

GAS DEMAND GROWTH BEYOND POWER GENERATION



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This IEF-KAPSARC Dialogue Insight Paper helps to inform the 6th IEF-IGU Ministerial Gas Forum Panel Session 2 on Gas Demand Growth beyond Power Generation. It highlights the main trends in gas consumption that have made gas the fastest growing fossil fuel, but kept its overall market share unchanged over the last decade. It identifies sectors and regions where gas is likely to grow in the coming years, especially outside the power sector. These include the industrial, petrochemicals, road and maritime transportation sectors in the non-OECD region. The paper highlights gas market advances in China and India, and shows that long-term government support, anchored in environmental and health standards, enables the gas industry to deliver on its promise of the ‘golden age of gas.’ The share of gas by then, may well exceed 25 percent of total energy demand, resulting in a more secure and sustainable world energy market.

The paper is an outcome of the collaboration between the International Energy Forum (IEF) Secretariat and the King Abdullah Petroleum Studies and Research Centre (KAPSARC) aimed at enhancing synergies between the two organizations in accordance with the conclusions of the 16th International Energy Forum Ministerial Meeting in New, Delhi India on 10-11 April 2018. The collaboration will help to inform the IEF energy dialogue, consisting of IEF member countries and industry stakeholders, in the areas of energy security, energy transition and energy transparency, by leveraging KAPSARC’s research resources and capabilities in these areas.

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10 CONSIDERATIONS FOR POLICY AND INDUSTRY DECISION MAKERS

1. To keep up with the pace of gas demand growth in Asia and diversity of supply requirements in other key demand centres such as Europe, **gas producers must invest in new supply facilities to reliably cater to new gas demand.**
2. **Large growth markets** such as China and India and import-dependent markets such as Europe, **can commit to large volumes with significant demand for natural gas. New gas importing countries** in South East Asia, South America, the Middle East and Africa with smaller and more varied demand patterns **require more agile approaches to foster long-term growth.**
3. **Flexibility offered through new technology solutions** that reduce costs and offer more optionality, as well as **innovative marketing and contract terms**, are important means of **unlocking demand in nascent gas markets.**
4. **Governments also have a role to play to stimulate gas market growth in new regions through enhanced dialogue and cooperation**, and by facilitating cross-border trade and inland interconnections, to help build economies of scale that enable reliable supplies for new and existing markets.
5. **Developing demand from sectors beyond power generation can serve as a significant lever to enhance gas consumption globally.** Nearly 70 percent of the increase in gas consumption is forecast to be outside the power sector, with growth driven by rising demand from industry in Asia, petrochemical applications in the United States (U.S.) and the Middle East, and rising mobility needs.
6. **Demand for gas in the industrial sector is increasingly coming from its use as a feedstock instead of as a combustion fuel.** Since sectors such as fertilizers and petrochemicals are more competitive globally, and hence likely closer to the efficiency frontier, **gas demand growth in these sectors is likely to remain robust in the long-term.**
7. **Demand from the building and transport sector is fragmented** and usually more closely linked to the development of distribution networks. Achieving **cost advantages through economies of scale** in these new growth sectors **is impossible without strong government support** to leverage the required private sector investments.
8. Successful gas market advances show the importance of **anchoring future gas demand in long-term policies focused on environmental and health standards** to achieve clean air, greenhouse gas emission reduction and energy access goals.
9. At the regulatory level, **gas market reforms and regional integration** can further help overcome hurdles such as market access constraints, inefficient price formation, and rigid contract terms.
10. **Robust and reliable policy and market signals** will ensure that the required investment in gas infrastructure and storage facilities moves forward in tandem with future gas demand trends that healthy and secure world energy markets require. This consideration extends beyond the use of natural gas in the power sector alone.

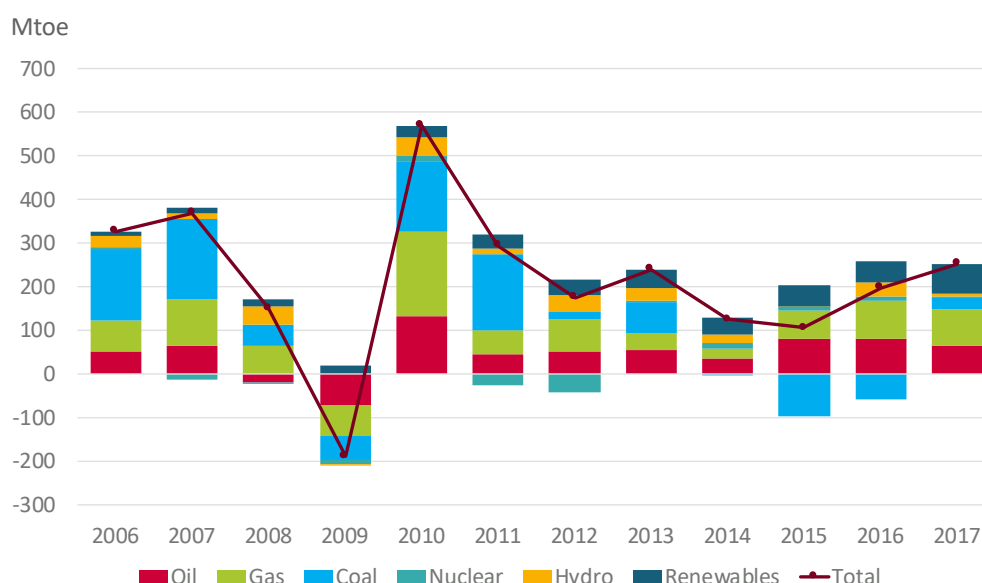
1. GAS DEMAND GROWTH BEYOND POWER GENERATION

Global growth in energy consumption returned to its longer-term trend in 2017 and gas again provided the largest increment to meet this additional demand. Demand for gas from the power sector has historically been the biggest driver for growth in consumption. However, it is expected that this stimulus from power generation will moderate as growth shifts to the industry, transport and the building sectors.

1.1 NATURAL GAS IN THE GLOBAL ENERGY MIX

Global energy consumption grew by 1.9 percent in 2017, faster than the average growth of 1.7 percent per year during the previous ten years (2006-16), according to industry sources. This growth rate was also substantially higher than average annual energy demand growth projections by the International Energy Agency (IEA), OPEC, and the Gas Exporting Country Forum (GECF) that range from 1 percent to 1.3 percent in main scenarios to 2040. This amounted to the largest increase in global energy consumption since 2011, with the growth rate in 2017 returning to the trend in energy demand growth from before the global financial crisis (see Figure 1).

Figure 1: Strong global energy consumption growth
Energy demand growth is back to pre-financial crisis levels

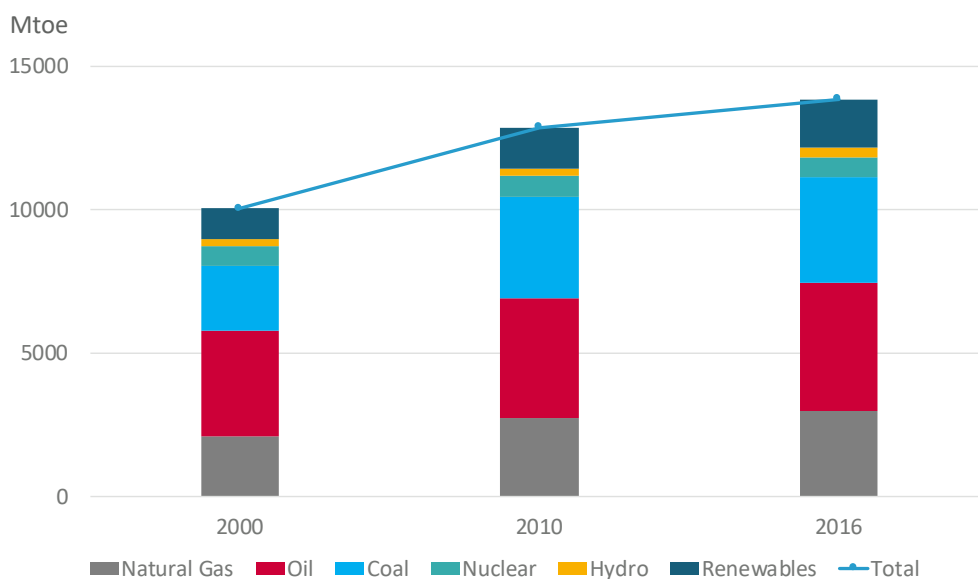


Data Source: BP, 2018

The largest increment in energy consumption in 2017 came from natural gas. In fact, since 2000 gas has contributed the largest increments to global energy consumption for seven years. Overall, gas consumption in 2017 grew by 2.7 percent, marginally slower than in 2016 but higher than the previous ten-year average of 2.3 percent per annum (2006-16). This higher growth rate, compared to overall energy consumption, has meant that the share of gas in the global energy mix has increased from around 20 percent of total primary energy in 2000 to 21.7 percent in 2016, and reached 23.4 percent in 2017 according to industry.

Nevertheless, these gains have been slow to come by, with competition from coal at one end and renewables, especially in the power sector, at the other. A number of commentators have characterised this slow progress as evidence that the 'golden age of gas,' prophesied in the early 2010's, is slow to materialise and could have used more conservative assessments (see Figure 2).

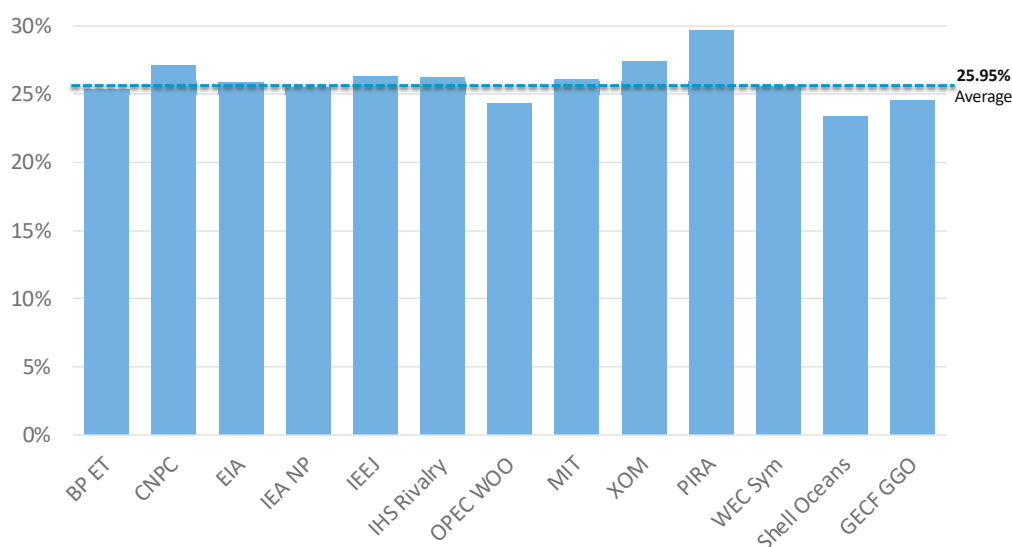
Figure 2: GECF shows similar historical trend in total demand
But share of gas grew modestly from 20.8% in 2000 to 21.7% in 2016



Data Source: GECF, 2017

The IEA in 2011 described a scenario where gas consumption would grow twice as fast as overall energy consumption resulting in the share of gas rising to 25 percent in the energy mix by 2035, whereby it would overtake coal and approach oil in terms of overall market share. In comparison to that scenario, and as the historical data from industry and government sources now shows, gas consumption has grown more slowly but does appear to be on track to overtake coal and close the gap with oil in the long-term. Scenario projections of the share of gas in total energy consumption range from 23 percent to 30 percent by 2035 in key energy forecasts. These forecasts, on average, converge on the share of gas in total primary energy demand rising to 26 percent by 2035 (see Figure 3).

Figure 3: Gas market share ranges from 23% to 30% in 2035
According to key government and industry outlooks that converge on 26%

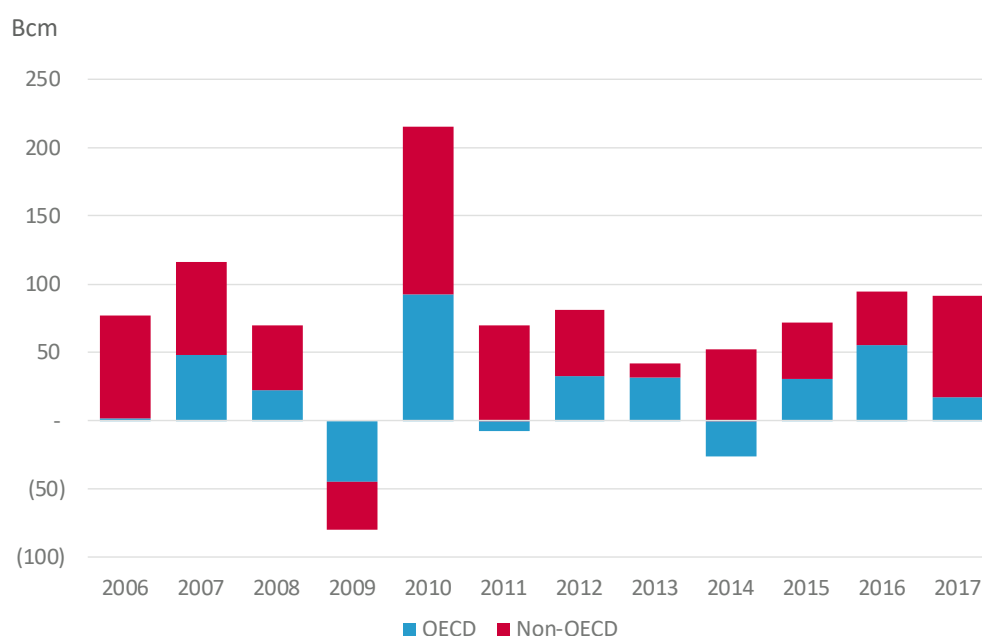


1.2 A REGIONAL LENS ON GAS CONSUMPTION

The move in the centre of energy demand growth from the Organisation for Economic Co-operation and Development (OECD) region to the non-OECD region masks important dynamics between the three major gas markets, Asia, Europe and North America. While there is a balance between Asian gas supply and demand, North American gas markets show net gas export volumes building, with growing European gas import dependencies.

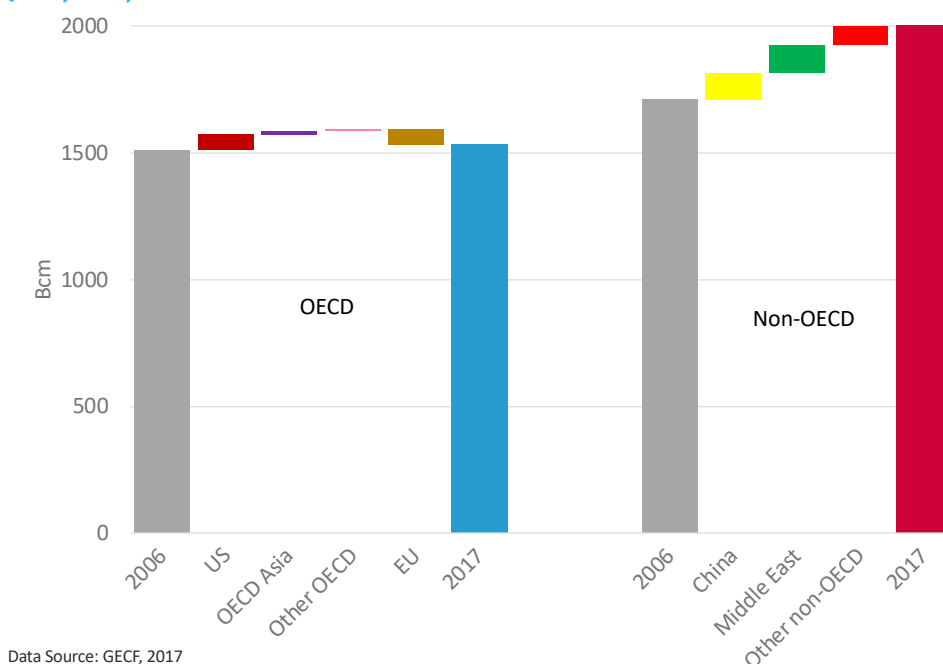
A key characteristic of the IEA's Golden Age of Gas scenario is that about 80 percent of the growth in gas consumption is forecast to come from developing or non-OECD countries. In 2017 over 80 percent of the increase in gas consumption came from non-OECD countries, according to industry sources. These Non-OECD countries provided nearly 80 percent of the growth in global gross domestic product (GDP) during this period and over 90 percent of the global population growth. As such, it is not surprising that developing countries are leading growth in gas consumption as they industrialise and become more populous. Since 2006, non-OECD countries have accounted for over half of global gas consumption (see Figure 4).

Figure 4: Gas market growth in OECD and non-OECD regions
80% of gas market growth came from the non-OECD region



China and the U.S. have dominated growth in gas consumption, together accounting for over 53 percent of the global increase since 2010. Another 35 percent of the total increment has come from the Middle East, with Iran, Saudi Arabia, and Qatar accounting for nearly all of the increment in the region. The only region of the world where gas consumption has fallen in volumetric terms is the European Union (EU), where decreasing energy demand along with the rapid increase in renewables have crowded out gas amongst other fuels in the power sector. Since 2015, this trend has been partially reversed in the EU, and since 2014 the region's gas consumption has increased (see Figure 5).

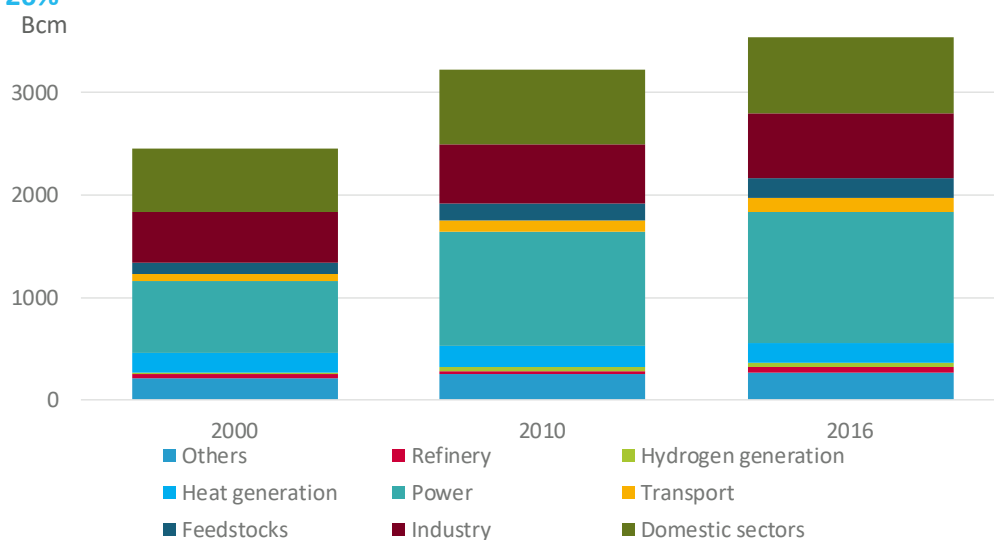
Figure 5: In regional growth China, U.S., and Middle East lead
53% China and U.S., while 35% of gas market growth came from Saudi Arabia, Qatar, and, Iran



1.3 GAS CONSUMPTION BY SECTOR

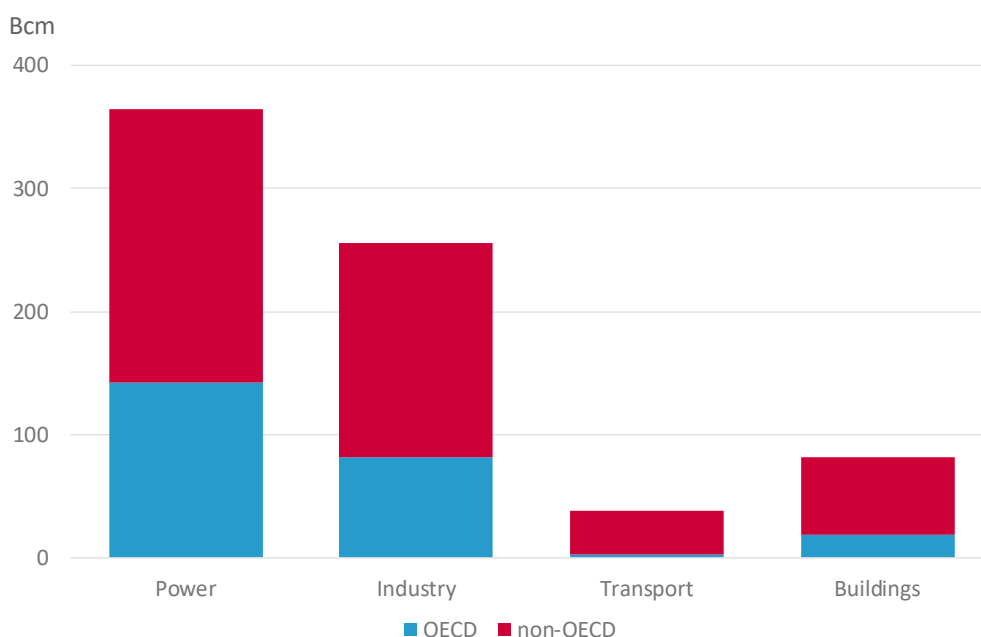
Currently, power generation accounts for 36 percent of global gas consumption, followed by industry (including feedstock for petrochemicals, refinery use, and other industrial applications) at 26 percent. Almost all of the remainder is consumed in the buildings sector, with transport accounting for just 4 percent of global gas consumption. Power generation has dominated gas consumption growth over the last ten years, accounting for just over half of the total growth since 2010. Industrial consumption has been the second largest source of growth accounting for 35 percent of the increase since 2010 and has just about maintained its share of total consumption over the past ten years. More importantly, the use of gas as feedstock in petrochemicals (as opposed to for combustion) has become more prominent, with consumption from the petrochemicals industry rising by 2.8 percent per annum since 2010, compared to just 1.5 percent per annum in other industrial sectors. The fastest growth in gas consumption comes from the transport sector, though this sector still represents very small volumes (see Figure 6).

Figure 6: Gas consumption by sector
Power generation accounts for 36% of gas consumption, followed by industry at 26%



The non-OECD countries account for a larger proportion of the increase in gas consumption for power generation compared to OECD countries, with over 60 percent of the increase in the power sector from this region. However, the contribution of the non-OECD countries to growth in other sectors is even more significant. Almost all of the growth in gas consumption in the transport sector over the last ten years has been accounted for by countries in the non-OECD region. Similarly, 68 percent of gas consumption growth in the industrial sector and 77 percent of growth in the building sector has come from the developing world. The shift in the centre of growth of gas consumption to the non-OECD region is attributable to much more rapid development in industrial activity and accelerating urbanisation since 2006 (see Figure 7).

Figure 7: 70% of growth is beyond the power sector
Almost all of the growth in beyond the power sector is in the non-OECD region



Data Source: Calculated from (IEA, 2017) and (BP, 2018)

Going forward, the IEA forecasts that industry would account for 40 percent of the incremental gas consumption during 2016-2040, with an annual growth rate of over 2 percent per year during this period. This would be followed by growth in gas consumption for power generation, though much more slowly than industry, at just 1.2 percent per year. The remainder would be accounted for by buildings, growing at 1.3 percent per year and transport where demand will increase at a much higher rate at 4.2 percent per year. Thus, nearly 70 percent of the increase in consumption is forecast to be outside the power sector, with rising gas demand in industry in Asia, petrochemical applications in the U.S. and the Middle East, and rising mobility needs as the main levers of growth.

1.4 GROWTH PROSPECTS IN INDUSTRIAL APPLICATIONS

According to the U.S. Energy Information Administration (EIA), the industrial sector consumed more energy globally than any other sector, about 54 percent of the world's total. Energy is used in industry for a wide range of thermal, lighting, and feedstock purposes. The EIA forecasts that industrial energy consumption in non-OECD countries will grow three times faster than in the OECD, resulting in the share of developing world's industrial energy consumption rising to nearly 75 percent of the global total by 2040, compared to its current share of about 66 percent. In recent years, over 80 percent of the rise in gas consumption has come from industry and buildings.

Natural gas consumption in industry is forecast to grow more rapidly in the non-OECD compared to the OECD region. While gas barely maintains its market share of around 30 percent of OECD industrial energy consumption between 2016 and 2040, its share of total energy consumption within the non-OECD industry sector rises from about 20 percent currently to 27 percent by 2040. This includes the use of gas not just for combustion purposes but also as feedstock used to produce agricultural inputs such as fertilisers, for the manufacture of chemicals and plastics, among other uses. This portion of gas consumption is the fastest growing source of industrial incremental demand (see Figure 8).

Figure 8: Gas in industry only grows in the non-OECD industry sector
Gas market shares rises from 20% today to 27% in the non-OECD industry sector by 2040



Data Source: from (EIA, 2016) and (BP, 2018)

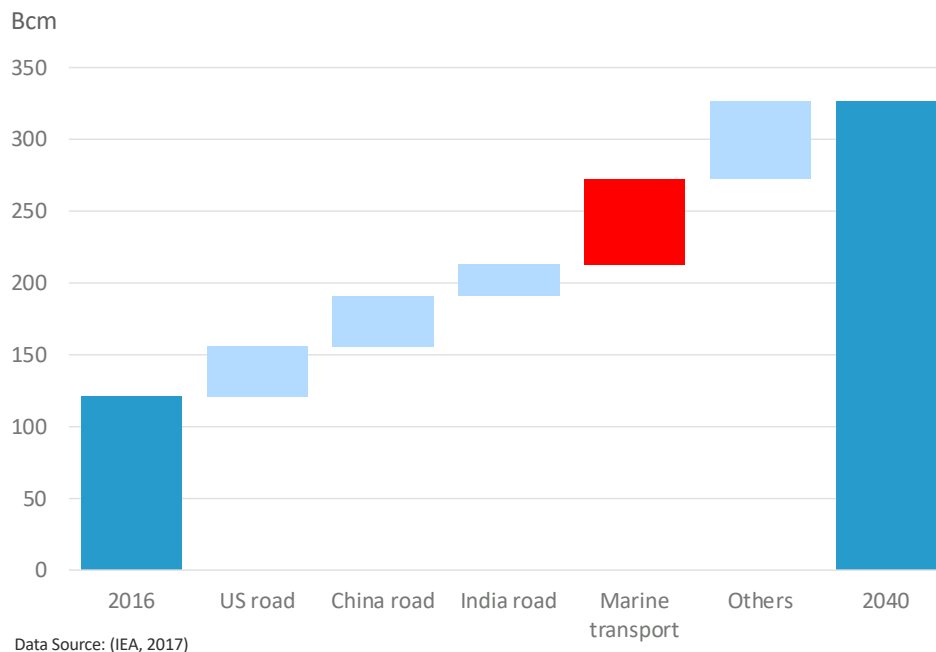
1.5 GAS DEMAND FROM THE TRANSPORT SECTOR

The IEA forecasts that gas demand in the transport sector will rise by 170 percent between 2016-40. The single largest source of growth is marine fuel, with the International Maritime Organization's regulations on sulphur emissions from shipping vessels and energy efficiency targets encouraging a shift towards gas and away from liquid fuels. Road transport demand in the U.S., China, and India accounts for over 40 percent of total growth during this period, and marine gas consumption could contribute another 27 percent of the increase in natural gas demand for transportation.

According to the EIA, the share of natural gas in global transportation fuel demand will grow from 3 percent in 2012 to 11 percent by 2040 (EIA, 2016). This increase is largely attributed to a move away from heavy-duty diesel engines. This trend is echoed in the BP Energy Outlook where growth in natural gas for transport is concentrated in the use of liquefied natural gas (LNG) in long-distance road haulage and marine transportation (see Figure 9).

Figure 9: Gas demand grows by 170% in transport

With marine shipping fuel providing the single largest growth component to 2040

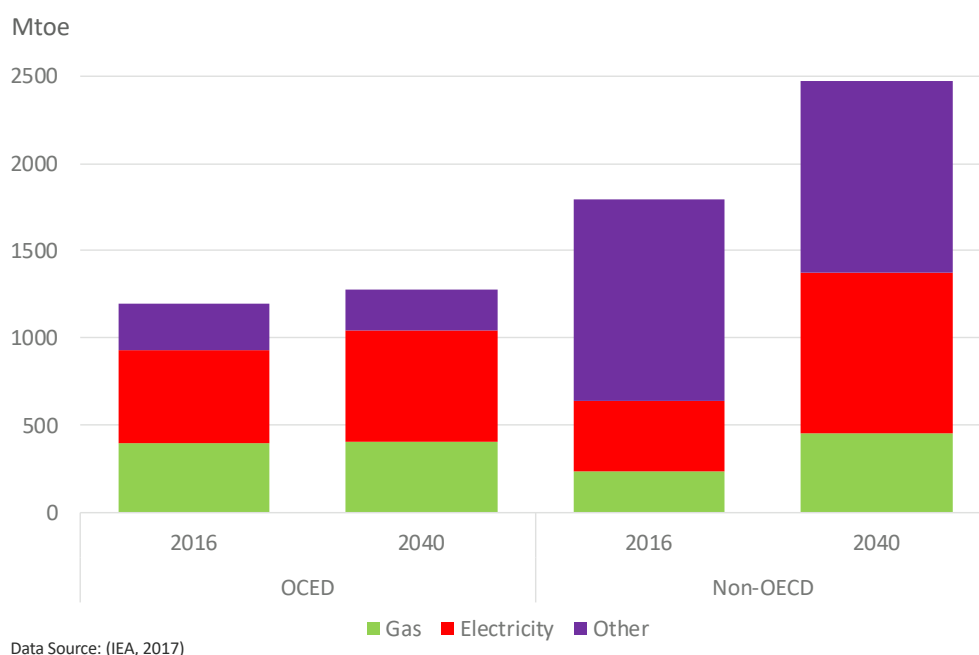


1.6 GAS DEMAND FROM THE BUILDING SECTOR

Energy consumed in the building sector consists of residential and commercial end users and accounts for 22 percent of the total delivered energy consumed worldwide. In its 2016 International Energy Outlook the IEA forecasted energy consumption in buildings to increase by an average of 1.5 percent per year until 2040, while the IEA projects a much more modest increase of 0.9 percent per year until 2040. In both forecasts though, the increase in energy consumption in the non-OECD region is significantly larger than in the OECD region, with population growth, rapid urbanisation and lifestyle changes in the developing world driving up demand for energy.

The direct use of gas increases from 21 percent of total energy consumption in the building sector in 2016 to 23 percent in 2040. Electricity becomes a more important energy source in the future with its share of total building energy consumption rising from 31 percent in 2016 to over 40 percent by 2040. Industry sources ascribe this faster growth in electricity demand to an increase in demand for space cooling, lighting and electrical appliances. Rising consumption of electricity for space cooling is projected to dominate growth due to growth in energy consumption in the building sector, mostly from the non-OECD region (see Figure 10).

Figure 10: Gas demand in buildings grows slowly
The EIA and IEA project 1.5 % and 0.9% yearly growth to 2040 respectively



2. THE ENVIRONMENTAL CASE FOR NATURAL GAS

The growth in gas consumption outside gas producing countries is increasingly motivated by the environmental benefits of using natural gas compared to other fossil fuels. Key gas importing countries such as China and India have aggressively promoted the use of natural gas using mandates and subsidies to improve local air quality. The success of these initiatives illustrates the kind of policy support necessary to promote gas in the global energy mix.

2.1 REDUCING RELIANCE ON COAL IN CHINA

In the early part of this decade, urban air pollution became an increasingly urgent issue in China. Poor air quality was blamed on the rising use of coal and rapid growth in industry, especially in eastern and central China. The Global Burden of Disease Study estimated that air pollution led to 1.2 million premature deaths in China in 2010 alone. In response, the Chinese government launched the Action Plan for Air Pollution Prevention and Control in 2013, providing a “roadmap at provincial level for efforts to improve air quality over the period 2013-2017” in three regions: the Beijing-Tianjin-Hebei area, the Yangtze River Delta and the Pearl River Delta. In the subsequent 13th Five-Year Plan for Ecological and Environmental Protection (2016-2020) issued in 2016, the scope increased to over 300 large cities with the stated objective to reduce incidences of poor air quality to “20% of the time” by 2020.

A large part of China’s efforts to improve air quality has focused on moving away from coal and diversifying its energy mix further. Natural gas has been a beneficiary of this policy drive, and its share in the energy mix more than doubled from 2006 to 2017, reaching 6.6 percent. The country has a target of 10 percent of gas in the energy mix by 2020 and 15 percent by 2030. As a result, the use of natural gas has increased among all sectors in China, with power generation and buildings accounting for a large part of the increase. To meet this additional demand, China has augmented its gas import infrastructure by building pipelines and LNG regasification terminals, linking the country with new sources of gas. Starting from its first terminal in 2006, China now has 20 LNG regasification terminals with a total capacity of over 90 billion cubic meters per year (bcm/y). Similarly, pipeline trade which

began in 2010 with the first line of the Central Asia Gas Pipeline, today has four pipelines in operation with an overall capacity of nearly 70 bcm/y. The Power of Siberia pipeline from Russia is expected to add another 60 bcm/y to pipeline import capacity by the end of this decade, even as the contracted quantity is currently 38 bcm/year, according to industry reports.

Continuing the policy support for natural gas, the National Development and Reform Commission in July 2017 published a report titled “Opinion of Accelerating and Advancing the Utilization of Natural Gas.” This report furthered the theme of increasing access to imported gas by encouraging private companies to participate in LNG procurement and in developing LNG regasification terminals. On the demand side, there is greater emphasis on increasing the use of gas for residential heating in northern China by increasing household connectivity to the gas grid, moving industrial boilers from coal to gas, increasing the use of gas in specific industries such as glass and textiles, and speeding up the development of a gas-based transport fleet, among other measures. Recognizing China’s focus on increasing gas use in its energy mix, the IEA forecasts that gas will be the fastest growing fossil fuel in China with growth of between 4.3-4.7 percent per year until 2040.

2.2 MITIGATING URBAN AIR POLLUTION IN INDIA

The birth of the natural gas revolution in New Delhi lies in regulatory and judicial mandates. A small and voluntary compressed natural gas (CNG) program started in Delhi during the early 1990s when the Hazira-Vijaipur-Jagdishpur (HVJ) Gas Pipeline was extended to Delhi to supply industrial users in the region. The major push though came about in 1998 when the Supreme Court, in response to public interest litigation on air pollution, issued a series of directives invoking the constitutional principles of ‘right to life’ and precautionary principles for public health protection. A multi-stakeholder body, the Environment Pollution (Prevention and Control) Authority, was created to advise the court on pollution control measures and also monitor implementation of the court orders. The Authority, based on recommendations from the city government amongst others, recommended an expansion of the city bus fleet along with the proviso that the entire public transport fleet in New Delhi be converted to CNG or any similarly clean fuel. In addition, taxis and other intermediate public transport vehicles were also mandated to convert to CNG. This directive, in conjunction with another directive to expand New Delhi’s CNG supply network, resulted in the entire city’s public transport fleet running on CNG by the mid-2000s. Today Delhi has about 450,000 CNG vehicles and over 400 CNG filling stations.

The impact on the improvement in air quality in New Delhi since has been notable. The Central Pollution Control Board reported that after the implementation of the CNG program, the particulate levels dropped by about 24 percent from 1996 levels. Subsequently, this program has been extended to other polluted cities in the country with the Supreme Court directing that “The Union of India will give priority to the transport sector including private vehicles all over India with regard to the allocation of CNG.”

3. CONCLUSIONS

Global energy consumption is set to increase even as growth rates may slow. While the centres of global energy demand shift from OECD to non-OECD countries, regional gas market trends show important new dynamics between the three major gas market centres of Asia, Europe and North America. While Asian gas supply and demand balances, North American gas markets show net gas export volumes building, and European gas import dependencies grow. Since the environmental benefits of natural gas have already made a significant impact on emission reductions in the U.S. as a consequence of the shale gas revolution, they stand to make an even bigger contribution to the achievement of clean air and global greenhouse gas emission reduction goals in non-OECD growth economies.

Global shifts and policy demands mean that natural gas will remain the fastest growing fossil fuel, with its share in the global energy mix set to overtake coal in the medium-term, closing the gap with oil by 2040. This rapid growth in global gas consumption can be traced back to continued industrialisation in the non-OECD countries, with rising population and GDP in the developing world generating the vast majority of the growth in gas consumption. In fact, the non-OECD world has accounted for over half of the global gas consumption since 2006 and will continue to increase its share.

The pattern of growth in gas demand is set to change. Though in the past the larger gas consumption growth increments came from the power sector, competition from coal and the increasing cost competitiveness of renewables mean that future drivers for gas consumption are shifting to other sectors, in particular industry and transport. The environmental advantages of gas compared to other fossil fuels and the consequent role of policy support become increasingly important. Successful gas market advances in China and India provide good examples of the importance of anchoring future gas demand to long-term policies focused on environmental and health standards to achieve clean air, greenhouse gas emission reduction, and energy access goals. These gas market advances show that long-term government support anchored in environmental and health standards enables the gas industry to deliver on its promise of the ‘golden age of gas.’ The share of gas by then may well exceed 25 percent of total energy demand, resulting in a more secure and sustainable world energy market.