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The impact of decarbonization on the gas and LNG industry

The energy mix is shifting across industries. Developing a five- to ten-year strategy can help oil and gas companies navigate the long term.

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The imperative to reduce the negative effects of global climate change becomes more urgent with each passing day. Consequently, an increasing number of countries and companies are pledging to become carbon neutral by 2050, and fossil-fuel supply and demand are set to decline, particularly in oil and gas. Of the two, gas appears to be more resilient in the years to come, especially liquefied natural gas, but even LNG will ultimately be substituted by renewable energy sources or undergo emissions mitigation to meet the requirements of a 1.5-degree pathway (see sidebar, "The importance of a 1.5-degree pathway").

In the meantime, global, comprehensive action is needed to reduce CO_2 and methane emissions across all industries, including oil and gas. First, however, the industry will have to address significant challenges. To begin with, while oil and gas companies have the same incentives to reduce Scope 1 and 2 emissions (from operations and bought fuel) as companies in other energy-intensive industries, they also face increasing pressure to address Scope 3 emissions (from products).[1] In addition, changing regulations and rapidly evolving customer and societal expectations around clean energy make it difficult to determine which assets across the production process should adopt new technologies to decarbonize and which should be left behind.

That said, gas and LNG companies that meet the energy transition head-on will reap both economic and environmental benefits. Companies need to communicate a clear five- to ten-year strategy detailing decisive, bold actions that can be taken

[1] For more on the three types of emissions, see "Greenhouse Gases at EPA," US Environmental Protection Agency, epa.gov.

The importance of a 1.5-degree pathway

The world is increasingly committed to a 1.5-degree pathway, which refers to mitigating climate change through decarbonization to limit warming to 1.5 degrees Celsius by 2050.[1]

Based on the limits of today's technologies, this goal presents a significant challenge. But political and corporate efforts increasingly respond to calls to reduce emissions. For example, major energy consumers including the European Union, Japan, and South Korea have committed to achieving carbon neutrality by 2050. China has announced a similar commitment for 2060. Meanwhile, leading international oil companies, together with major energy consumers, have set goals to reach net-zero carbon emissions from operations and to drastically reduce emissions across the full life cycle of their products. Finally, public and investor expectations increasingly appear to be moving in the same direction, which could have a significant impact on fossil-fuel use.

Our reference case, which reflects current trends in policy and technology, indicates that coal use has already peaked, oil use is likely to peak in 2029, and use of gas and LNG will peak in 2037 and 2046, respectively. However, current trends would also lead to a temperature rise of approximately 3.5 degrees Celsius by 2100. Thus, an acceleration of the energy transition would likely lead to an earlier-than-expected peak in oil, gas, and LNG use.

[1] For more on the 1.5-degree pathway, see Kimberly Henderson, Dickon Pinner, Matt Rogers, Bram Smeets, Christer Tryggestad, and Daniela Vargas, "Climate math: What a 1.5-degree pathway would take," *McKinsey Quarterly*, April 2020, McKinsey.com.

today rather than announcing long-term targets that overlook the short term. This article discusses the resilience of natural gas and LNG and outlines three key strategies for managing decarbonization: reducing the carbon footprint of assets and customers, managing risk by integrating emissions costs into business decisions, and enhancing the resilience of portfolios.

The energy sector is changing

In recent years, the energy sector has drastically increased its focus on sustainable, resilient assets and renewable energy sources.[2] As a result, several fundamental shifts are altering the long-term future of companies along the entire value chain.

To begin with, the energy mix is shifting. The world is increasingly electrifying, with renewable energy sources expected to meet up to 80 percent of global demand by 2050. Until now, clean-energy investment has been relatively flat (30 to 37 percent total). Capital markets are also rewarding expected growth in renewables, and investors concerned about transition risks and stranded assets are beginning to divest from fossil fuels. Environmental, social, and governance investing, which accounts for approximately 30 percent of assets under management, is tightening its criteria, while activist investing is propelling impact via targeted resolutions.

In response, stakeholders are increasingly calling for commitments to emission reductions and for transition planning to ensure the stability of future supply. Some governments and regulators are wielding their policy powers to push decarbonization by influencing demand rather than relying on direct regulation. Carbon taxes in Norway are just one example.

Finally, environmental consciousness has become much more widespread, entering the political mainstream in many markets. In particular, Generation Z is increasingly influential, often favoring companies with explicit sustainability initiatives. Many customers believe that traditional oil and gas activities do not align with environmental consciousness. As a result, organizations that are unwilling to adapt their company cultures and ways of working may struggle to attract the talent required for transition.

The resilience of natural gas and LNG

In the face of changing perspectives on fossil fuels and increasing electrification, the oil and gas industry needs to take immediate action to prepare for the years to come. One such action is increasing the share of natural gas in portfolios. Our reference case shows that gas, unlike other fossil fuels, will experience growing demand until the mid-2030s. In a 1.5-degree climate pathway scenario, natural gas will be more resilient than other fossil fuels for another five to ten years. This is primarily because natural gas is among the cleanest fossil fuels, so it will be the last to be replaced as part of the energy transition (Exhibit 1).

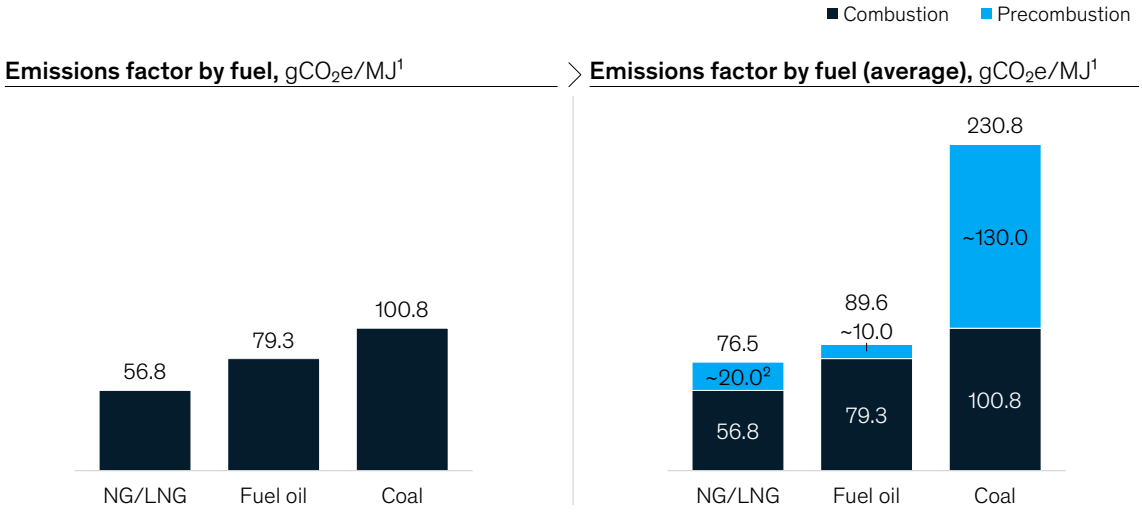
Additional factors contributing to the resilience of natural gas include the following:

— *Lower carbon intensity and lower particulate emissions.* Gas generates lower emissions per unit of energy than coal or oil, both before and during combustion. In China, coal boilers near cities have been replaced with gas boilers to reduce pollution and alleviate public-health concerns.

[2] For more on how the oil and gas industry is navigating the energy transition, see Chantal Beck, Donatela Bellone, Stephen Hall, Jayanti Kar, and Dara Olufon, "The big choices for oil and gas in navigating the energy transition," March 10, 2021, McKinsey.com.

Exhibit 1

Natural gas and LNG are among the cleanest fossil fuels, even when accounting for precombustion emissions.



[1]Grams of carbon-dioxide equivalent per megajoule.
[2]Weighted average GHG emissions of 2016 LNG flows into China, including 13 projects: APLNG, Atlantic, Gorgon, Malaysia, Nigeria, Oman, PNG, Qatargas, QCLNG, Snohvit, Sabine Pass, Tangguh, and Yamal.
Source: *Nature*; *Sustainability*; UK Government; US Department of Energy

— *Low gas prices in key markets.* The cost of gas in key markets (especially North America) has decreased more than that of competing fossil fuels. This has helped gas maintain its competitiveness and increase its market share in the power sector, particularly in relation to coal. For example, the average Henry Hub gas price was $2.53 per million British thermal units (MMBTUs) in 2019, compared with $4.26 in 2014. While the switch from coal to gas has primarily been propelled by economic factors, it also has a tangible impact on decarbonization. Gas to power grew 70 percent between 2007 and 2019 in the United States, but the same period saw an overall 14 percent reduction in total CO_2 emissions in the power sector.

— *Rapid overall energy demand growth in Asian markets.* Asia has seen a rapid increase in power-sector and industrial demand. The former will see substantial additional coal-to-gas switching as well as gas and renewables working as complementary technologies. And the latter will see the need for new infrastructure to meet industrial demand for gas. Both can be scaled at speed and require complementary technologies. As an example, onshore- and offshore-wind generation and solar photovoltaics are intermittent and often backed up by gas plants to power the grid in low-wind or cloudy conditions.

— *Substantial share of gas demand from 'hard to electrify' feedstock or high-heat-intensity applications.* Our estimates suggest that the chemical sector will contribute nearly one-fourth of gas-demand growth until 2035. Together with other industrial sectors, chemicals will account for approximately 50 percent of growth.

LNG appears to be even more resilient than gas overall. As a delivery mechanism that can reach

markets with limited pipeline-import infrastructure as well as markets in South and Southeast Asia where domestic production is declining, LNG holds a strong advantage and is expected to see continued growth until around the mid-2040s.

Ultimately, however, the need to reduce emissions across the board will affect all fossil fuels, including gas and LNG. As a result, demand will decline (Exhibit 2). Much uncertainty remains regarding which geographies and sectors will act first, as well as how quickly demand will decline. For example, McKinsey's 1.5-degree outlook shows demand at 72 percent below 2016 levels by 2050. The extent of the decline depends on which technologies can be scaled. For example, a significant reduction in the cost of carbon capture, utilization, and storage (CCUS) technology could lead to widespread adoption of this technology, which would result in higher levels of gas use in power and industry.

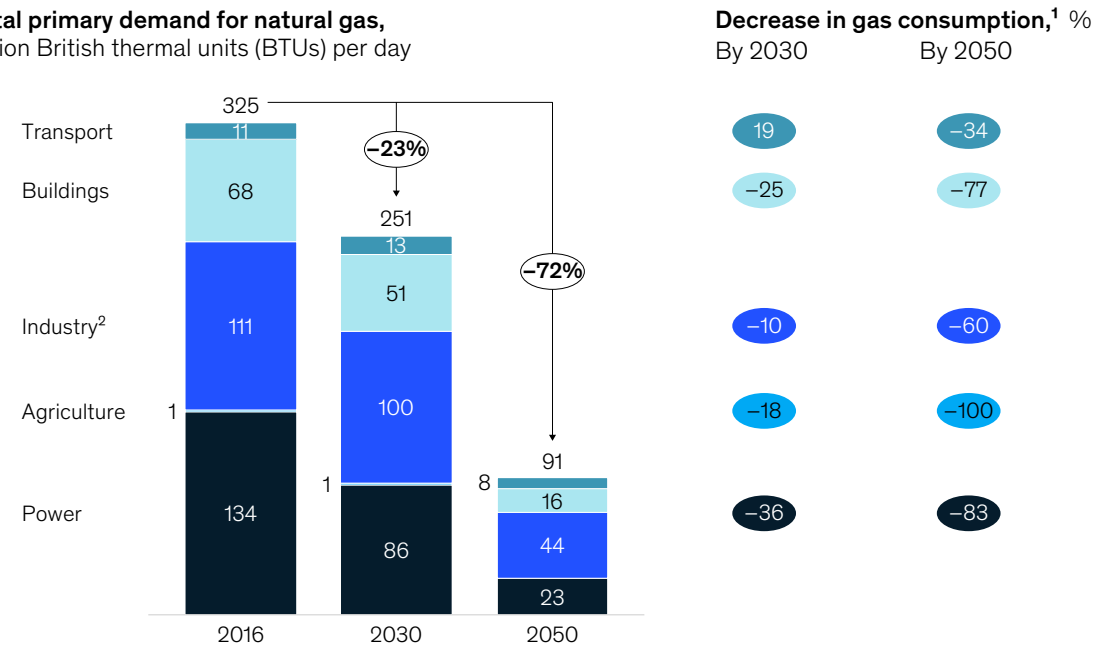
That said, a constant pattern emerges across forecasts: gas demand will peak in the mid- to late 2030s, and LNG demand will peak about a decade later. Natural-gas and LNG companies that understand this pattern—and the factors behind it—will have a longer window of opportunity not only to prepare for the effects of decarbonization but also to learn from other industries that have already experienced the impact of the energy transition.

What gas and LNG companies can do now

Overcoming uncertainty will be key to maintaining a competitive edge in the years to come. And even though many emissions-related targets are 20 or 30 years in the future, gas and LNG companies must take immediate action to stay ahead of the curve. A clear five- to ten-year strategy can help leaders determine next steps as well as priorities over the

Exhibit 2

Fossil-fuel use would decline rapidly in a 1.5-degree pathway.



[1]Decrease vs 2016.
[2]Includes natural-gas demand for hydrogen production via steam methane reforming.
Source: McKinsey, Global Energy Perspective 2019: Reference Case; McKinsey 1.5˚C scenario analysis (Scenario A)

longer term. With this in mind, leaders should focus on the following three priorities:

1. Assess, report, and mitigate carbon emissions
Today, companies are expected to take full responsibility for an asset's emissions over its life cycle and to publicly commit to working with wider stakeholders, including customers, to aid decarbonization efforts. This means emissions must be monitored at every step of the value chain and categorized within Scopes 1, 2, and 3. Companies must also differentiate among various greenhouse gases (GHGs), such as CO_2 and methane.

Tracking emissions is both difficult and critical, particularly around methane, but it is an imperative step in the industry's decarbonization. On this point, companies face two primary challenges: a lack of granular data around methane emissions and a lack of clear regulation to set standards for reporting.

Regarding the first challenge, methane has an outsize impact on the near-term warming trajectory due to its short atmospheric lifetime and high heat absorption. The concentration of methane in the atmosphere today is 2.4 times higher than preindustrial levels, but emissions are not monitored or regulated at the local or global level. Typically, methane emissions are dispersed and episodic, making them hard to monitor, regulate, and mitigate. The 2017 launch of the TROPOspheric Monitoring Instrument aboard the Sentinel-5P satellite enabled a truly global picture of methane emissions. Daily revisits enabled the monitoring and quantification of large methane leaks from oil and gas operations. Additional satellites launched by GHGSat have provided an increased spatial resolution of the sources as well as an ability to detect small and medium-sized leaks. Meanwhile, on-the-ground solutions are proliferating and being reduced in cost.

The European Commission's methane strategy will be the world's first high-level effort to regulate methane emissions.[3] The next step is to increase efforts to monitor, report, and verify methane emissions to enable effective regulation and compliance with reduction targets. Investors may also want to start using and proving company claims of reducing emissions intensity and communicating these results to stakeholders, including consumers.

The impetus for tackling the second challenge—a lack of clear regulation to set standards for reporting and mitigation—typically comes from individual companies. Several large players have pledged to monitor, report, and reduce their methane emissions, and buyers increasingly see emissions intensity transparency as important. In fact, 33 percent of buyers who responded to McKinsey's recent LNG Buyers Survey expect this transparency to become standard.[4]

Still, the past 18 months have seen momentum build around decarbonized or green LNG, with a number of spot transactions for which the emissions associated with an LNG cargo have been offset by voluntary carbon credits. While no LNG plant can currently claim to produce and sell decarbonized LNG, a number of industry players have announced measures to reduce emissions via CCUS and renewable energy. This market development is the clearest indication to date that plant owners and operators are assessing the full cycle and carbon intensity of their plants as an additional risk factor and potentially even a way to monetize lower-carbon-intensity projects through price premiums.

Upstream gas companies can invest in decarbonization technologies for which they have an existing advantage in terms of cost or

[3] For more, see "Reducing greenhouse gas emissions: Commission adopts EU Methane Strategy as part of European Green Deal," European Commission, press release from October 14, 2020, ec.europa.eu.
[4] Alessandro Agosta, Nicholas Browne, Giovanni Bruni, and Nicole Tan, "How COVID-19 and market changes are shaping LNG buyer preferences," August 17, 2020, McKinsey.com.

Companies need to accept and acknowledge risk by incorporating emissions into their calculations of returns on project investments.

knowledge. For example, while CCUS technologies are still uneconomic, they show potential for upstream companies with depleted fields to reduce anticipated decommissioning costs, decarbonize existing operations, and grow new value pools.

2. Integrate emissions costs into business decisions

Companies need to accept and acknowledge risk by incorporating emissions into their calculations of returns on project investments. This means looking at new investments from the perspective of both cost and emissions.

Historically, oil and gas companies looked only at rates of return. While these are still important, the economic impact of emissions must also be taken into consideration. For instance, stress testing economic valuation under different regulatory scenarios and explicitly including customer preferences in the assessment. Companies will also need to test downstream risk regulation from the customer perspective and assess the declining role that some products play in specific markets.

Depending on how regulation develops in downstream markets, products that don't meet specified emissions standards may be banned or taxed, a cost that is likely to fall on the supplier. Many companies have therefore begun discussing how to move to net-zero emissions and now need to review their assets one by one—not only on the basis of cost but also on emissions intensity. Players across upstream, infrastructure, and LNG must strike a balance between costs and emissions intensity of the portfolio.

3. Build a resilient portfolio

Companies should back their beliefs in the direction of the industry and enhance resilience by locking in future demand and adopting new technologies to reduce their exposure to carbon-intensive sectors.

To begin with, investments made today should aim to lower production costs. When demand for gas declines, expensive sources will become uncompetitive and ultimately be the first to stop supplying customers. Meanwhile, reducing the relative emissions intensity of a project will also serve to reduce costs if and when carbon taxes are introduced.

Gaining certainty in future demand can be achieved by focusing on geographies where gas demand is expected to play a role in displacing coal and continue growing over the longer term, particularly in Asia. This also includes sectors in which gas plays a role in reducing emissions from existing technologies, such as LNG bunkering, as well as where gas will be difficult to displace, such as some industrial activities. By aligning incentives between suppliers and downstream customers through decarbonization initiatives, players can secure demand over longer time frames and capture

higher returns. In addition, companies can develop new products, such as “green” gas and LNG, that incorporate carbon mitigation and offsets to reduce overall emissions, help them meet buyer requirements and compete in LNG tenders, and ensure longer-term demand resiliency.
Finally, companies should embrace the shift to renewable energy sources and diversify across portfolios to include positions on promising technologies, such as CCUS, and other energy sources, such as hydrogen and biogas.

Making the right decisions will allow companies to evaluate initiatives at the country and sector level rather than at the project level. This will further enable them to support the transformation of energy ecosystems, including the supply of gas and the development of complementary energy solutions, with the ultimate goal of building an integrated energy system. In turn, these systems will provide longevity for these companies in a decarbonizing and rapidly changing energy sector.

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