources of energy, such as renewables, nuclear and domestic natural gas can also substitute for liquid fuels, without recourse to LNG.
- On average, northern hemisphere summer LNG prices can be \$0.50 per million British thermal units (MMBtu) lower than the yearly average price of LNG. This offers a good option for counter-cyclical markets such as Saudi Arabia, which uses more power in hot months than in cold ones and can thus import LNG when global LNG demand and prices are low.
- Several countries neighboring Saudi Arabia have successfully imported LNG to optimize their fuel mixes. However, such diversification comes with both commercial and technical challenges.

Summary

Between 2007 and 2017, the production of natural gas in Saudi Arabia grew by 40 billion cubic meters (bcm), a 57% increase. But despite efforts to further develop the country's domestic gas reserves, current supply has not kept pace with fast-growing demand. The shortage in gas supplies has resulted in the Saudi power sector, the anchor customer for natural gas in the Kingdom, burning more liquid fuels, at a significant opportunity cost. Given this backdrop, and with existing gas infrastructure (e.g., pipelines, processing plants) in place, combined with the recent developments in global gas markets, it is worth Saudi Arabia considering the importation of liquefied natural gas (LNG).

Today's LNG market is demonstrating real long-term strengths and opportunities to create value in a number of different areas. A confluence of factors over the past few years has enabled the global LNG industry to evolve and gain liquidity. On the supply side, low-cost producers such as the United States (U.S.) and Russia have expanded their LNG exports, while innovative contracting and reduced liquefaction construction costs have lowered the net cost of LNG cargoes. In terms of demand, floating storage and regasification units (FSRUs) have played a key role in opening up new markets. The ease of installation and flexible charter terms of FSRUs compared to purpose-built onshore regasification terminals, has attracted new demand

centers. Policy support from governments around the world has also been crucial for promoting LNG demand in developing markets. This has helped to increase liquidity in global LNG trade and accelerate the commoditization of LNG. Saudi Arabia has high summer electricity needs due to cooling demands. In contrast, major northern gas markets, mainly in Europe and Northeast Asia, are winter-weighted for heating, so summer LNG prices are advantageous for Saudi Arabia and also provide added value to LNG exporters and shippers.

Energy and electricity price reforms in Saudi Arabia have started to rationalize energy consumption overall and have paved the way toward optimizing the country's power fuel mix. Neighboring countries, such as Kuwait and the United Arab Emirates (UAE), have already experimented with LNG imports and have had success in countering gas shortages, but not without some challenges. The economic benefit of importing LNG to free-up crude oil for export and increase government revenue is also apparent. However, other alternative sources of energy, such as renewables, should not be ruled out – the costs associated with solar and wind power are falling steeply and can compete with LNG imports on price. However, the increased flexibility of today's LNG marketing and procurement regimes allows for adaptation to domestic energy goals and future energy demand uncertainties.

Background to the Workshop

Saudi Arabia relies significantly on liquid fuels for power generation, which has a large opportunity cost. Natural gas has been playing an increasingly important role in Saudi Arabia's energy mix. While developments are underway to ramp up domestic natural gas production, supplementing domestic supply with liquefied natural gas (LNG) imports is presenting itself as a viable option for the Kingdom. It is important, however, to understand the policy drivers required and market configuration needed to facilitate LNG imports into Saudi Arabia and what value it brings to the country against alternative sources of energy that can substitute for oil. Thus a workshop was organized with the following objectives:

- To develop an understanding of future trends in global LNG markets, including innovative solutions in making LNG cost competitive.
- To draw lessons from neighboring countries on their experiences of importing LNG and what obstacles must be overcome.
- To identify the value of importing LNG for Saudi Arabia's stakeholders and consumers.
- To pinpoint how a counter-cyclical gas market, such as Saudi Arabia, can add value to LNG producers.

LNG in Saudi Arabia's Energy Mix: Energy Supply Optimization

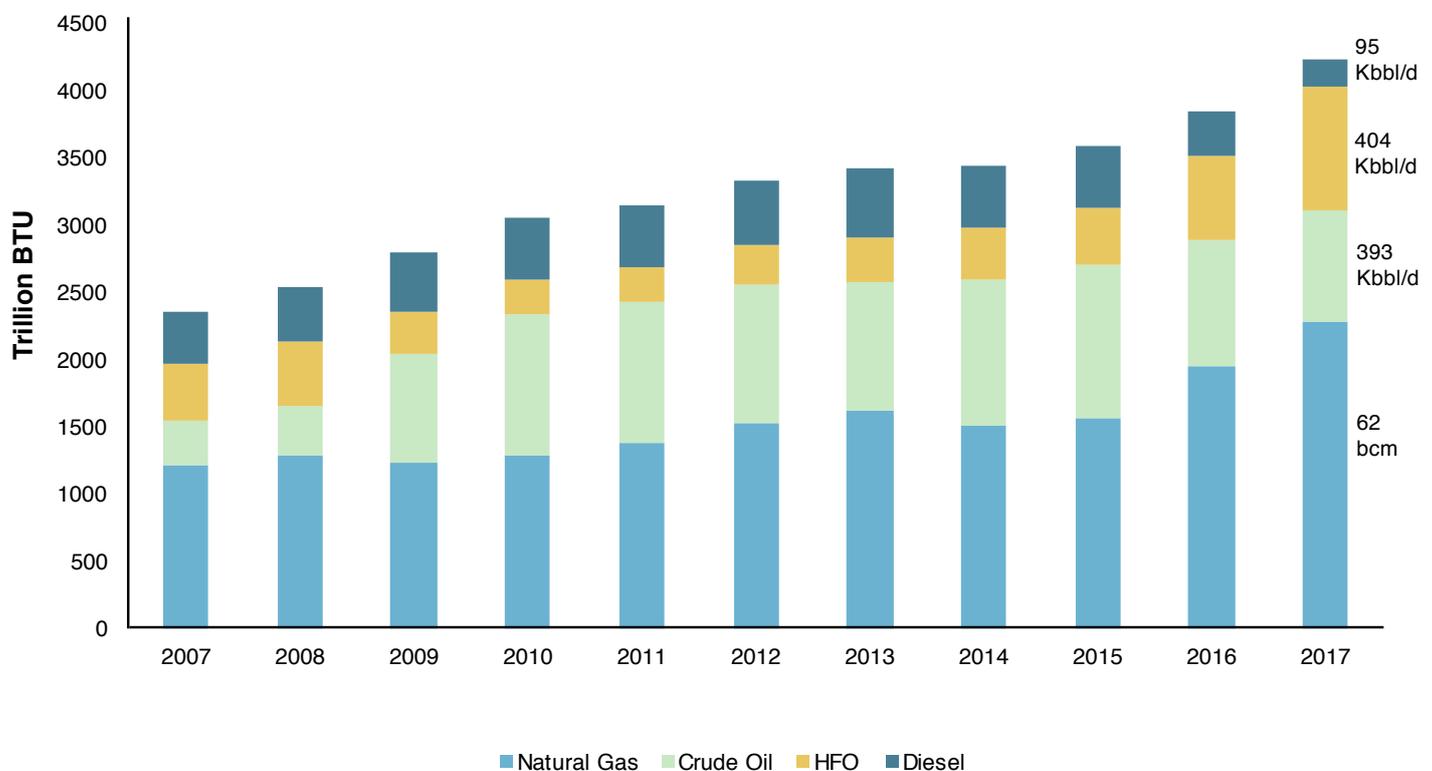
Saudi Arabia's domestic natural gas output has grown from 71 billion cubic meters (bcm) in 2007 to 111 bcm in 2017. The gas is mainly used as fuel for power generation but is also an important feedstock for petrochemicals production and as fuel for energy-intensive industries. There are plans to double the Kingdom's natural gas production to 238 bcm by 2030. While past production targets were almost achieved, further increases could be challenging as the industry shifts from easy-to-produce associated gas reserves to more costly and technically complex non-associated and unconventional production.

The growth in demand for gas, particularly for power generation, has been outpacing supply in

recent years and, as a result, Saudi Arabia has been burning oil to generate power. Since 2016, the Kingdom has had two waves of price reforms to rationalize energy consumption and drive the diversification of energy sources, partly with the aim of freeing-up more oil for export.

In 2017, Saudi Arabia consumed almost 900 thousand barrels per day (Kbbl/d) of liquids – comprising crude oil, heavy fuel oil (HFO) and diesel – to meet power and water demand, accounting for 46% of its fuel mix (see Figure 1). With the Kingdom's future energy demand set to grow on the back of more industrialization and economic diversification, LNG imports could offset the significant opportunity cost of burning oil.

Figure 1. Yearly fuel consumption of power and seawater desalination by type.



Source: Electricity & Cogeneration Regulatory Authority; KAPSARC.

LNG has taken on a larger role in the global gas trade, and the industry is evolving, making LNG more attractive for new importers. Over the last few years, with improvements in technology and a lowering of some costs, the market has become more flexible and more liquid. Although there is no measure of liquidity, secondary measures such as spot and short-term cargoes have grown rapidly over the last five years.

There is a case for LNG to supplement domestic Saudi natural gas production, especially seasonal summer imports, to meet the high demand for power to cool buildings and produce water in the hotter months. A KAPSARC study has shown that

importing LNG to free oil barrels for the export market would add a marginal benefit to the Saudi economy, although it would be a costly option compared to the savings that could be generated from other policies (Blazquez et al. 2018). In addition to the economic benefits from increased spot market trades and short-term LNG contracts for importers and the growing availability of floating storage and regasification units (FSRUs), LNG offers Saudi policymakers a viable insurance policy against delays in meeting domestic energy supply targets, whether from domestic gas, renewables or nuclear. Under these circumstances, importing LNG could be an effective energy security policy tool for Saudi Arabia.

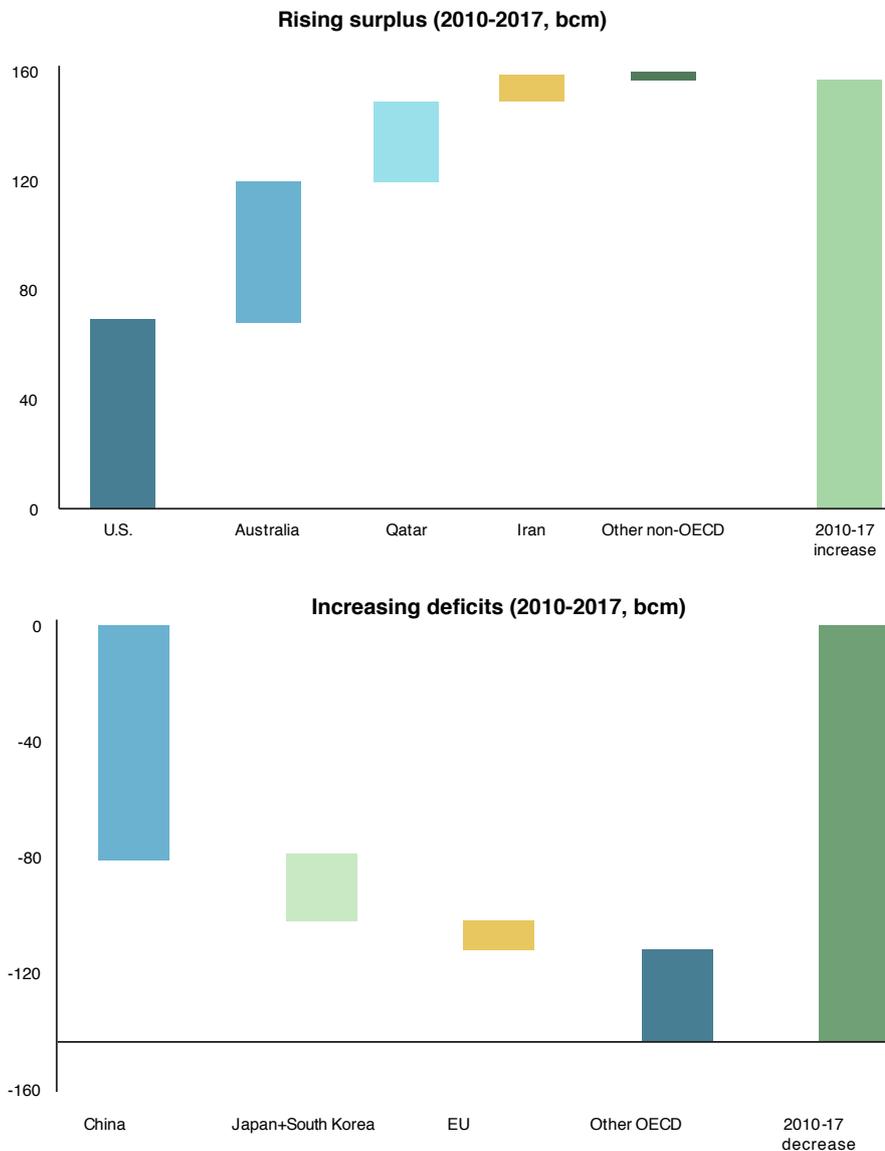
Expected Future Growth of the LNG Market

Natural gas remains the fastest growing fossil fuel globally. Global gas consumption grew by 2.7% in 2017, marginally slower than in 2016 but higher than the previous 10-year average of 2.3% per year (2006-16) and higher than other energy sources. Past global demand growth for gas was primarily driven by the electricity sector, but future gains are expected to come from industry and, to a lesser extent, transport.

In the past decade, the growth in natural gas production has overtaken domestic consumption in some countries, particularly the United States (U.S.), Australia, and Qatar. Other countries, notably China and other parts of East Asia, have seen demand outstrip domestic supply (see Figure 2).

As a result, flows of gas toward these gas-deficit countries have increased sharply since 2010, and

Figure 2. Natural gas net surplus by country and region.



Source: BP Statistical Review of World Energy 2018, KAPSARC.

a growing share of that is cross-border trade, especially in the form of LNG which can be transported by seagoing tankers. In general, the growth rate of the global gas trade is expected to be twice that of gas consumption and, within that, LNG trade flows are expected to grow even faster. The International Energy Agency (IEA) has forecasted that LNG's share of world cross-border gas trade will increase from around 40% of the total in 2018 to 60% by 2040.

Initial forecasts of the growth in LNG supplies had predicted a glut in the global LNG market. However, a number of small new LNG consumers have increased their demand volumes since 2015, and Chinese LNG demand has surged since 2016, keeping pace with the increase in new supplies of LNG, notably from Australia. China is likely to continue to be a big driver of global LNG demand growth, although estimates on future consumption differ widely.

Among the world's other big LNG consumers, the uncertain prospects for nuclear power in Japan and South Korea and changing energy policies in India will be crucial in determining future growth outcomes for LNG. Notwithstanding declining domestic gas production in several Asian and European countries, combined with a number of new LNG importers, East Asia will remain a major consumer of LNG going forward. This trend has been facilitated by the growing availability of FSRUs and more flexible contracts that have

allowed new consumers to enter the LNG market and contribute to the growth in demand.

The current boom in LNG supplies mirrors the last growth cycle (2009-11), which was led by the rapid expansion of Qatar's LNG export capacity. Australia is leading the current growth cycle (from its coal bed methane deposits) and the U.S. (from shale), with Russia, and even Papua New Guinea joining the pack. At the end of this growth cycle, marginal LNG cargoes will likely be supplied by the U.S. and consumed by Asia. The spike in international LNG supplies could also lead to global gas prices – which currently vary greatly in different parts of the world - converging to within a narrower global range and eroding the current wide spreads between contract and spot prices.

Policy decisions affecting natural gas are crucial for demand growth in many developing markets but especially for LNG. For example, without the Chinese government's commitment to fighting air pollution, the LNG market in China would not have grown as quickly as it has. Affordability, however, remains key for all current and potential LNG import markets, including Saudi Arabia. LNG does not necessarily work for all countries or regions because alternative sources of energy, such as coal and renewables are becoming more price-competitive. Nonetheless, LNG can play a flexibility role, complementing renewables when they enter the power mix and/ or where government policies promote cleaner and more efficient generation, creating value for LNG players.

Innovative Solutions Are Enabling Lower-Priced LNG

In the long run, LNG has to be cost-effective to be adopted as a fuel of choice. The LNG market in 2018 showed long-term strengths and opportunities to create value for producers and consumers. LNG demand has been driven by factors such as environmental policy, growing electrification, balancing renewable energy and replacing depleting domestic gas reserves. On the supply side, new and low-cost supplies of gas, and hence LNG, are emerging from countries such as the U.S. and Russia. There has also been a step-change in bringing down the cost of liquefaction units. Construction of liquefaction plants has shifted from being built from scratch on site to assembling modules in a factory – a cheaper and safer solution.

Financing of LNG projects is also becoming easier. As LNG trade moves toward a spot market model, future LNG projects are trending toward an equity-heavy model with less debt. This implies a high level of confidence by project stakeholders in the growth of LNG demand going forward, taking on volumes and selling LNG on the spot market. That being said, long-term supply contracts, agreed in advance

of project completion, are still needed to finance some projects. Earlier-than-expected tightness in the global LNG market has also pushed some buyers to lock into long-term contracts.

On the import side, the increased availability of FSRUs has helped open up new markets and presents a quick and relatively cheap solution to meeting a country's energy needs by importing LNG. Low barriers to entry, such as getting permits, environmental assessments and the upfront costs, make FSRUs more attractive than more costly and environmentally-sensitive land-based terminals. Customers can charter an FSRU on a short-term basis and not worry about the underutilization of permanent infrastructure or having stranded assets. For Saudi Arabia, FSRUs could be a good testing ground to integrate LNG into the Kingdom's domestic gas market for the purposes of price discovery. For example, energy-poor Argentina started importing LNG in 2008. Eventually LNG pricing incentivized domestic shale gas production. Similarly, India has started to use an LNG parity price as a way to incentivize its domestic gas production.

The Value of Counter-Seasonal Markets

The largest consumers of LNG are northern heating-based markets, which need extra gas in their winter months. The Northeast Asian market is becoming even more seasonal, with low gas storage capacity increasing the spread between summer and winter prices in the region. Counter-seasonal markets such as Saudi Arabia can therefore benefit from discounted summer LNG prices. Over the last 10 years, northern hemisphere summer LNG prices (roughly from April through October) were on average around \$0.50 per million British thermal units (MMBtu) lower than the average annual price. At the same time, suppliers would like to sell LNG all year round, which could make markets such as the Middle East valuable counter-seasonal sinks. In 2017, counter-seasonal markets helped balance a mismatch between world LNG supply and demand because Europe's traditional role as a balancing market was limited.

It has been predicted that a large part of the growth in gas markets going forward will come from non-OECD (i.e., developing) countries where demand will not come from heating in the residential and commercial sectors, but from space cooling. This will create new demand for electricity generation and thus may help narrow the traditional seasonality in global gas demand. National energy policies may also play a role in managing how much electricity can be used during the summer months. India, for example, has introduced its National Cooling Action Plan, which aims to reduce overall cooling demand by between 25% and 30%. A strong policy push by other countries to manage

their power demand, especially during peak periods, could significantly change the seasonality of global gas demand going forward.

LNG imports in the Middle East are not new. Kuwait and the United Arab Emirates have both imported LNG to help balance their gas markets and optimize their fuel mix for power generation. Kuwait was the first country in the Middle East to import LNG. Its power sector is the main gas user and has a similar power load profile (summer peaking) to Saudi Arabia's. In 2007, the Kuwaiti authorities realized that additional gas was needed to meet the country's future energy demand. An FSRU with a capacity of 0.5 billion cubic feet (Bcf) per day was built as a short-term solution, with a projected lifespan of five years. Importing LNG in this way helped Kuwait overcome its summer gas shortages and encouraged the government to extend the contract of the FSRU by 15 years, to 2025. There were challenges in the process, such as quality differences between the imported LNG and domestic gas supply, but these were overcome. In addition, skilled manpower had to be acquired. On the commercial side, procuring LNG was challenging in the initial years as LNG was not a very big market at that time and FSRUs were supplied by a limited number of companies. Saudi Arabia will likely not face the same problems as LNG markets are now much more liquid and the availability of FSRUs has grown. However, Kuwait also assessed the prices and logistics of alternative sources of energy before deciding to import LNG. This would also hold for Saudi Arabian policymakers. The cost factor will play an important role, but ultimately the future energy mix of Saudi Arabia will likely also depend on the government's energy policies.

About the Workshop

KAPSARC organized this workshop, held in Riyadh on Oct. 15, 2018, as part of the Future of Natural Gas in Saudi Arabia project, specifically to explore the option of LNG imports to supplement domestic gas and displace oil from the power sector in Saudi Arabia. The workshop brought together some 40 energy experts from industry and research institutes around the world to discuss which policy factors and market configurations were required to make LNG imports a viable option for the Kingdom. The workshop was held under a modified version of the Chatham House Rule under which participants consented to be listed below. However, none of the content in this briefing can be attributed to any individual attendee.

List of participants

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Ayed Al-Fadhli – Senior analyst, Kuwait Petroleum Corporation

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Reem Alsadoun – Engineer, Saudi Aramco

Mohammed Alzumaia – General Manager, Shell Saudi Arabia & Bahrain

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Anne-Sophie Corbeau – Head of Gas Analysis, BP

Andrew Crowe – VP & Country Chairman, Shell Saudi Arabia & Bahrain

Swati Dsouza – Consultant, Brookings India

Tom Earl – Chief Commercial Officer, Venture Global LNG

Bassam Fattouh – Director, Oxford Institute of Energy Studies (OIES)

Geert Greving – Senior Fellow, Clingendael International Energy Program

Mark Gyetvay – Chief Financial Officer, Novatek

Scott Hutchins – Senior Energy Advisor, U.S. Embassy in Saudi Arabia

Roa Ibrahim – Consultant, Qamar Energy

Aziz Kassim – Director Business Development, Excelerate Energy

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Hideki Matsubara – Chief Representative, Diamond Gas International

Yasushi Murakami – General Manager, Mitsubishi (Al-Khobar)

Olivier Pasquier – Economic Attache, Embassy of France in Saudi Arabia

Mike Peters – Regional Manager LNG Origination – MENA & South Asia, Shell

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Mehmet Soytas – Fellow, KAPSARC

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Adam Sieminski – President, KAPSARC

Colin Ward – Director, KAPSARC

References

Blazquez, Jorge, Baltasar Manzano, Lester Hunt, and Axel Pierru. 2018. "The Value of Saving Oil in Saudi Arabia." KAPSARC discussion paper. Doi: [10.30573/KS--2018-DP030](https://doi.org/10.30573/KS--2018-DP030)

About the Team



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Kaushik Deb

Kaushik is a research fellow in the Markets and Industrial Development program. He is an applied economist who previously worked in BP's Economics team, leading its analysis of global natural gas markets and macroeconomic developments in the Asia Pacific region. His earlier roles include policy research and advocacy on infrastructure and environmental economics issues at IDFC. Kaushik has also guided and implemented research in applied economics at TERI University and was the program director of TERI's MBA programs.



Maxime Schenckery

Maxime is a visiting researcher at KAPSARC and currently the Director of the Center for Energy Economics and Management at the IFP School. He has over 20 years of experience in the oil and gas industry as a corporate chief energy economist, senior policy adviser and professor. His areas of work encompass oil and gas markets forecasting, energy transition policies and innovation penetration in energy systems. He holds a Ph.D. in Economics from the University of Paris-North.



Colin Ward

Colin is a research fellow in KAPSARC's Markets and Industrial Development program primarily focusing on cost estimation for energy projects and environmental impacts of the global energy industry. He holds an MBA from the University of Texas, a B.S. degree in electrical engineering from the University of Houston, and a B.A. degree in philosophy from Tulane University.

About the Project

The objective of this project is to investigate the value that natural gas can provide to the economy of Saudi Arabia, allowing for LNG imports. While developments are underway to ramp up domestic natural gas production, supplementing domestic supply with LNG imports could become an option for the Kingdom. The project aims to assess this option and its consequences.



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