World Energy Perspectives | 2017

THE ROLE OF NATURAL GAS

EXECUTIVE SUMMARY

WORLD ENERGY COUNCIL

AN INITIAL FOCUS ON THE FUTURE OF GAS IN THE GRAND ENERGY TRANSITION DERIVED FROM THE 2016 WORLD ENERGY SCENARIOS

During the World Energy Congress in Istanbul in October 2016, the World Energy Council (the Council) presented three scenarios, developed in collaboration with Accenture Strategy and the Paul Scherrer Institute. In 2017, and with the support of the Global Gas Centre (GGC), the Council elected to analyse in greater detail, the place of gas in the three scenarios, identifying the central uncertainties affecting the role of gas and specifying the challenges facing the gas industry.

KEY FINDINGS

1 **GAS IS EXPECTED TO** provide a cleaner bridge to a renewable energy future: it is the only fossil energy source which is projected to grow to 2050 during The Grand Transition – a period when demand for either coal and oil will peak. However, the long-term future for gas is less secure: there needs to be further investment and innovation to ensure that natural gas holds an essential place in the global energy mix to 2060, but beware of stranded resources with the trend to carbon pricing.

2 **OVER THE COMING DECADES,** the pattern of demand and pace of growth will reflect significant diversity in regional market dynamics with peak demand in some regions and continued growth in some others. The geographical centre of the global gas market will shift to Asia, where demand is expected to grow rapidly, providing new national policy frameworks and policy reforms are forthcoming and successfully implemented in key countries, such as China and India. Meanwhile, demand growth in Europe and North America is expected to stagnate or even decrease.

3 **IN THE NEAR-MEDIUM TERM** the role of gas will be closely linked with developments in the power. Global electricity demand is expected to double by 2060 and the power sector offers the highest growth potential for natural gas. An increasing market share in power generation will be the main driver of gas demand growth in the medium term but gas faces tough competition from other energy sources, notable renewables, and the scope for growth will depend on key policy decisions by governments and regulators and presents highest uncertainty.

4 **THERE IS SIGNIFICANT DOWNSIDE** risk for gas if it doesn't succeed to innovate and develop new technologies making it "cleaner" and increasingly "renewable". All of the Council's scenarios fail to secure global warming below 2 degrees and further moves to reduce the use of fossil fuels in the energy mix would impact gas. The share of gas in power generation would especially be at risk in the absence of commercially viable Carbon Capture and Storage (CCS) and the economic viability of new technologies like biogas or Power to Gas is a challenge for gas evolving towards a renewable energy source.

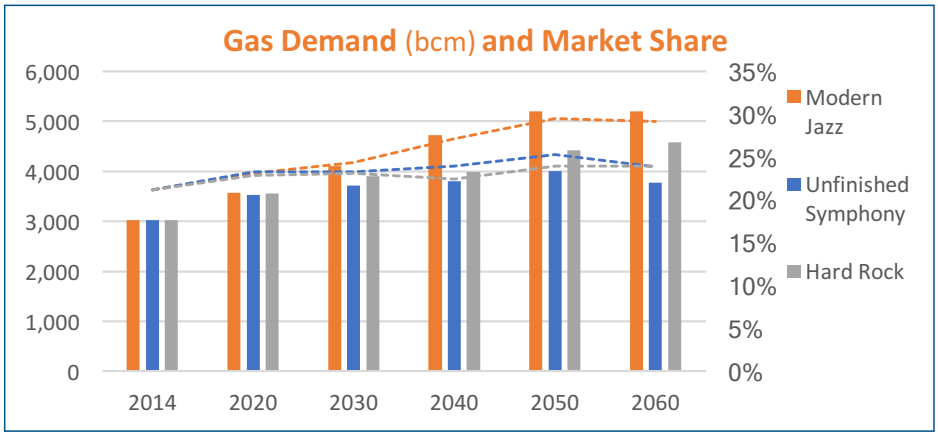
THE FUTURE OF GAS IN THE GRAND ENERGY TRANSITION

A BRIDGE TO A LOW-CARBON ECONOMY...

In the face of an anticipated peak of energy demand growth, a move towards renewable energies and the possible emergence of disruptive technologies, fossil fuels face a perfect storm over the next thirty years. Of the three main hydrocarbon fuels - oil, gas and coal, only gas faces a moderately secure future though there are clear risks on the horizon. All of the Council's scenarios see global gas demand growing while retaining a share between 25% and 30% of global energy mix.

Thanks to large reserves, gas supplies are likely to be plentiful in the medium to long term making the cleanest of hydrocarbons a good bridge to a low-carbon future. However, the pressure for continued de-carbonization of energy supplies means that this relatively clean fuel is likely to come under demand-side pressure.

Much will depend on the way the world evolves in terms of policy and societal change. The value of the Council's scenarios is that they show a range of possible outcomes.



In the market-driven world represented by Modern Jazz, gas is supported by strong economic growth in a globalised economy, increasing awareness of environmental issues and an active private sector. It is abundant and accessible and, as a result, by 2050 is the world's the main primary energy source. Gas demand grows by more than 70% between 2014 and 2050 and then reaches a plateau over the last decade of the period.

If, by contrast, the world becomes more focused on decarbonisation with the backing of appropriate government policies as represented by Unfinished Symphony, then gas has in the medium term a continued role as a major contributor to the decarbonisation of the electricity sector through coal substitution but, in the longer term, it is progressively replaced by renewables, starting with mature markets.

Mixed signals are given in a free-for-all world represented by Hard Rock: gas development is supported by weak environmental concerns but it is hampered by a fragmented market and a continued key role for coal, of which there are plentiful and cheap global supplies.

Modern Jazz
The first primary energy

- Market forces drive high economic growth in a competitive globalised world shaped by market mechanisms.
- Awareness of environmental issues increases
- Gas seen as low-cost cleaner fuel for power generation and transport.
- Rapid deployment of RES
- **High growth** (+70%) to 2050
- 5,000 bcm in 2050
- Flat after 2050

Unfinished Symphony
The bridging fuel

- Societal consensus on climate change leads to effective Govt policy on Energy
- Moderate economic growth, rising energy efficiency, more stringent emissions standards and rapid deployment of renewables dampen growth for gas
- **Low growth** (+25%) to 2050
- 4,000 bcm in 2050
- Peak around 2050

Hard Rock
A major player

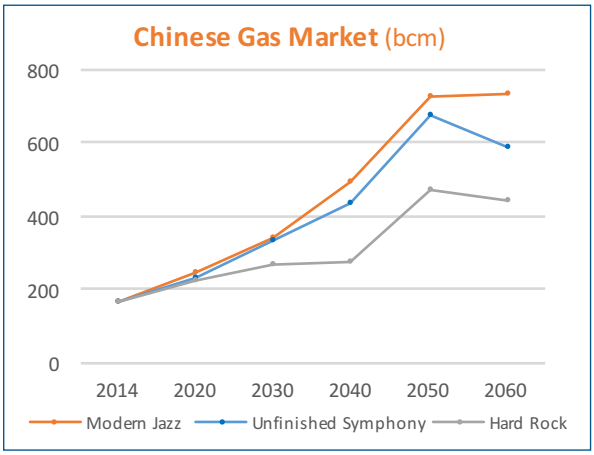
- Promotion of national agendas result in low focus on climate change and a fragmented market
- Energy shows high dependence on fossil fuels but gas growth is dampened by coal remaining in the mix
- **Moderate growth** (+50%) to 2050
- 4,400 bcm in 2050
- Continues to grow

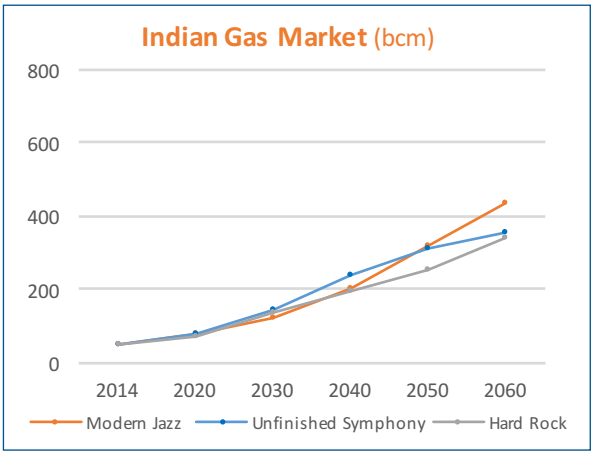
...BOOSTED BY CONTINUED DEMAND FROM ASIA.

Gas is set to be an important and growing element of the energy mix in Asia but, again, varies according to the scenario. In Modern Jazz, from 2014 to 2030 Asia accounts for half of demand growth. This trend increases beyond 2030, with China and India accounting for more than 50% of growth in gas consumption. Their combined primary gas demand totals over 1,15O bcm in 2060.

In Unfinished Symphony, Asia represents 25% of demand growth in the years to 2030, with India and China providing particularly strong demand growth beyond 2030 when an anticipated decline in gas use in the United States and Europe is partially offset by these two Asian countries. Demand for gas in India grows as it seeks to displace coal in power generation.

Under Hard Rock natural gas faces contrasting pressures. The emphasis on security leads to a steep decline in energy trade, resulting in a substantial fall in liquidity and transparency in global markets. Thus, energy commodity prices become increasingly volatile and pricing at regional hubs sees widening differentials. Its growth averages 1.6% p.a. in the years to 2030, led by North America and Europe. Beyond 2030, gas growth slows substantially in Europe while North America sees a slight decline. However, China, India, Middle East and North Africa and Latin America continue to see significant growth in natural gas demand to 2060.





IT'S ALL ABOUT ELECTRICITY...

Global electricity demand could double by 2060 and the future of gas hinges on its ability to grab market share in this rapidly expanding sector. But gas demand in generation is very uncertain and dramatically varies across the scenarios. In 2014, 22% of the world's electricity was produced by natural gas. By 2060, this could decrease to 17% in Unfinished Symphony or increase to 26% in Hard Rock and 32% in Modern Jazz.

In a Modern Jazz world with improved quality of life, increasing technology, and rapid economic growth, lifestyles demand more electricity. Growth in demand for electricity averages 1.9% p.a. to 2030. New generation is dominated by natural gas and wind and solar. Beyond 2030, demand for electricity continues to climb but more slowly. By 2060, electricity generation will have doubled since 2014.

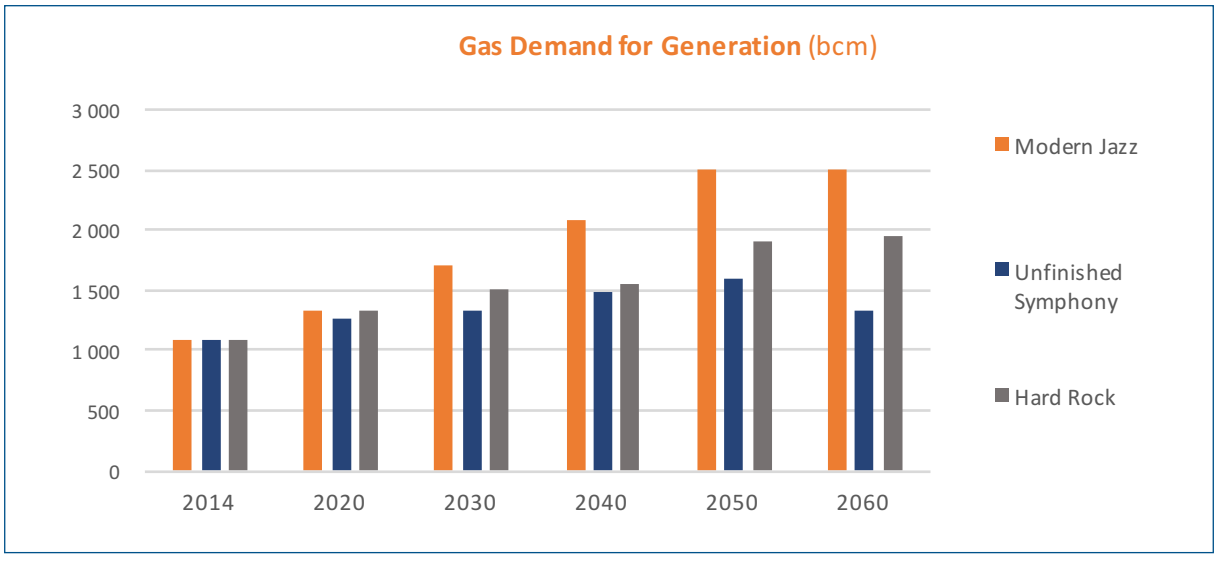
In this scenario, consumers increasingly see natural gas as a low-cost and cleaner source of power. In resource-rich regions, natural gas increasingly takes share from coal and fuel oil in power generation and as a feedstock for chemicals. Natural gas accounts for 50% of generation growth to 2050 by massively substituting coal. During the period, the production of electricity from gas triples but is very rapidly caught by wind and solar. The position of gas in electricity production, however, remains highly dependent on the deployment of Carbon Capture and Sequestration (CCS) beyond 2040. "Gas with CCS" represents nearly one third of the electricity production from gas in 2060.

In a more policy-driven economy represented by Unfinished Symphony, there is likely to be a much greater emphasis on energy efficiency and lower economic growth. Growth in electricity demand is fuelled largely by new wind and solar capacity, which encompass by 2030 53% of generation growth. Beyond 2030, demand for electricity slows to 1.2% p.a. and by 2060, electricity generation has grown 1.9 times since 2014. More than 39% of electricity generation comes from wind and solar power plants.

Between 2014 and 2050 natural gas benefits from the increase in electricity production and maintains its share of a little over 20%: electricity production from gas increases by more than 70% essentially through coal substitution. However, the longer-term picture is not so rosy; it begins a sharp decline at the end of the period to the benefit of renewables whose electricity production represents 2.3 times that of gas by 2060. At that time gas accounts for only 17% of electricity generation.

While coal has almost disappeared in electricity generation after 2050, the increasing use of CCS foster growth in gas-powered generation. The role of gas as a key fuel in the power sector is contingent on the ability of the electricity and gas sectors to develop and deploy massively high-performance and cost-effective CCS technologies.

Compared to Modern Jazz the future for gas is less promising in electricity generation if markets find themselves in a world that is fractured with inward-looking countries and geopolitical tension. The Council's Hard Rock scenario suggests that slower economic growth will limit electricity demand growth to a steady 1.6% p.a. to 2030 and 1.3% p.a. beyond. By then, the electrification of final energy consumption has reached 25%, with only 20% of electricity coming from wind and solar. Despite coal remains a major energy source in this scenario and dampens gas growth, gas demand for electricity almost doubles between 2014 and 2060.



...BUT GAS FACES MAJOR UNCERTAINTIES: THERE ARE DOWNSIDE RISKS BUT ALSO OPPORTUNITIES.

The Council's three scenarios show that globally gas is bound to grow at least until the middle of this century but in no scenario does the world manage to limit global warming to below 2°C from pre-industrial times. A global concerted effort to reduce carbon emissions poses a risk for the future of gas. Even though it has lower emissions that oil or coal, gas could be the most vulnerable as it is easier to substitute than oil and lacks the political backing enjoyed by coal in key markets. Some gas producers – in particular, those exposed to high cost resources, - could find that their resources are stranded.

The future uptake – or not - of CCS is also a major risk. It is a key enabling technology in two of the Council's scenarios (Modern Jazz and Unfinished Symphony) but in reality is so far failing to take off. Energy leaders surveyed in the Council's annual World Issues Survey, place an increasingly lower emphasis on the technology. Yet, in Unfinished Symphony, power generated by CCGT with CCS represents 89% of total power generated by gas.

Even though it has lower emissions that oil and coal, natural gas is still a fossil fuel that emits greenhouse gases. However, emerging innovative technologies could give the possibility to position itself as a renewable energy and dramatically change the role of gas in the energy transition. The potential of biogas remains significant but there are technical and economic hurdles. Nevertheless, the experience of Germany with nearly 2,000 projects and 6 TWh production shows that biogas cannot be written off.

The role of gas in the transport sector is also questionable. Decarbonisation of the transport sector is one of the most challenging elements of energy transition. The contribution of gas to this process is limited to heavy-duty freight and marine transport, with a potential market share of around 7%-8% of transport fuels by 2060, but at most 300 bcm. CCNG for light vehicles could also have an important role to play in decarbonisation of transport provided the economic and regulatory environment is favourable. In the European Union's the "Clean Power for Transport" package, which established natural gas and bio methane as part of the European Union mix of alternative fuels, lays the foundation for a significant development of CNG and LNG in road and maritime transport, which could give gas a market share substantially above the one predicted in the three scenarios.

THE COUNCIL'S THREE SCENARIOS

For its 2016 report, the Council developed three scenarios as a tool to provide an insight into possible alternative futures in the years to 2060: Modern Jazz, Unfinished Symphony, and Hard Rock. Modern Jazz represents a 'digitally disrupted', innovative, and market-driven world while Unfinished Symphony is a world in which more 'intelligent' and sustainable economic growth models emerge as the world drives to a low carbon future. The Council has also introduced an emerging and more fragmented scenario called Hard Rock, which explores the consequences of weaker and unsustainable economic growth with inward-looking policies.

Many lessons can be learned from the Modern Jazz, Unfinished Symphony and Hard Rock scenarios. Each of these scenarios contributes to the debate on how environmental goals, energy security, and energy equity can best be achieved considering a broad range of industry and policy structures.

All three scenarios are based on some pre-determined elements. The global population will grow substantially more slowly in the next 45 years - rising by around 40% - leading to slower growth in the labour force. Technology will continue to evolve at a rapid pace and will reshape economic and social options. The world will become increasingly multi-polar as Asia increases its weight in the global economy and world politics and a large urbanised middle class will continue to grow in all regions. Global and national agendas will continue to focus on environmental danger zones such as climate change, pollution, biodiversity, deforestation and the availability of water.

THE GRAND ENERGY TRANSITION

The Council's 2016 World Energy Scenarios report highlights that a major transformation in the global energy system is underway that will radically change the global energy mix in the years to 2060. It predicts per capita energy demand will peak before 2030, in stark contrast to historic growth levels, which have seen global demand for energy more than double since 1970. Technological innovation, government policies and lower growth expectations will have a significant impact on the sector in the coming decades. The report goes on to highlight that there will be a shift in final energy consumption with demand for electricity doubling by 2060. Solar and wind, which currently account for approximately four percent of power generation, will see the largest increase so that by 2060 they will represent between 20 percent and 39 percent of power generation.

Fossil fuel usage could fall to as little as 50 percent of the primary energy mix in one of the scenarios, with very differing futures for coal, oil and natural gas. However, in all three scenarios the carbon budget is also likely to be broken within the next 30 to 40 years. Oil will continue to play a significant role in the transportation sector representing over 60 percent of the mix in all three scenarios to 2060 and natural gas will continue to increase at a steady rate.

ABOUT THIS REPORT

The World Energy Perspectives report on Natural Gas is part of a series of reports based on expert insights from the World Energy Council's network of energy leaders and practitioners. This series provides a bottom-up assessment of the key issues.

This first Natural Gas report, produced in collaboration with the Global Gas Centre (GGC), looks at the long term future where there needs to be further investment and innovation.

WORLD ENERGY COUNCIL

The World Energy Council is the principal impartial network of energy leaders and practitioners promoting an affordable, stable and environmentally sensitive energy system for the greatest benefit of all.

Formed in 1923, the Council is the UN-accredited global energy body, representing the entire energy spectrum, with over 3,000 member organisations in over 90 countries, drawn from governments, private and state corporations, academia, NGOs and energy stakeholders.

We inform global, regional and national energy strategies by hosting high-level events including the World Energy Congress and publishing authoritative studies, and work through our extensive member network to facilitate the world's energy policy dialogue.

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Published by the World Energy Council 2017

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World Energy Council
Registered in England and Wales
No. 4184478

VAT Reg. No. GB 123 3802 48

Registered Office
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London EC3V 3NH
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