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An unsure future for natural gas: How risks could derail the current boom

Evidence suggests that the natural gas market boom is likely to continue in the short-to-medium term. Natural gas is a convenient way to produce energy, due to its abundant supply, versatility, and the fact that it pollutes less than other fossil fuels. Moreover, its derivatives are used as raw inputs in a wide range of industries, notably in petrochemicals. However, this commodity market is not free of challenges. The energy industry is quickly evolving: as renewable energy sources increase in popularity compared to fossil fuels, their costs are plummeting. New forms of electricity conservation have recently become the focal point of widespread international attention, resulting in heavy investment and research. Furthermore, natural gas is increasingly losing its reputation as a cleaner energy source in the battle against climate change, as it pollutes more than renewable alternatives.

Natural gas – ahead of the pack...

Demand and supply are expected to remain steady

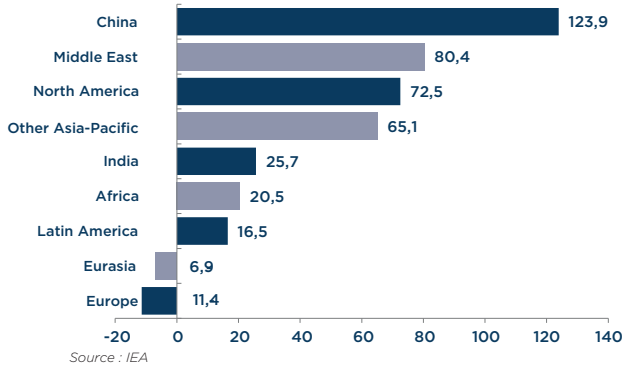
According to the International Energy Agency[1], natural gas demand will continue to grow, forecasting an annual growth of 1.6% between 2017 and 2023. While the growth in demand for electricity generation will likely be more constrained in India and Japan (the latter is slowly returning to nuclear energy for power generation following the 2011 Fukushima Daiichi nuclear disaster), Asia will certainly be at the forefront of consumption growth. China will be increasingly reliant on gas in order to comply with its environmental policies, and will account for nearly 33% of all gas demand growth between 2017 and 2023 **(Graph 1)**. In fact, the "Blue Skies" policy requires the country to meet stringent air quality targets[2]. This policy will thus impose stricter rules on power generation due to the mandatory switch from coal to gas.

On a global scale, the industrial sector will also have a huge impact on demand growth, as the chemical sector requires large amounts of ethane, a natural gas by-product. The abundance of relatively cheap natural gas in the US is boosting the prospect of using ethane as a raw material in the chemical manufacturing process. According to the US Energy Information Administration (EIA)[3], ethane production will rise in the US by 29%, from 1.71 million barrel a day (mbd) to 2.2 mbd in 2020.

Supply of natural gas is expected to rise to meet growing demand. The US will see a major increase in its production capacity, with six LNG[4] plants expected to be operational during 2019[5]. Australia and Russia will take the second and third places respectively. Globally, supply is forecast to grow by 1.6% per annum between 2017 and 2022, adding 300 billion cubic meters (bcm) to the 3,736 bcm already being produced[6].

1 - IEA (2018) *Gas 2018: Analysis and forecasts to 2023.*
2 - China Dialogue (2018). *China releases 2020 action plan for air pollution.*
3 - Energy Information Administration (2019). *Short Term Energy Outlook.*
4 - LNG, or liquefied natural gas, is natural gas cooled down to be easily shipped and for safety concerns.
5 - Australian Department of Industry, Innovation and Science (2018). *Resources and Energy Quarterly September.*
6 - McKinsey (2018). *Global Gas and LNG Outlook to 2035.*

GRAPH 1
Natural gas demand growth from 2017 to 2023, in billions of cubic meters



Source : IEA

One third of this additional supply will come from LNG infrastructures, while pipelines will continue to provide the bulk of natural gas. Nevertheless, this will likely change, as LNG is set to provide as much of the additional natural gas supply as pipelines by 2025. Many newcomers are set to enter the natural gas production market, notably countries in Africa, which is predicted to be the next frontier in this industry. For instance, Senegal and Mauritania currently share an offshore reservoir of gas. Furthermore, potential discoveries in the Comoros Islands would also add to Africa's natural gas reserves, as would lucrative fields in Mozambique[7].

Business evolution permits more flexibility linked to infrastructure development

With the surge of Australian and US LNG exports, the use of traditional gas extraction methods is slowly decreasing. LNG contract pricing has been traditionally tied to oil prices under a long-term agreement. However, the rise of new exporters, the renewed interest in small-scale liquefaction and reliquefaction units, and the push-back of some buyers against rigid frameworks have fostered transactions on spot markets in Western Europe and in the US[8].

Natural gas flows highly depend on flexible infrastructures for trade. In the case of LNG, the cost of building a plant increased between 2010 and 2014[9], when oil and gas contractors were able to somewhat dictate more favourable prices for themselves. Since then, the "total price paid" has fallen from 70% to 50%. Many factors triggered this decrease, notably the drop in input prices. However, it is also important to mention the impact of small units of regasification[10], which enable cash-constrained players to quickly access natural gas supplies and to distribute it at an affordable cost to the population[11].

Natural gas has erupted as a major source of electricity generation in recent years

According to 2018 IEA data, natural gas is the second-largest energy source in the world, behind oil. It is the only fossil fuel to have experienced a steady increase in recent years in its use as an energy source, due to the widely held belief that natural gas is the sole fossil fuel that can be easily used in tandem with renewable energy sources to combat climate change, because of its its abundance and relatively low cost. However, this belief is widely disputed by many scientists and environmentalists[12].

A commodity whose contribution to energy and chemical production is surging

Natural gas has experienced the greatest consumption growth rate of all fossil fuels **(Table 1)** since 2006. Several factors help explain this trend. Firstly, natural gas is less damaging to the environment than other fossil fuels, such as oil and coal. Compared to coal, natural gas emits 40% less carbon dioxide (CO2), particulate matter (PM2.5), sulphur dioxide (SO2) and nitrogen oxides (NOx), and 20% less than oil[13], when burned for heating or electricity generation. As such, it has been widely viewed as a "greener" source of energy among fossil fuels.

Furthermore, natural gas is more versatile than other fossil fuels. Since the turn of the century, the use of renewable energy has surged **(Table 1)**. Renewable energy sources, such as solar panels and wind farms, can be intermittent, and require rapid and reliable backup energy sources[14]. Natural gas serves as a reliable and affordable backup to renewable energy, due to its abundance in many parts of the world, such as Qatar, Australia, Malaysia, Russia and the United States (US).

The application of fossil fuels goes beyond power generation: they are also integrated into industrial processes, notably as feedstock for petrochemicals and fertilisers. Natural gas is no exception, with the industrial process isolating the ethane[15] contained within. Natural gas and related liquids represent approximately 29% of all fossil fuels used as feedstock in the chemical industry as a whole[16], marginally exceeded by oil and liquid oil related products, such as naphtha. According to Levi and Cullen's calculations, the global use of natural gas and others liquids associated with the chemical process amounts to 199 millions of tonnes per year. The International Energy Agency[17] states that 8% of natural gas demands in 2017 came from the chemical sector, ranking fourth after electricity generation (40%), building and home heating (21%), and industrial gas processing[18] (15%).

TABLE 1: Consumption growth rates of major types of energy sources

	2017 growth rate	2006-2016 growth rateper annum
Oil	1.7%	1.1%
Natural Gas	3%	2.3%
Coal	1%	1.3%
Renewables	17%	16.2%
Nuclear	1.1%	-0.7%
Hydroelectricity	0.9%	2.9%

Source: BP Statistical Review of World Energy 2018

7 - African Business Magazine (2019). Indian Ocean oil and gas: Africa's next energy frontier.
8 - International Gas Union (2018). World LNG Report.
9 - Songhurst B. The Oxford Institute For Energy Studies (2018). LNG Plant Cost Reduction 2014–2018.
10 - Regasification is the process of reverting LNG back into natural gas.
11 - International Gas Union (2018). World LNG Report.
12 - Union of concerned scientists (2014). The climate risk of natural gas.
13 - IEA (2017). The environmental case for natural gas.
14 - Traditional base load powers, such as those using oil or coal, need a backup system, as demand seldom matches supply. Peaks in demand have generally been met using flexible power systems such as gas.
15 - A natural gas byproduct used extensively in the chemical industry.
16 - Levi P. and Cullen J. (2018). *Mapping Global Flows of Chemicals: From Fossil Fuel Feedstocks to Chemical Products.* Author calculations.
17 - IEA (2018).*The Future of petrochemicals.*
18 - Industrial companies use natural gas and its byproducts to generate energy or integrate them into their processes.

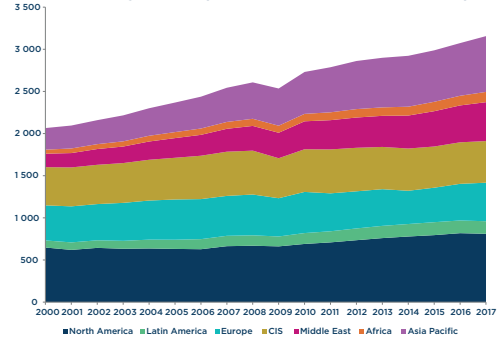
Exports are no exception driven by LNG flows and irruption of new actors

The five major natural gas producers in 2017 were the US (631 million tonnes oil equivalent, mtoe), the Russian Federation (546 mtoe), Iran (192 mtoe)[19], Canada (151 mtoe) and Qatar (151 mtoe). Natural gas is predominantly traded through pipelines. Liquefied natural gas (LNG) exports are equivalent to only half of the gas flows traded through pipelines (393 billion cubic meters versus 740 in 2017). Although the US has always been a major gas producer, it has recently experienced a surge in its exports, which increased by 300% between 2016 and 2017 thanks to new liquefaction facilities in the Sabine Pass plant in Texas. The US is the third-largest LNG exporter in the world, behind Qatar and Indonesia. The major destination markets are in Asia, due to better prices there. Yearly-averaged LNG price in Asia[20] was higher than natural gas delivered via the Henry Hub pipeline, traded at 6.9 $/MMBtu[21]. Australia's LNG exports have also risen since 2016, increasing by 22% in 2017 due to recent facilities in the western part of the country. Demand from major neighbouring countries – such as Japan, China, and South Korea – coupled with Australia's huge reserves have helped the country to ramp up exports.

Pricing mechanism: a fragmented landscape

Pricing systems also play an important role in the natural gas industry. Many pricing mechanisms and markets operate on a regional basis, which prevents the adoption of a universal pricing system. Many regional markets exist, each with their own benchmark pricing system. The larger markets include North America, which is dominated by the US; Western Europe – which is dominated by the United Kingdom, Germany, France, the Netherlands and Italy – and lastly Asia, which is dominated by Japan, China, South Korea and India. Contrary to the oil market, where the Brent pricing system is more universally used than other benchmarks (Dubai, WTI, etc.), each gas market has developed at least one[22] of its own benchmark pricing system over the years, dependent on the type of gas flows[23]. For instance, in the US, the leading indicator is the Henry Hub; in Europe, the Dutch TTF[24] is typically preferred to the British National Balancing Point (NBP); and in Asia, the major indicator is the JKM — a pricing system of liquefied natural gas coming from overseas to Japanese or Korean ports[25].

GRAPH 2: Natural gas consumption evolution in million tonnes oil equivalent



Source: BP Statistical Review of World Energy 2018

...that has to 'compete' with 'cleaner' and more affordable renewables

Burning natural gas won't save the planet

Although natural gas emits less CO_2 than oil or coal when burned, it is by no means a clean energy source. Methane, a component of natural gas, is leaked when gas is extracted or transported through pipelines. Methane is much more potent than CO_2[26], and approximately 1% to 9% all of gas produced in the US per year is leaked into the atmosphere. Furthermore, the combustion of gas for heat and/or electricity generation will not reduce the risk of global warming. The advantage of gas over coal is therefore diminished. Moreover, as the US solidifies its position as one of major gas exporters in the world due to abundant reserves enclosed in shale basins, which it extracts via fracking, it is important to note that this method of gas extraction is highly polluting. Fracking requires vast amounts of water, which lowers groundwater levels, and the injection of chemicals into the earth in order to frack the rock. This technology pollutes tap water as well, threatening access to drinking water in rural communities[27].

Renewables more affordable than natural gas

Renewable energy sources are more competitive than natural gas, as their prices are decreasing and driving out many fossil fuels, such as oil, coal, and natural gas. According to the global financial firm Lazard's latest levelised cost of energy analysis (LCOE)[28], unsubsidised wind energy[29] is already cost-competitive with the cheapest method of producing electricity from natural gas – the "gas combined cycle"[30]. The LCOE[31] of wind energy ranges between USD 29 and USD 56 (cost of megawatt per hour), while the combined cycle is estimated to be between USD 41 and USD 74. For solar photovoltaic energy, the cost ranges between USD 36 and USD 46, depending on the technology employed. However, the cost of owning a gas peaking facility is significantly higher (a fact that has impacted several utilities across the world, notably in Western Europe): the estimated cost is in a range between USD 152 and USD 206. It is worth nothing that natural gas prices are highly volatile, adding uncertainty to the decision-making process. Furthermore, several gas turbine makers have suffered from a drop in the market, as utilities are developing large-scale renewable projects to generate electricity. According to General Electric, the company's gas turbine orders fell to 29 GW in 2018 from 56 GW in 2015. Orders are expected to reach the 25-30 GW range in 2019, which may not bode well for the prospect of natural gas in the forthcoming years. Additionally, if consumption rises steadily in the future, much more than supply, not only would Henry Hub[32] prices increase, but main Asian LNG benchmarks could rise as well. This could be exacerbated by the availability

19 - BP (2018). Statistical Review of World Energy.
20 - JKM also known as Japan-Korea Marker.
21 - Millions of British Thermal Units.
22 - Intercontinental Exchange. Global natural gas futures.
23 - Natural gas is not an easily shipped commodity: when the origin and the destination are far away and separated by sea, liquefying it and putting it in a special vessel is the only viable option. Transport via pipelines is difficult when crossing an ocean due to various technical reasons.
24 - Title Transfer Facility, a virtual trading market in the Netherlands.
25 - Japan-Korea Marker, an Asian benchmark for LNG prices assessed by S&P.
26 - Union of concerned scientists. *Infographic: The Climate Risks of Natural Gas — Fugitive Methane Emissions.*
27 - Union of concerned scientists. *Environmental Impacts of Natural Gas.*
28 - Lazard (2018). Levelised cost of energy analysis – version 12.0.
29 - Ait Yahia K. (2018). *Wind Energy: How long will the wind stay in the industry's sails?.*
30 - EDF. Combined cycle gas turbine power plants.
31 - Levelised Cost Of Energy. Measures in $/MWh the lifetime costs of a plant divided by energy production
32 - A distribution hub and a benchmark pricing point for natural gas futures contracts in the United States.

of LNG tankers, which increase the daily spot rate for LNG. According to S&P[33], average Asia-Pacific LNG spot daily rates doubled between 2017 and 2018 (USD 39,000 per day versus USD 80,000). This, combined with higher prices, may push decision-makers to rethink which energy sources they rely on.

Renewables and storage: the hidden foe

Using gas as a backup to electricity generation from renewables is necessary to cope with intermittency. However, electricity storage is making advances, and will sooner than expected pose a threat to peaking natural gas facilities, therefore representing a risk to natural gas companies. According to energy and research consultancy Wood McKenzie, electricity storage capacity in GW/h more than doubled during 2018, growing by 140%. According to Wood McKenzie, the natural gas market is likely to keep increasing, forecasting an annual compound growth rate of 38% between 2019 and 2024. Automotive manufacturer Tesla is already experimenting in Australia with a battery storage system tied to the Hornsdale[34] wind farm. During its first six months, this system had already generated EUR 8.1 million for a cost of EUR 56 million. Although the technology is in its infancy, many actors and governments are rushing to develop their own battery storage champions. The case of Northvolt in Sweden is compelling, as it aims to be the largest European battery maker.

33 - S&P (2019). *Outlook 2019: Growing LNG marketplace to drive spot shipping rates in 2019.*
34 - The Guardian (2018). *South Australia's Tesla battery on track to make back a third of cost in a year.*

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