MARKET REPORT SERIES

International Energy Agency
Secure Sustainable Together

GAS 2017

Analysis and Forecasts to 2022

EXECUTIVE SUMMARY

INTERNATIONAL ENERGY AGENCY

The International Energy Agency (IEA), an autonomous agency, was established in November 1974. Its primary mandate was – and is – two-fold: to promote energy security amongst its member countries through collective response to physical disruptions in oil supply, and provide authoritative research and analysis on ways to ensure reliable, affordable and clean energy for its 29 member countries and beyond. The IEA carries out a comprehensive programme of energy co-operation among its member countries, each of which is obliged to hold oil stocks equivalent to 90 days of its net imports. The Agency's aims include the following objectives:

- Secure member countries' access to reliable and ample supplies of all forms of energy; in particular, through maintaining effective emergency response capabilities in case of oil supply disruptions.
- Promote sustainable energy policies that spur economic growth and environmental protection in a global context – particularly in terms of reducing greenhouse-gas emissions that contribute to climate change.
- Improve transparency of international markets through collection and analysis of energy data.
- Support global collaboration on energy technology to secure future energy supplies and mitigate their environmental impact, including through improved energy efficiency and development and deployment of low-carbon technologies.
- Find solutions to global energy challenges through engagement and dialogue with non-member countries, industry, international organisations and other stakeholders.

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Low prices give natural gas a helping hand

Gas will grow faster than oil and coal over the next five years, helped by low prices, ample supply, and its role in reducing air pollution and other emissions. In our new five-year forecast to 2022, gas demand will grow at 1.6% per year, a slight upward revision from last year's forecast of 1.5%. This means that annual gas consumption almost reaches 4 000 billion cubic metres (bcm) by 2022, from around 3 630 bcm in 2016. Almost 90% of the anticipated growth in demand comes from developing economies, led by the People's Republic of China (hereafter, "China").

Industry emerges as the main engine of demand growth, accounting for half of the forecast growth in global gas demand. A growing use of gas in the chemical sector, strong demand for fertilisers in countries like India and Indonesia, and the replacement of coal by gas in a host of smaller industrial applications in China mean that industrial gas demand grows by almost 3% per year. Gas use for transportation also grows rapidly, albeit from a much lower base, reaching 140 bcm by 2022 from 120 bcm in 2016. Demand in the main gas-consuming sector – power generation – continues to expand, but at a much more modest rate of less than 1% per year. In many mature markets, the rapid increase in power generation from renewables, combined with modest growth in electricity demand, limits opportunities for thermal generation. In many emerging markets that rely on imported gas, especially those without a price on carbon or strict regulations on air pollution, gas faces very strong competition from coal.

Many countries are reforming their gas markets to increase the use of gas and to attract new investments. A diverse group of countries worldwide, including Mexico, China and Egypt, are moving ahead with important gas market reforms, allowing more private participation in the supply, transport and marketing of gas, and introducing third-party access to gas infrastructure. If implemented rigorously, these reforms can lead to more investments throughout the supply chain and generate more sustainable demand and supply balances. Subsidies on fuels, including gas, are being reduced substantially in many parts of the Middle East, North Africa, Latin America, and Asia; this practice can expose gas to more competitive pressures in relation to other fuels and technologies, but prices that reflect market fundamentals will also lead more efficient consumption and enhance incentives for investment in new supply.

Gas gains a firmer foothold in South and East Asia

The availability of ample, competitively-priced supply helps to expand opportunities for gas in Asia, where China accounts for 40% of global demand growth. After a period of slower growth in 2015-16, gas demand in China is forecast to rise by 8.7% per year to 2022, assisted by the policy drive to improve air quality. China's 13th Five-Year Plan provides strong policy support for gas, helping it to counter tough competition from coal in almost every sector. Replacing coal in power generation, household heating and industrial applications, such as textile, food and other types of manufacturing, has the potential to substantially boost the use of gas in China. Consumption rises to almost 340 bcm by 2022, of which imports account for 140 bcm, up from 70 bcm in 2016.

India leads growth in the rest of Asia. Gas accounts for only 5% of primary energy demand in India, leaving plenty of room for expansion; and strong economic growth leads to higher utilisation of gas-based power capacities and increased use in industry, led by fertilisers. This will drive gas demand use to almost 80 bcm by 2022 from 55 bcm in 2016. Other countries in South Asia, notably Pakistan

and Bangladesh, show a similar picture of strong growth underpinned by cheaper LNG and incremental gas use for power and industry.

Resource-rich parts of the Middle East and Africa also see strong demand for locally-produced gas. The Middle East will experience relatively strong growth in consumption of 2.4% per year, to around 540 bcm, met in the main by increasing domestic production. Growth is relatively strong in the power sector, where there are opportunities to substitute gas for oil, as well as in the industry sector as the region's economies grow and diversify**.** Consumption in Africa rises even more quickly, at 3.1% per year, to reach more than 150 bcm. Egypt, Algeria and Nigeria are the main countries pushing consumption higher, even though lower hydrocarbon revenues and economic growth hold back demand in some resource-rich parts of the continent. Elsewhere, annual gas demand growth in Latin America averages 1.3%, while the consumption outlook remains flat in the Russian Federation (hereafter, "Russia"), Eastern Europe and Central Asia.

Gas markets are approaching saturation in many parts of the developed world, but consumption continues to grow in the United States.

Gas use continues to grow in the United States, the largest gas-consuming country in the world, albeit at a slower pace than during the period from 2010-16. Coal-to-gas switching in US power generation, the main driver of gas demand growth in the recent past, will slow down significantly as gas prices are expected to increase from the USD 2.5/million British thermal units (Henry Hub) average seen in 2016. Most US growth in gas consumption occurs in the industrial sector, where competitiveness continues to be boosted by cheap gas. Together with Canada and Mexico, countries with whom the US gas sector is closely integrated, demand in North America as a whole will surpass 1 000 bcm by 2022 – one-quarter of global gas consumption.

European gas demand rose in 2016, thanks to low gas prices and coal plant retirements, but is forecast to stay flat out to 2022. After four years of decline from 2010, European gas demand increased for the second year in a row in 2016. Lower gas prices, higher coal prices, coal plant retirements and nuclear outages in France have pushed up gas demand for power generation. In Germany, gas-fired power generation increased substantially, reversing a continuous decrease since 2010. In the United Kingdom, the carbon price floor has supported an 8 bcm increase in gas demand for the power sector between 2015 and 2016. Over the forecast period, demand will remain flat, as growth will be constrained in the power sector by limited electricity demand growth and the continued rise of renewables, and in industry by sluggish growth in European industrial output.

Gas consumption is expected to decline in Japan and Korea although a policy shift in Korea could open up new possibilities for gas. Japan and Korea consumed around 45% of the globally traded liquefied natural gas (LNG) volumes in 2016, with significant future volumes already committed. After a big increase in gas use in the aftermath of the Great East Japan Earthquake and safety issues with nuclear power plants in Korea, demand has started to decline in both countries. Gas demand is expected to fall in both Japan and Korea throughout the forecast period, but there are significant uncertainties over the trajectory in both countries. In Japan, 12 nuclear reactors received the green light from safety authorities and 5 have restarted, although the size of the fleet restarting in the coming years remains uncertain. Korea's new government is targeting a reduced role for nuclear and coal-fired power, which would lead to an increase of gas use.

The United States takes the lead on global supply as the shale revolution gets a second wind.

The United States, the world's largest gas producer, will increase production more than any other country over the next five years, accounting for almost 40% of global output growth. While overall US production fell in 2016, output from the Marcellus basin continued to grow, underscoring the ability of US gas drillers to counter the effect of lower prices by improving efficiency and producing more gas with fewer rigs. The continuing development of the Marcellus and Utica shales is being supported by the extension of pipeline infrastructure from the Appalachian region to ship more gas to markets in the Northeast, Midwest, and Southeast regions of the United States and in Eastern Canada. Over the forecast period, US gas output is expected to grow by 2.9% per year, adding around 140 bcm to global production. By 2022, the United States will produce approximately 890 bcm, or 22% of the total gas produced worldwide. Although US domestic demand for gas is growing due to increased demand in industry, more than half of the production increase will be turned into LNG for export. By the end of our forecast period, the United States will be well on course to challenging Australia and Qatar for global leadership among LNG exporters.

The Middle East will see remarkable production growth, while limited access to markets means that Russia grows more slowly. With expanding demand in the power and industrial sectors, the Middle East will add around 70 bcm to world production as production increases to 650 bcm by 2022. Half of the forecast increase will come from Iran. Russia, the second-largest gas producer in the world after the United States, has plenty of under-utilised production capacity in the Yamal peninsula but will see its gas production grow only at an average rate of 1.5%; with demand in the domestic market stagnant and flat-lining in its main European market, the opportunities for growth come primarily from exporting LNG – via a new project in the Yamal peninsula – and, towards the very end of the forecast period, the anticipated start of pipeline exports to China.

China becomes the world's fourth-largest gas producer. China's domestic production is expected to increase by around 65 bcm to 200 bcm by 2022, representing growth of 6.6% per year, making China the fourth-largest natural gas producer in the world. While challenging geological issues raise uncertainties about the increase in domestic production, China's national oil companies are intensifying gas exploration and production activities in China.

Global LNG trade is growing while markets search for the right balance

The volume and diversity of LNG trade flows are increasing rapidly with the appearance of new exporting and importing countries. Liquefaction capacity is expected to grow by 160 bcm over the period to 2022, led initially by Australia (30 bcm), but with the largest increase in growth then coming from the United States (90 bcm). This additional LNG capacity is being added to a market that is already well supplied, particularly as demand is declining in some of the large, traditional LNG-importing countries such as Japan. In these conditions, with relatively low LNG prices, exporters are having to work hard to open up new markets. A sign of this effort is the rapid growth in the number of countries importing LNG, which has already grown from 15 in 2005 to 39 today. This growth in LNG has been helped by the increased use of floating storage and regasification units, and it will absorb some of the surplus gas on the market as another eight countries are expected to add LNG import facilities by 2022. Nonetheless, the growth in LNG demand is not expected to be sufficient to rebalance the LNG market before the end of the forecast period.

Ample availability of LNG is putting pressure on traditional ways of pricing and marketing natural gas. Over-supply and the decline in the price of oil have brought down natural gas prices in all regions: the huge price divergences between regions seen as recently as 2013 – when prices in Japan

and Korea were around six times US wholesale prices – have narrowed considerably. This has limited profitable export opportunities for many players, at least temporarily. An intensely competitive international supply environment is also loosening some of the pricing and contractual rigidities that have characterised long-distance gas trade in the past. This change will be further accelerated by the expansion of US exports, which are not tied to any particular destination and so will play a major role in increasing the liquidity and flexibility of LNG trade.

Pipeline trade continues to grow but faces strong competition in many markets. Pipeline trade between the United States and Mexico has expanded rapidly in recent years, and pipeline supplies to Europe held their ground in 2016 despite the availability of LNG: Europe saw little change in LNG imports as Russia, Norway and Algeria ensured that they maintained their strategic position as suppliers to the European market. Europe's import needs are set to grow in the coming years, mainly because of the continued decline in indigenous production. Two long-awaited new gas trade routes are anticipated to start operation in the next five years: an expanded connection between Azerbaijan, Turkey and the main European markets via the TANAP and TAP pipelines; and the "Power of Siberia" connection between Russia and China, which has the potential to become a major artery of global gas trade in the future.

In Australia, higher LNG exports have raised domestic security of supply concerns. Gas prices in Australia's major eastern market have traditionally been very low but have now risen sharply, in part because new export projects have created a pricing link with international markets. Higher end-user prices have led to concerns about the impact on industrial competiveness. In response, the Australian government has introduced a domestic gas security mechanism that gives it the power to restrict exports if there is a risk of shortfalls on the domestic market.

Concerns about security of gas supply have appeared in some other major producing countries. In Nigeria, Africa's biggest economy, militant attacks on gas facilities, the absence of political reforms and a lack of investment have led to structural gas shortages. The reduction in gas-fired power generation by 50% from recent average levels has deprived millions of power and hurt the economy. The recent standoff between Qatar and some of the other Gulf States and Egypt has also underscored some potential risks to gas supply security from the Middle East: Qatar supplies around 30% of the world's LNG.

Longer-term risks to gas security could also arise from a shortage of investment in new gas supply infrastructure although the US looks well placed to respond once international markets show signs of tightening. Well-supplied markets in the short term are maintaining downward pressure on prices and discouraging new upstream investment in LNG. In 2016 only two new final investment decisions (FIDs) were taken to expand existing or build new LNG facilities and, at the time of writing, only one FID has been taken so far in 2017. If major new investments in gas supply struggle to make headway, this would increase the risk of a hard landing for gas markets in the 2020s; however, brownfield expansions of existing facilities, notably in the United States, provide a safety valve since they could bring new gas to markets relatively rapidly once the need arises.


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The natural gas market is undergoing a fundamental transformation. Industry has overtaken the power sector as the driving force behind the growing use of gas, thanks to rising demand in places like the People's Republic of China, developing Asia, the Middle East and the United States. At the same time, structural changes in gas supply and trade are changing the global gas market. Heavily oversupplied markets, the ongoing shale-gas revolution in the United States, the second wave of additional liquefaction capacity from Australia and the US, and the fast-growing LNG trade are disrupting traditional gas business and pricing models. This is forcing market players to redefine their strategies and explore new markets.

The IEA's renamed *Gas 2017* market report provides a detailed analysis of supply and trade developments, infrastructure investments, and demand-growth forecast through 2022. It assesses the main changes that will likely transform the gas market, led by rising demand in countries that include China, India, and Pakistan, thanks to ongoing economic growth and relatively low LNG prices. It also explores widening regional differences to traditional gas users, with flat demand forecast in Europe and structural demand decline in Japan.

Oversupplied markets will also keep pressure on prices and discourage new upstream investment in gas production and LNG liquefaction capacity. At the same time, market reforms in places like Egypt, Brazil, Argentina and Mexico have the potential to bring new investments and technologies to unlock vast domestic resources, creating new prospects for the gas industry.

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