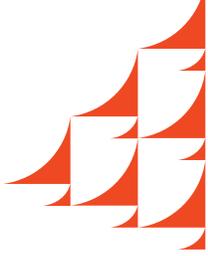




The Arab Gulf States  
Institute in Washington  
Building bridges of understanding



Looming Peak Oil Demand Triggers Gulf Race for Natural Gas  
Kate Dourian



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## Looming Peak Oil Demand Triggers Gulf Race for Natural Gas

Kate Dourian

July 20, 2020

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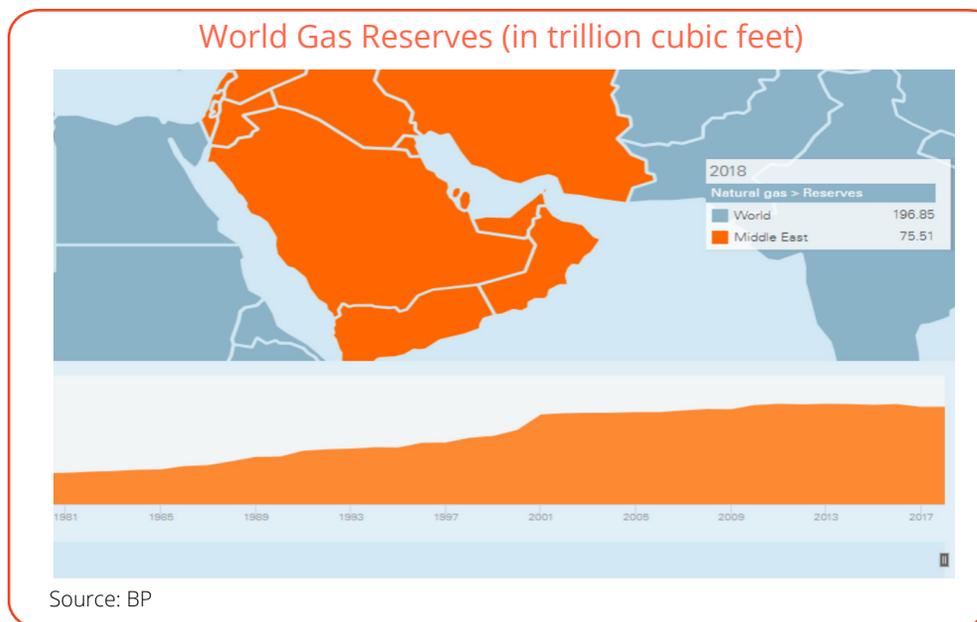
Cover Photo Credit: REUTERS/Ahmed Jadallah

## About the Author

**Kate Dourian** is a non-resident fellow at the Arab Gulf States Institute in Washington, the regional manager for the Middle East and Gulf states at the World Energy Council, and a fellow at the Energy Institute. Previously, she was the programme officer for the Middle East and North Africa in the Global Energy Relations Division of the International Energy Agency. Her role included building relationships between the IEA and the governments of several Middle Eastern and North African countries, using the extensive contacts that she accumulated during three decades spent in several Middle Eastern and North African countries as a journalist and energy analyst. She also helped write and edit the Middle East and North Africa sections of several IEA publications and contributed to the supply section of the Oil Market Report. She joined the IEA from the Middle East Economic Survey where she was a senior editor covering energy-related developments in the Middle East from 2013-15.

## Executive Summary

Natural gas is the fastest-growing fossil fuel, and its share of the energy mix is set to grow in the coming decades as demand for oil and coal peaks. Most forecasts see natural gas as the only fossil fuel to increase its share of the global energy mix between now and 2050. As a cleaner-burning fossil fuel, natural gas is considered an essential alternative to coal, the most polluting of the hydrocarbon family. But as the energy transition away from fossil fuels has gained traction in recent years, the environmental impact of natural gas is being reassessed and debated in energy circles. While natural gas will have a role in the energy transition, some question whether climate goals can be achieved without decarbonizing natural gas and eliminating methane emissions into the atmosphere. Whether natural gas is a bridging fuel along the path to a cleaner energy future or a destination fuel is still a matter of much debate. The energy policy adopted by the European Union in its European Green Deal to 2050<sup>1</sup> envisages a reduction in the share of natural gas in power generation and a higher percentage of renewable energy in the mix as coal is phased out. The same goes for the United States, where demand for natural gas for power generation is forecast to plateau or decline. But natural gas is more of a regional story than oil, which is more global in nature.



Over the coming decades, the pattern of demand and pace of growth will be determined by regional market dynamics with peak demand in some regions and continued growth in others. The Asian market, led by China and India, will account for more than half of total growth in energy demand to 2040, according to International Energy Agency projections. The Middle East is the second fastest-growing demand region, where natural gas will displace oil in power generation and other sectors. In Africa, natural gas will play a key role in ensuring

<sup>1</sup> European Commission, *The European Green Deal* (Brussels: European Commission, November 12, 2019).

reliable energy access to the more than 600 million people who still lack access to electricity.

For most of the Gulf Arab states that rely heavily on crude oil exports for revenue, natural gas is increasingly being prioritized over oil and is seen as an engine of economic growth and diversification. But aside from Qatar, a global gas powerhouse, the other Gulf Arab states, which were late in monetizing their gas resources, are racing to secure natural gas supplies to meet soaring demand for power generation, desalination, and an expanding petrochemical industry. Even those countries in the region that have significant gas resources of their own have become importers. Bahrain, Kuwait, Oman, and the United Arab Emirates are all importing natural gas either via pipeline or as liquefied natural gas and, in some instances, both. Saudi Arabia plans to invest tens of billions of dollars to develop its unconventional gas resources while exploring opportunities to invest in overseas gas projects.

This dash for gas will have ramifications for economic and energy models of the region's petrostates for years to come as environmental pressures mount within the region and beyond. Natural gas security would be enhanced if the Gulf Arab states put aside geopolitical differences and create a regional gas market and an integrated grid where transparency and cross-border trade can flourish.

## Introduction

Natural gas demand is projected to rise by 1.3% annually between 2018 and 2050, according to the Gas Exporting Countries Forum outlook.<sup>2</sup> Demand growth is driven by environmental concerns, air quality issues, coal-to-gas switching, and economic and population growth. The share of natural gas in the energy mix is anticipated to rise to 27% from 23% currently, with Asia and the Middle East leading growth in demand. The Gulf Cooperation Council countries have an abundance of natural gas reserves, but outside of Qatar, the development of these reserves has been slow to materialize, leading to a deficit that is being plugged by imports of liquefied natural gas.

Members of the GCC held 1,379 trillion cubic feet of natural gas reserves or close to 20% of the global total at the end of 2018, according to the BP Statistical Review of World Energy 2019.<sup>3</sup> Qatar is by far the largest reserve holder and currently ranks as the world's biggest LNG exporter. However, the reserves don't tell the full story with production levels for the other GCC members below their full potential, a sign of the lag in developing these reserves. Removing Qatar, which accounts for 4.5% of total gas production, the other five members produced 6.4% of the global total. The Gulf states have historically been among the highest per capita consumers of energy due to a combination of rapid economic growth, an expanding energy-intensive industry, and energy subsidies. The collapse in oil prices in 2014-15 provided an opportunity to introduce price reforms, and several GCC states began to gradually ease or scrap subsidies on certain fuels, although in much of the region electricity is still subsidized, which exacerbates the gas deficit.

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<sup>2</sup> Gas Exporting Countries Forum, *Global Gas Outlook 2050 Synopsis* (Doha: GECEF, February 2020).

<sup>3</sup> British Petroleum, *BP Statistical Review of World Energy 2019* (London: BP, June 2019).

**World Gas Reserves (in trillion cubic feet)  
Estimated Reserves at End of 2018**

COUNTRY		SHARE OF GCC	SHARE OF WORLD
Qatar	872.1	63.2%	12.6%
Saudi Arabia	208.1	15.1%	3.0%
UAE	209.7	15.2%	3.0%
Kuwait	59.9	4.3%	0.9%
Oman	23.5	1.7%	0.3%
Bahrain	6.4	0.5%	0.1%
<b>GCC Total</b>	<b>1,379</b>	<b>100%</b>	<b>19.9%</b>
Iran	1,127	-	16.2%
Russia	1,375	-	19.8%
Turkmenistan	688.1	-	9.9%
United States	419.8	-	6.0%
Rest of the World	1,962.9	-	28.2%
<b>Total World</b>	<b>6,951.8</b>		<b>100%</b>

Source: BP Statistical Review of World Energy 2019

By 2040, renewable energy is forecast to overtake coal as the largest source of global power generation. So, where does natural gas fit into this scenario, specifically for the Gulf oil-producing states? According to BP's 2019 Energy Outlook, renewables and natural gas account for almost 85% of the growth in primary energy to 2040.<sup>4</sup> It projects natural gas growing at a rate of 1.7% annually, driven by demand and the increased availability of natural gas, particularly LNG. The United States and the Middle East lead the growth in supply with Russia and China also contributing. Of the world's top 10 gas producers, three are in the Gulf region, but supply continues to lag demand, which has doubled since 2005.<sup>5</sup>

To ramp up production to meet anticipated higher demand will require considerable investment. A report by the Arab Petroleum Investments Corporation puts the energy investment requirements of the Middle East and Africa at \$1 trillion over the next five years, with 19% of the total dedicated to gas projects.<sup>6</sup> The report notes, however, that this comes at a time when governments face constrained budgets and competing demands for funds. The report was published in late 2019, before the coronavirus pandemic and the oil price war between Saudi Arabia and Russia wreaked havoc on oil markets and oil prices, which have fallen to their lowest level in nearly two decades. The collapse in oil prices coupled with demand destruction caused by the pandemic will put further strain on the economies of Gulf states and may yet lead to steep budget cuts and project delays.

<sup>4</sup> British Petroleum, *BP Statistical Review of World Energy 2019* (London: BP, June 2019).

<sup>5</sup> Jonathan Stern, ed., *The Future of Gas in the Gulf: Continuity and Change* (Oxford: The Oxford Institute for Energy Studies, 2019), vii.

<sup>6</sup> Arab Petroleum Investments Corporation, *MENA Annual Energy Investment Outlook 2019* (Dammam, Saudi Arabia: APICORP, April 2019).

Yet there have been some significant developments on the gas front in the Gulf region with several key projects already approved and likely to be completed to boost supply in the near term. The largest increment will come from Qatar, the world's largest exporter of LNG. In 2017, Qatar lifted a moratorium on further development of the offshore North Field and plans to expand LNG production by 40% in the next five years. For the other Gulf oil-producing states, much of the gas is produced as a byproduct of crude oil, and volumes are affected by OPEC output restrictions.

In Saudi Arabia, the investment in natural gas production and related infrastructure has given the kingdom a certain amount of flexibility. Additional gas volume and the completion of gas processing facilities made it possible for Saudi Arabia to reduce the amount of crude oil and other petroleum liquids used to generate electricity and free up more crude oil for exports.

The kingdom's focus now is on developing shale gas resources, which are more expensive to produce because of the technological challenges of producing shale, or tight, gas resources, particularly in a desert environment where water is scarce. Saudi Aramco has committed more than \$110 billion to a single shale gas development that will be completed by 2036, a sign of the kingdom's determination to achieve self-sufficiency. The United Arab Emirates, which has the most diversified energy portfolio of all of the Gulf states, is a net gas importer but hopes to wean itself off imports with further development of its conventional and sour gas deposits. The discovery of a massive gas field in 2020 has been hailed as a promising step in that direction. The picture is not so rosy in Kuwait, where efforts to develop indigenous gas fields have proved elusive due to internal politics and successive ministerial changes. Kuwait remains an importer of LNG and is likely to remain so for some time. Iraq, which has barely touched its nonassociated natural gas reserves, flares up to 60% of the gas it produces in tandem with oil because it lacks sufficient infrastructure to use the gas produced. Oman, meanwhile, continues to import Qatari gas by pipeline via the UAE, although it too is a gas exporter. Bahrain, the smallest of the region's oil and gas producers, is assessing the potential of a massive unconventional oil and gas play that may change its fortunes.

As energy consumption is projected to rise, the need to secure additional gas supplies is becoming urgent. According to the BP Energy Outlook, per capita energy consumption in the Middle East will reach Organization of Economic Cooperation and Development levels by 2040 when it will be twice the world's average.<sup>7</sup> Energy consumption is projected to rise by 1.9% annually, driven by the power sector and industry. Gas and renewables together are projected to account for 78% of incremental energy demand with natural gas securing the lion's share with a 55% increase. Oil demand growth is limited as it is displaced by gas, renewables, and nuclear power. Oil's share in energy falls to 34% from 47%, while coal's share increases slightly to 2% of total energy demand by 2040.

Energy production is expected to increase by 36%, driven by growth in natural gas, which accounts for 60% of the expansion compared with 17% for oil. The Middle East will remain the largest producer of oil and the second largest of natural gas in 2040. Oil production is expected to rise by 5 million barrels per day over the outlook period, while natural gas will nearly triple to 1,056 billion cubic meters (bcm). Even then, the gas deficit will remain, and the

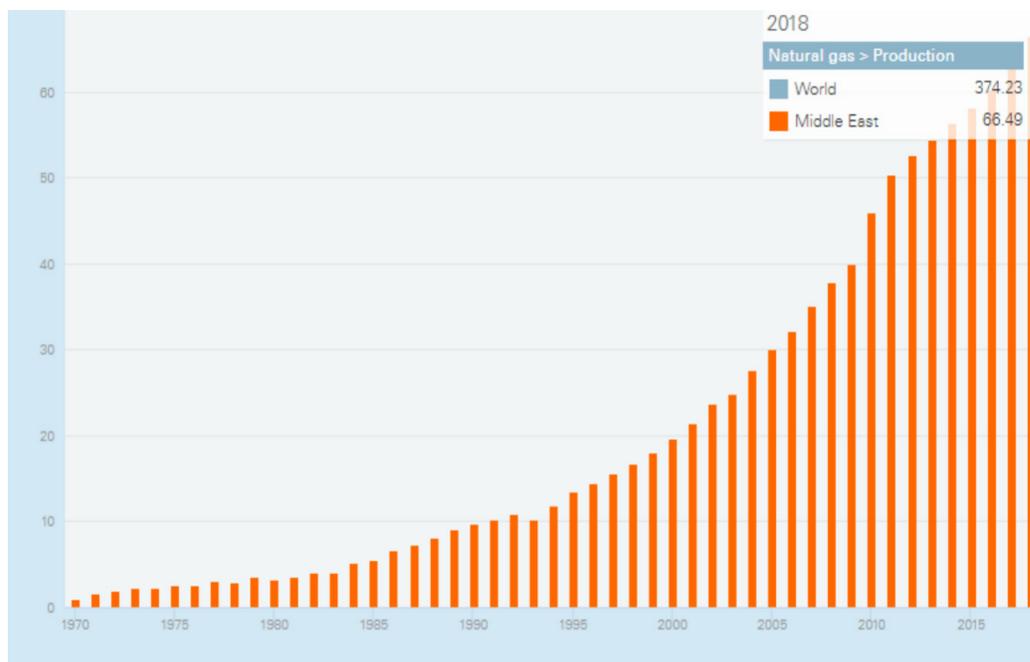
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<sup>7</sup> British Petroleum, *BP Statistical Review of World Energy 2019* (London: BP, June 2019).

region will need to import some 36 bcm of LNG to satisfy demand.

The energy transition now underway is changing the way energy is produced, consumed, and delivered. Meanwhile, the entire complex is being redrawn with renewable energy taking an increasingly bigger share of the global pie in the electricity sector.

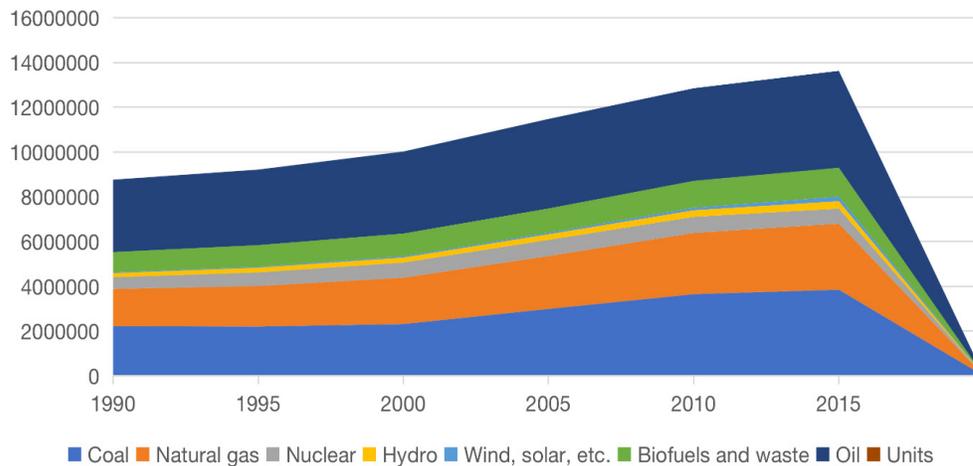
### Natural Gas Production in the Middle East 1970-2017 (in billion cubic feet per day)



Source: BP Statistical Review of World Energy 2019

For natural gas, the present challenge is the declining cost of renewable technologies that have become competitive with gas, even without subsidies. Without increased decarbonization efforts, natural gas may lose its appeal on environmental grounds. Advances in technology and battery storage are making it difficult to justify the continued use of hydrocarbons and gas, which are no longer seen as bridge fuels toward a more decarbonized energy system. Gas has been a necessary filler for intermittent periods when the sun doesn't shine or the wind doesn't blow. But energy storage solutions are being developed rapidly and, if deployed at scale, would overcome the intermittency problem and allow renewables to be deployed more widely. This has led some experts to question whether natural gas is a bridge or a destination fuel or whether it will end up as a "sunset fuel" beyond 2025-30.

### Progression of Energy Sources Since 1990 and Their Share of the Energy Mix



Source: International Energy Agency

## Gulf Focus on Gas

Although renewable and nuclear energy will play an increasingly important role in the future, natural gas will remain the primary fuel source for power generation and new energy-intensive industrial projects in Gulf Arab countries, making it a powerful engine of growth. For the Gulf states, natural gas will serve as a means for a more diversified energy mix when demand for crude oil peaks and as a way of diversifying their oil-based economies. It will also provide feedstock for value-added industries like petrochemicals, which would allow the Gulf states to monetize their gas and extract more value from their hydrocarbon resources. Demand for natural gas in the Gulf states is set to rise by 70 bcm between 2018 and 2024, according to the International Energy Agency's Gas 2019 medium-term outlook.<sup>8</sup>

Power generation accounts for half of total demand growth, followed by industry with 23 bcm, and buildings and other sectors with 12 bcm. Because of the harsh climate across the Gulf region, demand for cooling is high. Space cooling accounted for around 15% of total electricity demand in 2016, according to the IEA's 2018 "The Future of Cooling" report.<sup>9</sup> According to the report, peak load demand for cooling can be as high as 50% or more. In Saudi Arabia, air conditioning accounts for 51% of total electricity demand.

Aside from Qatar, much of the region's nonassociated gas reserves are relatively underdeveloped, and demand has overtaken supply with the gap expected to widen in the coming years. Renewable and nuclear energy will play an increasingly important role in the future, but the current percentage of solar and wind in the Gulf area remains low.

<sup>8</sup> International Energy Agency, *Gas 2019: Analysis and Forecasts to 2024* (Paris: IEA, June 2019).

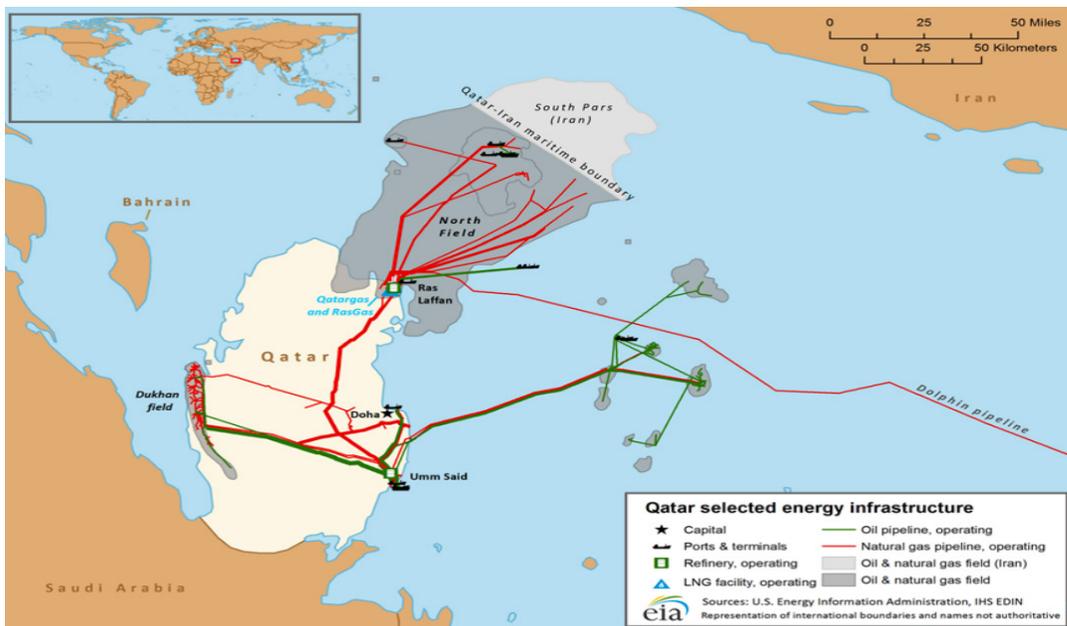
<sup>9</sup> International Energy Agency, *The Future of Cooling* (Paris: IEA, May 2018).

The International Renewable Energy Agency noted in its report, “Renewable Energy Market Analysis: GCC 2019,” that while the Gulf countries had made gains in the deployment of renewable energy, mainly solar, since 2014, renewables accounted for less than 1% of total installed power capacity in 2018.<sup>10</sup> The UAE, which already has some of the world’s largest solar parks, leads with 68% of total renewable capacity, followed by Saudi Arabia with 16% and Kuwait with 9%. The UAE is also due to have the first operational nuclear power station in the Gulf Arab region, although it continues to rely heavily on natural gas for power generation.

By capitalizing on its promising resources for renewable power generation and other applications like cooling and transportation, by 2030 the region could save 354 million barrels of oil equivalent and reduce the power sector’s carbon dioxide emissions by 22%, based on the renewable targets already in place.<sup>11</sup>

For now, natural gas remains the fuel of choice for power generation in much of the region where renewables have yet to secure a larger share of the energy mix. The Gulf states’ power demand more than doubled from 2000-17 due to the rapid expansion of energy-intensive industries and surging residential electricity consumption, as a result of rapid population growth. Supply also more than doubled during the same period, although Qatar accounted for more than 45% of the group’s total. The IEA, in its “Gas 2017” report, forecast a 15% rise in gas demand in Gulf states to 2022.<sup>12</sup> Excluding Qatar, demand in the other five GCC states surpassed production levels in 2010, and by 2017, their gas supply gap averaged around 10 bcm per year and is set to widen to 15 bcm by 2022, according to the IEA.

## Qatar: Banking on LNG in a Competitive Market



Source: U.S. Energy Information Administration

<sup>10</sup> International Renewable Energy Agency, *Renewable Energy Market Analysis: GCC 2019* (Abu Dhabi: IRENA, January 2019).

<sup>11</sup> Ibid.

<sup>12</sup> International Energy Agency, *Market Report Series: Gas 2017* (Paris: IEA, October 2017).

Qatar holds the world's third largest natural gas reserves after Russia and Iran. Its 872.1 trillion cubic feet of gas reserves are 12.5% of the global total. The tiny peninsula is currently the biggest exporter of LNG with capacity of 77 million metric tons per year (mt/y); plans to expand production are underway. A modest oil producer, Qatar moved rapidly to develop its massive gas reserves, nearly all of which are in the offshore North Field, the single largest concentration of nonassociated gas. The field is shared with Iran, where it is known as South Pars.

Development of the North Field was fast-tracked, and within a decade, Qatar had lifted production to a targeted 77 million mt/y, a milestone achieved in 2010, after which further development was halted while it conducted reservoir studies. A 2005 moratorium on further development of the North Field was extended until 2017 when Qatar Petroleum announced it was lifting the moratorium to expand capacity.<sup>13</sup>

Revenue from natural gas sales turned Qatar into one of the world's wealthiest countries with per capita income of \$65,138 in 2019, according to the World Bank.<sup>14</sup>

Having dominated the LNG world for over a decade, Qatar faces competition from a wave of new LNG supplies hitting the market in recent years, mainly from Australia, and more recently from the United States, where growth in shale gas production led to a surplus that is being exported to Europe, Asia, and even the Middle East. However, Qatar has the advantage of extremely low production costs and state of the art gas liquefaction facilities developed at its Ras Laffan industrial hub. It also has a dedicated fleet of tankers and supertankers that provide flexibility and security of supply to its customers around the globe. Qatar Petroleum took steps to streamline its operations in the wake of the 2014-15 oil price decline. At the end of 2016, it amalgamated RasGas and QatarGas, its two LNG operators, a move designed to cut costs and improve operational efficiency by merging the capabilities of the two joint ventures.

Although Qatar's reserves and production dwarf those of all other GCC countries combined, it has few regional customers except for the UAE and Oman, which receive a small volume of pipeline gas from Qatar via Dolphin Energy, the only cross-border energy project in the region. The flow of gas from Qatar via the Dolphin pipeline has not been affected by the diplomatic rift with the UAE and Saudi Arabia, both of which, along with Bahrain and Egypt, imposed a boycott against Qatar in 2017. Qatar continues to export around 2 billion cubic feet per day (bcf/d) of gas via pipeline to the UAE and Oman. Dolphin Energy is a joint venture among the UAE's Mubadala Development Company, Total, and Occidental Petroleum. Qatar is also exporting LNG to Kuwait, which, along with Oman, is not a party to the boycott. However, the unresolved dispute makes an increase in Qatari gas supplies to other GCC countries to offset supply imbalances highly unlikely at this time.

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*The growth in LNG supply depressed gas prices even before the coronavirus pandemic struck, slowing energy demand as much of the world went into lockdown.*

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The growth in LNG supply depressed gas prices even before the coronavirus pandemic struck,

<sup>13</sup> Diane Munro, "Qatar Moves to Ensure LNG Dominance," *Arab Gulf States Institute in Washington*, April 17, 2017.

<sup>14</sup> "Qatar Global Outlook," *World Bank*, accessed May 20, 2020.

slowing energy demand as much of the world went into lockdown. This demand destruction, coupled with the lowest oil prices in nearly a decade, has also had an impact on natural gas since most LNG contracts are linked to crude oil. On April 8, the price of LNG on the Asian spot market was assessed at a historic low of \$2.39 per million British thermal units (/MMBtu).

Qatar Petroleum CEO Saad al-Kaabi told Reuters in an April 6 interview that the company planned to press ahead with domestic and foreign expansion despite the turmoil caused by the coronavirus pandemic. He also said the company might seek to raise debt in 2021 for the North Field LNG expansion.<sup>15</sup>

Qatar Petroleum plans to increase its LNG production to 110 million mt/y initially and to 126 mt/y by 2027. This would represent a total capacity increase of 64%. Kaabi said in the interview with Reuters that the start of production from new facilities, initially expected in 2024, had been pushed back to 2025 because of a delay in the bidding process due to the pandemic. The collapse in LNG prices since the start of the year is likely to have altered the economics of the project at a time when potential foreign partners at international oil companies are slashing costs. ExxonMobil, the largest investor in Qatar's LNG production, announced on April 7 that it would cut its 2020 capital expenditure by 30% in response to low commodity prices resulting from oversupply and demand weakness from the pandemic. Shell, Total, Eni, and Chevron have all announced they would cut capital expenditures.

Qatar Petroleum has also been expanding its portfolio of investments abroad. It entered into a joint venture partnership with ExxonMobil for a 40% stake in a gas block offshore Cyprus, where the companies reported a gas discovery in 2019. It has also acquired exploration assets in 44 blocks around the world, including in Argentina, Brazil, Guyana, Kenya, Mexico, Morocco, Mozambique, Oman, and South Africa, through minority stakes in consortia led by Chevron, Eni, ExxonMobil, Shell, and Total.

Qatar Petroleum's largest overseas investment is its majority stake in the Golden Pass LNG terminal in Texas, where ExxonMobil is a minority shareholder. The companies plan to start construction of the 16 million mt/y plant in May, with a first phase due to begin in 2024. The project will provide the United States with an export outlet for its domestic gas production while the additional LNG volumes will allow Qatar to maintain its market dominance. It isn't clear whether the spending cuts announced by ExxonMobil and other international oil companies recently will lead to a review of projects. But the final investment decision for Golden Pass has already been made, and the project is likely to proceed as planned. Kaabi said no project has been taken off the table.

Qatar is expanding at a time of demand uncertainty and a supply glut. The IEA said in a June 2019 report<sup>16</sup> that more than 100 bcm of new LNG supply capacity was due to be commissioned between 2018 and 2023, with the bulk coming from Australia and the United States. The report, "LNG Market Trends and Their Implications," a joint study with the Korea Energy Economics Institute, indicated that so far, the wave of new liquefaction capacity had

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<sup>15</sup> Rania El Gamal, "Qatar Petroleum Not Scaling Down LNG Expansion Despite Delay in Bids," *Reuters*, April 6, 2020.

<sup>16</sup> International Energy Agency, *LNG Market Trends and Their Implications* (Paris: IEA, June 2019).

been absorbed, mostly by Asian importers, without signs of looming oversupply.<sup>17</sup>

A 2017 analysis of Qatar's LNG expansion plans by the Oxford Institute for Energy Studies argued that, as global LNG demand grows beyond projected supply from existing projects under construction, the world would require new supplies around the middle of the 2020s, in addition to the expected additional volumes from Qatar.<sup>18</sup> Given the relative cost-base advantage of new Qatari LNG projects, this will increase the competitive pressure on projects in more expensive locations.

Qatar Petroleum is looking beyond the current dip in demand with plans to expand its LNG tanker fleet to accommodate the expected increase in production once the North Field expansion is completed. Speaking in Japan in September 2019, Kaabi said Qatar Petroleum planned to build 100 LNG carriers over the next decade, adding that he expected production to rise to 110 mt/year by 2024.<sup>19</sup>

## Saudi Arabia: Joining the Shale Gas Revolution



Harad Gas Plant, Acid Gas Handling Area (Saudi Aramco)

Saudi Aramco has made the expansion of its gas production one of the main goals in its strategy,<sup>20</sup> as anticipated growth in power generation capacity will require additional volumes to replace liquid fuels. Saudi Arabia's per capita energy consumption is more than three times higher than the world average, at 6.5 tons per energy equivalent per capita in 2011, compared

<sup>17</sup> International Energy Agency, *LNG Market Trends and Their Implications* (Paris: IEA, June 2019).

<sup>18</sup> Howard Rogers, *Qatar Lifts its LNG Moratorium* (Oxford: The Oxford Institute for Energy Studies, April 2017).

<sup>19</sup> "Minister Al-Kaabi: Qatar is Reinforcing its Position as the World's Leading LNG Producer," *Qatar Petroleum*, September 26, 2019.

<sup>20</sup> Saudi Aramco, *This is Energy This is Aramco – Annual Report 2019* (Dharan, Saudi Arabia: Saudi Aramco, 2020).

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with the world average of 1.9 tons, according to the United Nations Development Program.<sup>21</sup>

Saudi Arabia's energy demand has flourished in the past three decades, and it currently consumes 38% of the petroleum products and gas produced in the kingdom. Demand is expected to double by 2030, according to data from the Saudi Energy Efficiency Center.<sup>22</sup> The energy efficiency plans underway targeting the transportation, building, and industrial sectors, which account for 90% of total consumption, are expected to result in savings of approximately 1.5 million barrels of oil equivalent per day by 2030, according to the center.

Gas is the largest single energy source in Saudi Arabia, accounting for roughly 36% of the overall primary energy mix and around 55% of the fuel mix for power generation and desalination, according to Saudi Aramco's 2019 annual report.<sup>23</sup> Aramco estimated total energy demand in the kingdom at 4.7 million barrels of oil equivalent. Aramco plans to increase the share of gas in the energy mix from 50% to 70%, all of which will come from domestic production at an estimated cost of \$160 billion – a large portion of this will go to the development of unconventional or shale gas reserves. BP's "Statistical Review of World Energy" put the kingdom's proven gas reserves at 208.1 trillion cubic feet (tcf),<sup>24</sup> enough to sustain production for more than 70 years.

According to Aramco, at the end of December 2019, the total gas processing system had a capacity of 17 billion standard cubic feet per day, up from 15.5 billion standard cubic feet per day. The company says that it plans to develop an integrated global gas portfolio and is pursuing investment in joint venture opportunities outside the kingdom in natural gas and LNG projects. However, despite negotiations conducted with Russia for stakes in its LNG projects and a preliminary agreement to purchase LNG and acquire a stake in a U.S. LNG project, Aramco has yet to move forward with overseas gas acquisitions.

In 2019, Aramco and Sempra Energy signed a preliminary deal to negotiate a 20-year LNG sale-and-purchase agreement for 5 million mt/y from the Port Arthur LNG export project under development in Texas. The preliminary agreement also included negotiations for Aramco to acquire a 25% equity investment in Phase 1 of Port Arthur LNG, Platts reported.<sup>25</sup>

While Saudi Aramco previously relied on associated gas, it shifted its focus to nonassociated gas exploration both onshore and offshore, and nonassociated gas now accounts for more than 50% of its total gas production. Its recent exploration efforts have resulted in several important discoveries, with particular success in the Ghawar area and in deep offshore reservoirs in the Gulf, Aramco noted in its report.<sup>26</sup> However, it gave no details as to estimated reserves or the commerciality of the discoveries. Aramco has long-standing plans to expand

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<sup>21</sup> "Saudi Arabia: Government Join Forces to Implement Energy Efficiency Labels," United Nations Development Program, accessed May 20, 2020.

<sup>22</sup> "Saudi Energy Efficiency Center," accessed May 20, 2020.

<sup>23</sup> Saudi Aramco, *This is Energy This is Aramco – Annual Report 2019* (Dharan, Saudi Arabia: Saudi Aramco, 2020).

<sup>24</sup> British Petroleum, *BP Statistical Review of World Energy 2019* (London: BP, June 2019).

<sup>25</sup> "Analysis: Saudi Arabia Unlikely to Become Gas Exporter Even With \$110 Billion Jafurah Field Investment," *S&P Global*, February 24, 2020.

<sup>26</sup> Saudi Aramco, *This is Energy This is Aramco – Annual Report 2019* (Dharan, Saudi Arabia: Saudi Aramco, 2020).

its gas production capacity to 23 bcf/d by 2023 from 14 bcf/d.<sup>27</sup>

A previous effort to explore for gas in the desert sands of the Empty Quarter, with the help of foreign oil companies – Shell, Total, Repsol, Eni, Lukoil, and China’s Sinopec – came to naught, and the companies withdrew after failing to negotiate an acceptable gas offtake price with Saudi Aramco. At the time, the company was supplying gas to domestic utilities and industry at \$0.75/MMBtu. The price it was willing to offer the multinationals was too low to justify the high cost of developing gas that is sour, high in sulfur, and geologically

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*Aramco's 2019 acquisition of the state's 70% stake in Saudi Basic Industries Corporation, one of the world's top petrochemical producers, will allow for consolidation of the industry under one umbrella and turn Aramco into a global petrochemical giant.*

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challenging. The cost of producing the gas in the remote area was estimated at the time between \$6/MMBtu and \$7/MMBtu. The Gas Initiative launched in 2001 was the first time Saudi Arabia had opened its upstream sector to foreign investors, and the international oil companies rushed to invest in the kingdom in the hope of securing a foothold should Riyadh open its upstream oil sector. Gas prices have since been raised as part of the energy price reforms instituted by the government in recent years to \$1.25/MMBtu for methane, used in the power sector, and \$1.75/MMBtu for ethane, a petrochemical feedstock. Despite the increases, prices were kept below international levels to protect the kingdom’s competitive edge in petrochemicals and other energy-intensive industries. Aramco’s 2019 acquisition of the state’s 70% stake in Saudi Basic Industries Corporation, one of the world’s top petrochemical producers, will allow for consolidation of the industry under one umbrella and turn Aramco into a global petrochemical giant. However, the merger has also created challenges.

Much of Saudi Arabia’s petrochemical sector is based on ethane feedstock. SABIC and its Saudi-based affiliates operate ethane crackers with a combined capacity of 1.2 bcf/d. This is some 20% more than the 1.0 bcf/d of ethane that Saudi Aramco produced in 2018, according to the Middle East Economic Survey, MEES.<sup>28</sup>

The Uthmaniyah ethane recovery project, which was due to be completed by the end of 2019, would relieve some pressure, although Aramco has not said whether the plant is operational. The demand for ethane means that the two companies are competing for feedstock. Aramco operates the Sadara and Petro Rabigh joint ventures, which require up to 85 million cf/d and 95 mcf/d of ethane, respectively. Some of the nine private petrochemical firms listed in the Saudi exchange, which mainly process intermediate chemicals produced by SABIC, also require some methane volumes. This makes substitution of feedstock or higher gas supply an imperative since an expanded petrochemical industry is part of the diversification policy of the kingdom’s Vision 2030 economic reform program.<sup>29</sup> Aramco said in its November 9 initial public offering prospectus that the SABIC acquisition “provides additional opportunities for the company to supply mixed feedstock of crude oil, refinery products, and gas to manufacture

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<sup>27</sup> Saudi Aramco, *This is Energy This is Aramco – Annual Report 2019* (Dharan, Saudi Arabia: Saudi Aramco, 2020).

<sup>28</sup> David Knott, “Sabic Handicapped by Saudi Ethane Shortages,” *MEES*, November 29, 2019.

<sup>29</sup> “Vision 2030,” Kingdom of Saudi Arabia, accessed May 20, 2020.

petrochemicals.”<sup>30</sup>

In addition to raising gas production, Saudi Arabia has been expanding its master gas system capacity to process additional associated and nonassociated gas. Saudi Aramco has gas processing capacity of 17 bcf/d and expects to add additional capacity of 7.5 bcf/d by 2024, once expansion projects are completed at its Haradh, Fadhili, and Hawiyah gas plants.<sup>31</sup> This will allow Saudi Aramco to substitute more natural gas for crude oil and liquid fuels for power generation, an environmental and economic advantage.

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*This tie between oil and gas production is one reason why Saudi Aramco has been keen to explore all options to secure additional domestic supply, including higher-cost shale production.*

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The incremental gas can also provide valuable feedstock for the petrochemical industry, which is expanding with the integration of refining and petrochemical plants within the kingdom. Aramco plans to use more naphtha, a high-value refined product, in petrochemical production, freeing up more gas for domestic consumption in other sectors, in particular for power generation. Saudi Arabia plans to add 26 gigawatts of capacity by 2023, and the 13 GW of capacity under execution is 90% gas-fired capacity, according to the Arab Petroleum Investments Corporation’s investment outlook.<sup>32</sup>

Should Saudi Arabia’s oil production decline because of the current slump in demand, its associated gas production would also fall. This tie between oil and gas production is one reason why Saudi Aramco has been keen to explore all options to secure additional domestic supply, including higher-cost shale production.

Aramco has significant shale gas reserves, estimated by Saudi Arabia’s former minister of energy, industry, and mineral resources, Ali al-Naimi, in 2013 at more than 600 tcf,<sup>33</sup> roughly twice the size of U.S. tight gas reserves. If confirmed, the numbers would rank Saudi unconventional gas reserves as the fifth largest in the world. Aramco has already started developing tight gas reserves in the Turaif basin to supply local industries. In February, Aramco said it had received regulatory approval to develop the Jafurah unconventional gas deposits at the cost of \$110 billion.<sup>34</sup>

Jafurah is located in the Eastern Province, the kingdom’s main oil hub, between the Ghawar oil field, the world’s biggest, and the Gulf coast. Aramco said Jafurah holds an estimated 200 tcf of rich raw gas that would provide valuable feedstock for the petrochemical industry.<sup>35</sup> The company expects production to start in early 2024 and reach approximately 2.2 bcf/d of ethane by 2036, representing about 40% of current production, as well as nearly 550,000 barrels per day of gas liquids and condensates, a valuable byproduct of gas production.

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<sup>30</sup> Saudi Aramco, *Prospectus* (Dharan, Saudi Arabia: Saudi Aramco, March 28, 2018).

<sup>31</sup> Saudi Aramco, *This is Energy This is Aramco – Annual Report 2019* (Dharan, Saudi Arabia: Saudi Aramco, 2020).

<sup>32</sup> Arab Petroleum Investments Corporation, *MENA Annual Energy Investment Outlook 2019* (Damman, Saudi Arabia: Arab Petroleum Investments Corporation, April 2019).

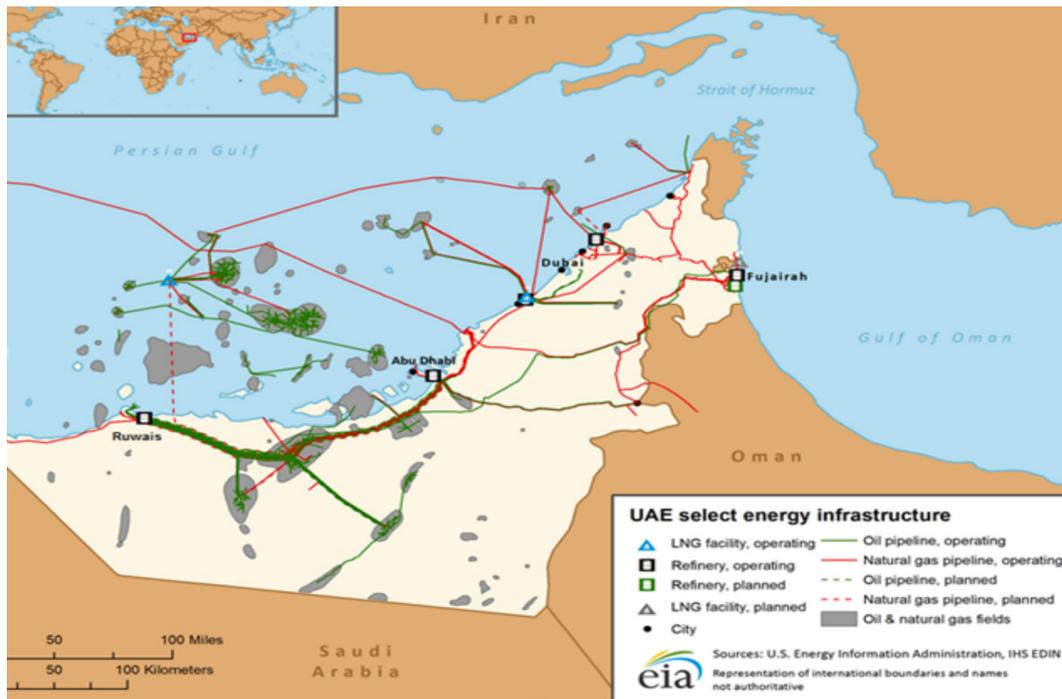
<sup>33</sup> Daniel Fineren and Reem Shamseddine, “Analysis: Saudi Kings of Oil Join the Shale Gas Revolution,” *Reuters*, April 3, 2013.

<sup>34</sup> “Saudi Aramco Announces Regulatory Approval of the Development of Jafurah Gas Field,” Saudi Aramco, February 22, 2020.

<sup>35</sup> *Ibid.*

But this will come at a high price, according to MEES.<sup>36</sup> Given current low LNG prices and shrinking oil revenue, Saudi Arabia would be better served by locking in LNG supplies rather than pouring billions of dollars into higher-cost offshore and shale production. The cost of developing offshore nonassociated gas is estimated at \$3.50/MMBtu to \$5.50/MMBtu as the fields contain a high percentage of sulfur. Although still reasonable by global standards, they are higher than the cost of producing associated gas. The cost curve moves higher for shale gas, which is estimated at \$6/MMBtu, and as high as \$10/MMBtu in some remote areas.

## UAE: A Diversified Fuel Mix With Nuclear Energy on the Way



Despite having the world's eighth-largest gas reserves and a more diversified energy mix than its Gulf neighbors, the UAE is a net gas importer and likely to remain so unless a recent onshore gas find lives up to the high expectations that accompanied news of its discovery. For the UAE, still at odds with Doha – although it continues to import gas via pipeline from Qatar as well as LNG from around the world – the objective is to attain self-sufficiency and end its reliance on imports to meet the high demand for natural gas by 2030.

The discovery of shallow gas straddling the border between the emirates of Abu Dhabi and Dubai near Jebel Ali with an estimated 80 tcf of gas in place is considered a significant step in that direction.<sup>37</sup> The development of Abu Dhabi's sour gas fields has already boosted

<sup>36</sup> Jamie Ingram, "Saudi Unconventional Plans Come At A Princely Price," *MEES*, February 28, 2020.

<sup>37</sup> "Sheikh Mohammed Bin Rashid and Sheikh Mohamed bin Zayed Witness the Signing of a Strategic Cooperation Agreement Between ADNOC and DUSUP for Further Exploration and Development of Shallow Gas in Abu Dhabi and Dubai," Abu Dhabi National Oil Company, February 3, 2020.

production with more projects due to come onstream in the medium term. This has resulted in net imports falling to a 4-year low of 1.15 bcf/d in 2018.

The Abu Dhabi National Oil Company noted that, “The discovery of the 80 Tscf of shallow gas resources was made within an area of 5,000 square kilometers between the two emirates with ADNOC drilling more than 10 exploration and appraisal wells, signifying the first time it has explored for hydrocarbon resources in Dubai.”<sup>38</sup> The statement also mentioned that ADNOC signed an agreement with the Dubai Supply Authority to continue with the exploration and development effort through horizontal and hydraulic fracturing methods to enable optimal productivity. The gas produced will support Dubai’s economy and enhance its energy security. Just how much can be extracted commercially from the field is to be determined since the announcement of the discovery on February 3 did not indicate how much gas is recoverable.

Recovery factors from shale gas reservoirs – the amount of gas in place that can be economically extracted – may be around 10% to 15%. That would allow 8 tcf to 12 tcf to be recovered from the Jebel Ali find. While not in the class of the Gulf’s biggest fields, it is still significant; it equates to about 17 years of all Dubai’s gas consumption. It has the economic advantages of being onshore, shallow (lowering drilling costs), close to infrastructure, and proximal to major sites of gas consumption, including the power generation and aluminum smelting complexes near Dubai’s Jebel Ali port and at Taweelah in Abu Dhabi.<sup>39</sup>

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*Although the energy mix in the UAE is the most diversified in the Gulf region, there is still a heavy reliance on natural gas for power generation and reinjection into oil fields for enhanced oil recovery.*

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Although the energy mix in the UAE is the most diversified in the Gulf region, there is still a heavy reliance on natural gas for power generation and reinjection into oil fields for enhanced oil recovery. This prompted a diversification policy to incorporate renewables, nuclear, and coal into the energy mix. The UAE accounts for nearly 80% of total renewables capacity in the Gulf states and will soon have the first nuclear power station in the Gulf Arab region in Abu Dhabi, while Dubai expects to have the Gulf region’s first coal-fired power station operational later this year.

In 2017, the UAE launched “Energy Strategy 2050,” its first unified energy strategy based on supply and demand. The strategy targets an increase in clean energy as part of the total energy mix from 25% to 50% by 2050. It aims to reduce the carbon footprint of power generation by 70% in addition to energy savings of 40% through energy conservation and efficiency measures. The government expects to invest around \$160 billion by 2050 to meet growing energy demand, which was estimated at 6% growth annually when the strategy was put in place.<sup>40</sup> By 2050, the UAE’s energy mix would consist of: 44% clean energy, 38% gas, 12% “clean” coal, and 6% nuclear.

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<sup>38</sup> “Sheikh Mohammed Bin Rashid and Sheikh Mohamed bin Zayed Witness the Signing of a Strategic Cooperation Agreement Between ADNOC and DUSUP for Further Exploration and Development of Shallow Gas in Abu Dhabi and Dubai,” Abu Dhabi National Oil Company, February 3, 2020

<sup>39</sup> Robin Mills, “Massive Gas Find Spurs UAE’s Pursuit of Self-Sufficiency,” *Arab Gulf States Institute in Washington*, February 6, 2020.

<sup>40</sup> “UAE Energy Strategy 2050,” The United Arab Emirates’ Government Portal, January 16, 2020.

In the gas sector, ADNOC is targeting improved operational efficiency, higher volumes of sour gas production, development of an integrated gas master plan, and the use of carbon dioxide in enhanced oil recovery to free up gas for power generation. ADNOC's increased gas exploration program has resulted in the discovery of additional volumes that have boosted its recoverable reserve estimates of natural gas by 58 tcf, taking total gas reserves up to 273 tcf of conventional gas and 160 tcf of unconventional gas resources.

The Dubai Supply Authority receives gas from ADNOC's operations in Abu Dhabi, and 730 million cubic feet per day through the 2.2 mmcf/d Dolphin pipeline from Qatar. It also receives imported LNG at the 960 mmcf/d Jebel Ali floating terminal, although imports have come down from a 2017 high. Dubai's limited offshore gas output is reinjected to offset oil production declines, while production at its onshore Margham gas field has been halted. Margham is located near Sharjah and is now used as a gas storage facility.

The UAE imported 1.15 bcf/d of gas in 2018, but demand is expected to decline as new solar capacity in Dubai and Abu Dhabi comes online. The start-up of the Barakah nuclear power plant, the first unit of which received its initial load of fuel in March, should reduce import dependency further. The Barakah plant is expected to satisfy 25% of the UAE's power demand once fully operational.

The concerns over the security of supply, the high cost of imported LNG (until recent price declines), and the lack of diversity in sources encouraged Dubai to unveil its Integrated Energy Strategy in 2011 and Clean Energy Strategy in November 2015. The two target a 30% reduction in energy use versus "business as usual," and a 2030 electricity generation mix of 61% gas, 7% "clean" coal, 7% nuclear (imported from Abu Dhabi's new reactors at Barakah), and 25% solar, derived mostly from the 5,000 megawatt Mohammed bin Rashid Al Maktoum Solar Park. Dubai's Hassyan coal plant is also scheduled to begin operations this year.

In November 2018, ADNOC released its integrated gas strategy, which has since been updated though the intention remains the same: attaining self-sufficiency in gas and transition to becoming a net exporter. To that end, ADNOC has signed agreements with Occidental, OMV, Eni, Wintershall, Lukoil, and Total to develop sour and unconventional gas deposits.<sup>41</sup>

Abu Dhabi's Ghasha ultra-sour gas concession is expected to provide more than 1.5 bcf/d by approximately 2025, while capacity from the onshore Shah sour gas field is being increased from 1.3 bcf/d to 1.5 bcf/d. ADNOC is also developing gas cap projects, targeting 1 bcf/d of unconventional gas from the Ruwais-Diyab gas concession by 2030. It is also targeting deep gas reservoirs and unconventional plays in its second licensing round, launched in May 2019.<sup>42</sup>

Another recent development that might provide additional gas security was the January announcement by Eni that it had discovered gas offshore Sharjah.<sup>43</sup>

At the same time, the use of carbon capture and storage will replace gas currently reinjected for enhanced oil recovery. The UAE's first nuclear reactor at Barakah in western Abu Dhabi,

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<sup>41</sup> "ADNOC Updates Global Energy Leaders on Its New Integrated Gas Strategy and Downstream Growth Plans," Abu Dhabi National Oil Company, November 14, 2018.

<sup>42</sup> Jamie Ingram, "UAE Gets Major Gas Boost With Jebel Ali Discovery," *MEES*, February 7, 2020.

<sup>43</sup> "Eni Announces a Gas and Condensate Discovery in the UAE Sharjah Emirate," *eni.com*, January 27, 2020.

and a new tender out by the Emirates Water and Electricity Company for its second large solar power plant, will also contribute to greater diversification and energy self-sufficiency.

Jebel Ali gas has to compete economically with imported LNG, which has recently hit record low prices, although this will likely rebound.<sup>44</sup> In 2032, the Dolphin pipeline contract will expire, and the new gas find will give the UAE leverage to negotiate with Qatar for a renewal at reasonable – although likely higher – prices, or to stop imports from its neighbor entirely. And even cheap gas supplies will struggle to compete in power generation with the extremely low cost of new solar. Dubai's latest 900-MW installation was awarded in October 2019 at a near-world record of 1.69 cents per kilowatt-hour.<sup>45</sup>

Beyond that, the UAE faces the question of what to do with all its gas. Expansion of the industry is planned, but the new unconventional and sour gas will likely be more expensive to produce than conventional gas. Significant LNG export expansions are improbable given relatively costly feedstock and the current depressed world market. The Jebel Ali find promises reduced import bills, improved security of supply, and more gas to boost the economy, but it will require some clever technical and commercial work to make full use of it.<sup>46</sup>

But the coronavirus pandemic and cost cutting may result in a delay or possibly the scrapping of some projects. On April 17, ADNOC canceled a \$1.65 billion contract awarded to United Kingdom-based Petrofac for the Dalma gas project just two months after the contract had been awarded. Petrofac said it would work with ADNOC to explore alternative options to deliver the project in a way that meets the UAE state-owned company's strategic objectives "within the current challenging environment."<sup>47</sup> This type of language usually means that the contractor would be revising its costs to secure the contract, though neither ADNOC nor Petrofac provided any further details.

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*... even cheap gas supplies will struggle to compete in power generation with the extremely low cost of new solar.*

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The engineering, procurement, and construction contracts were to develop the Ghasha ultra-sour gas concession, which ADNOC said was central to its strategic objective of enabling gas sufficiency in the UAE. The Dalma project, which was due to be completed in 2022, would have produced around 340 mcf/d of natural gas.<sup>48</sup>

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<sup>44</sup> Robin Mills, "Massive Gas Find Spurs UAE's Pursuit of Self-Sufficiency," *Arab Gulf States Institute in Washington*, February 6, 2020.

<sup>45</sup> Ibid.

<sup>46</sup> Ibid.

<sup>47</sup> "Dalma Project Update," Petrofac, April 16, 2020.

<sup>48</sup> "ADNOC Awards \$1.65 Billion Contracts for the Construction of Offshore Facilities for the Dalma Gas Development Project," Abu Dhabi National Oil Company, February 18, 2018.

## Oman: Hoping for a Gas Revival



Source: CIA World Factbook, updated May 2020

Oman is among the Gulf oil producers hardest hit by the recent oil price collapse since it relies on oil and gas revenue for roughly half of its income and started the year with a weak balance sheet. This has come at a time of a transition of power in the sultanate following the death of Sultan Qaboos bin Said in January. The transition so far to his designated successor, Haitham bin Tariq al-Said, has been smooth but the new sultan will be tested by the deteriorating economic outlook.

Although it lacks the massive oil and gas reserves of its Gulf neighbors, Oman has been a significant energy player thanks to an attractive investment regime that has drawn a number of international oil and gas companies to its upstream sector. It has also served as an incubator for innovative technologies to extract oil and gas from geologically complex oil and gas reservoirs. According to the BP Statistical Review of World Energy 2019, Oman had 700 bcm of proven natural gas reserves at the end of 2018, the region's smallest. It produced 36 bcm of natural gas in 2018, of which roughly 70% was consumed domestically.<sup>49</sup> This includes the supply of gas for its liquefaction facilities and for reinjection. Oman has 10.4 million mt/y of LNG production capacity while 20% of its gas production is used for reinjection into geologically complex reservoirs to extract heavy oil, according to Oman's National Centre for Statistics and Information.<sup>50</sup> Oman's Ministry of Oil and Gas is trying new techniques to use less gas for oil extraction as one way of freeing up more gas for exports. Oman exports LNG mainly to the Asian market under long-term contracts and has plans to raise export volumes by removing bottlenecks in its existing infrastructure to add 1 million tons per annum to capacity by 2021.

Oman's Ministry of Oil and Gas made it a priority to free up gas for exports and reduce dependence on imports by imposing a semimoratorium on gas-fired power projects and

<sup>49</sup> British Petroleum, *BP Statistical Review of World Energy 2019* (London: BP, June 2019).

<sup>50</sup> Kate Dourian, "Oman: A Small Oil Player With Big Ambitions," *Arab Gulf States Institute in Washington*, November 7, 2019.

limiting the volume of gas supplied to electricity generators in 2017. The move followed the collapse in oil prices in 2016, which widened the budget deficit that is likely to rise further as a result of the pandemic that has affected energy demand and stumped global economic growth.

Population growth and energy subsidies have encouraged a high level of domestic consumption and Oman has resorted to imports of pipeline gas from Qatar to meet domestic demand. However, the sultanate has been successful in attracting some of the best talent in the oil industry and managed to nearly double its gas production between 2008 and 2018.

This is largely due to megaprojects undertaken by international oil companies. The BP-led project to develop the Khazzan gas field, one of the largest unconventional gas reservoirs in the Middle East, provided a significant addition to production capacity since it was brought online in 2017 using hydraulic fracturing, a technology used to extract shale oil in the United States. The next big gas increment is due to come from the Khazzan-Makarem field in BP's Block 61. The first phase of the development came online in 2017 and, when the second phase is completed in 2021, it will add 1.5 bcf per day to gas production.<sup>51</sup>

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*The biggest challenge remains managing domestic gas consumption at a time when demand for electricity, which is mostly gas powered, is rising with new projects planned to expand capacity.*

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The incremental gas that came onstream in 2017 allowed Oman to run its LNG facilities at full capacity and export a record 10.4 million tons of LNG in 2018, according to Oman LNG's 2018 annual report.<sup>52</sup>

Because of its high consumption of gas, Oman signed an agreement with Iran in 2014 to import gas through a new subsea pipeline across the Gulf of Oman. However, the project has been delayed due to sanctions against Iran. Oman had planned to convert the gas to LNG for exportation. Omani Minister of Oil and Gas Mohammed bin Hamad al-Rumhy said in an interview with MEES in September 2018 that Oman was proceeding with the project, but he admitted that the sanctions had slowed it down.<sup>53</sup>

The biggest challenge remains managing domestic gas consumption at a time when demand for electricity, which is mostly gas powered, is rising with new projects planned to expand capacity. The Oman Power and Water Procurement Company plans to increase its power generation capacity from 7.77 GW to 11.7 GW by 2023 to satisfy projected peak demand growth of 6% per year by 2024.

In the longer term, Oman plans to commercialize its gas surplus with development of a petrochemical project in a joint venture with Kuwait, building a gas-to-liquids plant at Duqm, and other value-adding industries.

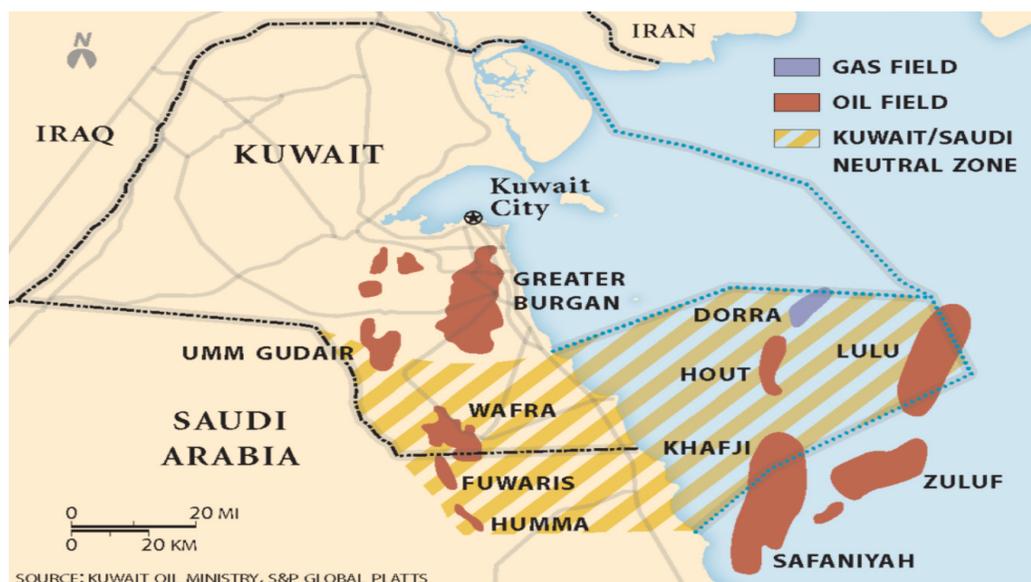
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<sup>51</sup> "BP to Develop Second Phase of Oman's Giant Khazzan Gas Field," BP, April 9, 2018.

<sup>52</sup> Oman LNG, LLC, *Annual Report 2018 - Delivering Value* (Muscat: Oman LNG, accessed May 20, 2020).

<sup>53</sup> Waylon Fairbanks, "Opportunities are Immense: MEES Speaks With Oman's Rumhy," *MEES*, September 7, 2018.

## Kuwait: The Gulf States' Gas Laggard



Kuwaiti-Saudi Neutral Zone

Kuwait relies almost exclusively on oil products and natural gas to meet its energy needs, with each fuel accounting for about half of total primary energy consumption. But while it is a significant oil producer and exporter, it is a net importer of natural gas due to the underdevelopment of its nonassociated gas potential. Kuwait plans to substitute natural gas for oil in power generation to retain oil export revenue for savings and investments. It also plans to increase the share of renewable energy in the power generation mix.

Expanding domestic natural gas and renewable energy use is part of the government's strategy to address the impact of climate change. Renewable energy satisfies just 1% of energy demand, while gas accounts for roughly half of primary energy consumption.

For years, the wealthy emirate has scouted around for additional gas from Iran and Iraq, albeit unsuccessfully. It resorted to LNG imports and is resigned to this becoming a permanent solution after building a fixed receiving terminal. Unlike its Gulf allies Saudi Arabia and the UAE, Kuwait did not sever diplomatic relations with Qatar, which continues to supply Kuwait with LNG. In January, state-owned Kuwait Petroleum Corporation signed a contract with Qatar Petroleum for the purchase of 3 million mt/y of LNG for 15 years, the companies said. The volume is roughly equal to current imports of LNG, which Kuwait has secured from Qatar and spot markets from as far afield as the United States and Australia.

Under the agreement with Qatar, LNG deliveries will start in 2022, when Kuwait's LNG receiving terminal at Al-Zour Port is fully operational.<sup>54</sup> The fixed terminal will replace the floating terminal at Mina Al Ahmadi, which at the time was meant as a temporary solution pending development of its own nonassociated gas, but these projects failed to materialize.

<sup>54</sup> Ahmed Hagagy, "Qatar to Supply Kuwait With 3 Million Tonnes of LNG a Year," *Reuters*, January 5, 2020.

The Qatari gas will help to meet Kuwait's growing energy needs and demand, particularly in the power generation sector, which relies heavily on gas-fired power plants.

After signing the agreement, Khaled Al-Fadhel, Kuwait's oil and electricity minister and KPC chairman, said that Kuwait was embarking on an ambitious path of economic growth that requires cleaner energy sources, such as natural gas, which will contribute to reducing emissions and improving local air quality. While KPC is working toward increasing local natural gas production, there remains a pressing need to secure imports of natural gas supplies, he noted.

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*Kuwait has stepped up its efforts to develop its nonassociated gas fields to meet demand from the power sector and for desalination and petrochemical production.*

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According to KPC's 2017-18 annual report, the entry into operation of two gas gathering stations at Al-Sabriya and Al-Rawdatain led to an increase in production of nonassociated gas to 215 mcf/d, part of its efforts to boost production of free gas to 1.2 bcf/d by 2025.<sup>55</sup> The Kuwait Oil Company, which manages all domestic oil and gas upstream activities, has set a production target of 3 bcf/d by 2030, more than double current production of around 1.4 bcf/d.

One reason for the lag in development of natural gas and the virtual stagnation of oil production in the OPEC member state has been the constant wrangling between successive governments and Parliament, which has led to delayed or scrapped projects. In the last two decades, Kuwait has had 15 oil ministers. The current minister holds both the oil and electricity portfolios, as well as the chairmanship of KPC. This should allow for a more coherent energy policy.

Like all oil-producing countries in the region, Kuwait is anxious to diversify its energy mix, but even if it raises its gas production, it will not be able to meet the expected increase in demand. Liquefied natural gas imports are projected to persist until 2035 or beyond.

Associated natural gas production makes up 80% of Kuwait's gas supply. Because OPEC-mandated quotas determine oil production, any cut in oil production can lead to a gas deficit. That is why Kuwait has stepped up its efforts to develop its nonassociated gas fields to meet demand from the power sector and for desalination and petrochemical production.

Kuwait produced 17.5 bcm of natural gas, mostly associated gas, in 2018, and consumed 21.8 bcm, according to the BP Statistical Review of World Energy 2019.<sup>56</sup> The deficit was filled by imports.

Ambitious plans to develop its northern Jurassic nonassociated sour gas fields have been stymied by Parliament, which needs to approve oil and gas projects. Royal Dutch Shell signed a technical service agreement in 2010 to develop the Jurassic gas fields, but the contract was suspended following a protracted parliamentary inquest into alleged irregularities. As a result, Kuwait's efforts to boost nonassociated production have floundered. Relatively unattractive terms offered to international companies for the development of the high-cost sour gas reserves have also hampered development.

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<sup>55</sup> Kuwait Petroleum Corporation, *Annual Report 2017/2018* (Kuwait City: KPC, accessed May 20, 2020).

<sup>56</sup> British Petroleum, *BP Statistical Review of World Energy 2019* (London: British Petroleum, June 2019).

A political detente between Kuwait's Parliament and executive branch paved the way for the award of contracts with international companies in 2016, enabling the start-up of new gas production from the giant Jurassic Non-Associated Gas Reserves in the northern region in early 2018. However, plans for the much-needed second phase of the project have been on hold since tenders were canceled in late 2017. Because Kuwait's nonassociated gas fields in the north are ultra-sour and technologically difficult to extract, it needs the expertise of international oil companies. The Kuwaiti Constitution does not allow foreign involvement in upstream activity, however, and Parliament has historically blocked KPC from awarding technical service contracts.

Kuwait's only other nonassociated natural gas field prospect is the offshore Dorra field in the partitioned Neutral Zone it shares with Saudi Arabia. The two countries recently resumed oil production from the Neutral Zone, where output has been shut down for four years, but they have yet to agree on a plan to jointly develop the Dorra gas field for the production of 500 mmcf/d to 600 mmcf/d of gas. Part of the field lies in Iranian waters.

Since most of the gas produced is associated with crude oil, cuts in oil production due to OPEC quotas or shutdowns can impact gas volume. Because it relies heavily on gas for power generation, Kuwait has experienced brownouts and blackouts during peak demand periods before it resorted to imports of LNG. At times it has had to close refining and petrochemical plants to make more gas available for power generation.

In 2019, the Kuwait Institute for Scientific Research produced an energy strategy blueprint to 2035 to help policymakers plan for a more sustainable and diversified energy future.<sup>57</sup> The outlook provides a roadmap that could, if implemented, put Kuwait on a path toward a more sustainable energy future. Among the report's recommendations are curbs on the consumption of fossil fuels and diversification of the energy portfolio, emphasizing energy efficiency and price reform as critical pathways.

The outlook predicts that if Kuwait stays on its current course, its greenhouse gas emissions and per capita consumption will remain among the highest in the world. Renewables, mostly solar, satisfy less than 1% of energy demand today and will meet just 3% of demand by 2035 rather than a targeted 15%.

Oil products, electricity, and water are all heavily subsidized, which encourages high consumption, particularly in the transportation and residential sectors, where demand for air conditioning in the arid desert country accounts for 70% of residential energy demand. The government passed a law in 2017 raising tariffs for electricity and water consumption on all but the residential sector.

Gasoline and diesel prices at the pump are among the lowest in the world, and there has been no effort to introduce alternative means of transportation or more fuel-efficient vehicles. Despite the wealth of its energy resources, these high levels of consumption and lack of investment in new generating capacity over previous decades have resulted in electricity blackouts in

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<sup>57</sup> Kuwait Institute for Scientific Research, *2019 Kuwait Energy Outlook, Sustaining Prosperity Through Strategic Energy Management* (Kuwait: Kuwait Institute for Scientific Research and Kuwait Foundation for the Advancement of Science, accessed July 20, 2020).

recent years, and reserve margins are falling to alarmingly low levels. The government intends to avoid these shortfalls with plans to add 17.6 GW of generation capacity over the outlook period – a 70% increase over current capacity. In theory, this would be achieved with the help of independent operators.

However, rigidities in the electricity sector's structure and the lack of coordination between the various institutions in the power sector are the main reasons for the lack of private sector involvement and the slow development and deployment of renewables.

## Bahrain: Exploring a Range of Gas Options

Bahrain is the smallest of the Gulf's oil and gas producers and its energy fortunes lie with Saudi Arabia, with which it shares an oil field that supplies much of its energy needs. Its own oil and gas reserves are negligible. But the discovery of major unconventional oil and gas deposits in the offshore Khalij al-Bahrain basin in 2018 may change the tiny kingdom's fortunes.

The discovery has drawn interest from a number of international oil and gas companies to what may be one of the few new frontiers in the Gulf region. Bahrain's Oil and Gas Holding Company (Nogaholding) in April 2019 signed a letter of intent with the United States' Chevron for a joint evaluation study of the Khalij al-Bahrain basin and potential LNG procurement opportunities, the Bahrain News Agency reported.<sup>58</sup>

Chevron has had a long-standing presence in Bahrain. It is one of the shareholders in the Bahrain National Gas Company, which is 75% owned by Nogaholding, 12.5% by Chevron Bahrain, and 12.5% by Boubyan Petrochemical Company.

The Bahrain News Agency said initial estimates by international consultants point to the presence of "at least" 80 billion barrels of tight oil reserves and deep gas reserves of around 10 tcf to 20 tcf. Appraisal wells are being drilled to assess how much is recoverable with production start-up seen within five years. Bahrain's minister of oil, Mohammed bin Khalifa bin Ahmed al-Khalifa, told MEES in an interview in January 2019 that recovery rates for unconventional hydrocarbons are in the range of 5% to 10%.<sup>59</sup>

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*... the discovery of major unconventional oil and gas deposits in the offshore Khalij al-Bahrain basin in 2018 may change the tiny kingdom's fortunes.*

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In recent years, Bahrain has made an effort to diversify its energy sources with gas a key component of its strategy. At present, Bahrain meets its domestic gas demand from indigenous production from the onshore Bahrain field. There is more gas in deeper strata below the Bahrain field that the Ministry of Oil and Gas is looking to develop, possibly with the help of international oil companies.

According to Mohammed bin Khalifa, the ministry was looking to de-risk its oil and gas resources and was in talks with all the oil majors, naming BP, Chevron, Total, and ExxonMobil. It isn't yet

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<sup>58</sup> "Nogaholding, Chevron Sign Letter of Intent," *Bahrain News Agency*, April 2, 2019.

<sup>59</sup> Jamie Ingram, "Bahrain's Grand Ambitions: Mees Speaks With Oil Minister Muhammad Al Khalifa," *MEES*, January 25, 2019.

known if cost-cutting measures announced by all the majors in response to the coronavirus pandemic's impact on energy demand and oil prices will discourage the multinationals from taking on new risk.

In the interim, Bahrain intends to import LNG to meet demand. In January, it completed construction of a floating LNG import terminal that is intended to provide flexibility and help satisfy unexpected peak demand for gas, the minister said.<sup>60</sup>

## Conclusion

For decades, the Gulf Arab countries were viewed as purely crude oil producers with significant gas reserves that all but Qatar had developed. Hydrocarbon exports accounting for most of the foreign revenue of GCC member states helped the region achieve high levels of economic growth. This drove energy demand to unsustainable levels, forcing a shift from oil to gas and forcing at least three oil producers to resort to gas imports to meet demand growth, which by 2040 is forecast to be twice the global average on a per capita basis. Qatar is investing in an expansion plan that will help retain its ranking as the world's top LNG exporter over the coming decade after it was briefly overtaken by Australia in 2019.

With natural gas a baseload fuel for power generation in the region, demand for natural gas to keep the lights on and homes cooled is on the rise. Developing the region's untapped nonassociated and unconventional gas reserves has become imperative to diversify the energy mix, preserve the environment, and prepare for the day when oil demand peaks.

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<sup>60</sup> Jamie Ingram, "Bahrain's Grand Ambitions: Mees Speaks With Oil Minister Muhammad Al Khalifa," *MEES*, January 25, 2019.

