IPIECA

Natural gas: Into the future

THE PARIS PUZZLE
Natural Gas

This document is one piece of the Paris Puzzle – a series of papers intended to address what we see as key components of efforts to address climate change, and demonstrate our commitment to meeting the challenge. Find the other pieces at www.ipieca.org

KEY MESSAGES

- Natural gas is the cleanest-burning fossil fuel and is increasingly accessible, affordable, abundant and flexible.
- Natural gas will continue to play a pivotal role in a global shift towards a low-carbon economy.
- There is a significant near-term opportunity to reduce global emissions by fuel-switching from coal to natural gas.

Natural gas, the cleanest-burning fossil fuel, is increasingly accessible, affordable, abundant and flexible. It has a critical role to play in today's and tomorrow's secure and diverse energy mix. In power generation, combined cycle gas turbines (CCGTs) generate around half the greenhouse gas (GHG) emissions of coal-fired power stations, at the generation plant[1]. They also have a significantly lower impact on air quality and emit much less nitrogen oxide (NOx) and sulphur dioxide (SO_2).

Natural gas production has been expanding globally as a result of a number of factors. Significantly increased resource estimates, and improvements in production and transport technologies, are allowing it to fill an expanding role in the global energy supply. In some regions, gas prices have also declined due to its increased availability.

Natural gas can play an important role in helping many nations' efforts to decarbonize their energy systems. Taking advantage of the flexibility offered by liquefied natural gas (LNG), China is importing increasingly larger volumes for domestic use. Between 2011 and 2014, China's consumption of LNG increased 56% from 12.8mtpa to 20mtpa[2]. While the increased energy consumption in the processing of LNG increases life-cycle emissions compared to natural gas, a 2015 study by Imperial College London[3,4,5] found that total emissions from LNG, when used to produce electricity, are lower than from coal.

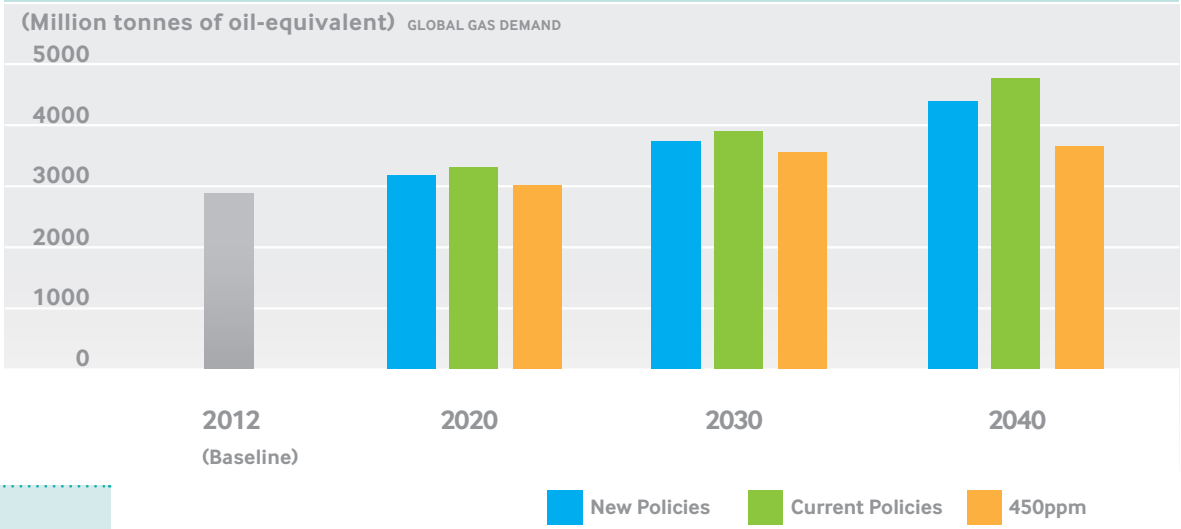
THE BENEFITS OF NATURAL GAS

As we consider what it means to transition to a low-carbon future, natural gas offers an immediate and material opportunity to reduce global emissions through fuel-switching from coal. For example, a study by energy consultancy IHS[6] demonstrated that conversion of all European coal and oil-fired power generation to best-in-class CCGT would reduce European emissions by 58% relative to 1990 levels. In its United States *Clean Power Plan*, the US Environmental Protection Agency (EPA) also acknowledged that raising the capacity of natural gas plants offered one of the best levers for reducing nationwide emissions. According to the EPA, the US federal government is counting on individual states to increase the federal average utilization rate of existing natural gas combined cycle capacity to 70% to displace higher carbon-intensity fossil fuel electricity generation[7].

Footnotes

1. de Gouw, J. A. *et al* (2014) Reduced emissions of CO_2, NOx, and SO_2 from U.S. power plants owing to switch from coal to natural gas with combined cycle technology. Earth's Future, 2: 75–82. doi:10.1002/2013EF000196.
2. Interpretation of IHS-Waterborne data (Feb 2015).
3. Korre, A. Nie, Z. and Durucan, S. (2012) Life cycle assessment of the natural gas supply chain and power generation options with CO_2 capture and storage: Assessment of Qatar natural gas production, LNG transport and power generation in the UK. *Sustainable Technologies, Systems & Policies*. 11.
4. Nie, Z. Korre, A. and Durucan, S. (2014) Life cycle modelling of alternative gas-fuelled power plants with CO_2 capture and storage. *Computer Aided Chemical Engineering*. 33, 985-990.
5. Nie, Z. Korre, A. and Durucan, S. (2013) Full chain analysis and comparison of gas-fired power plants with CO_2 capture and storage with clean coal alternatives. *Energy Procedia*. 37, 2840-2847.
6. IHS CERA European Power Balances.
7. EPA (2014) *Fact Sheet: Clean Power Plan Framework*. [Online] Available at: http://1.usa.gov/1FAVzjt

GLOBAL GAS DEMAND UNDER IEA SCENARIOS (WEO, 2014)



NATURAL GAS IN TRANSPORTATION

As it becomes more widely adopted as a marine fuel, natural gas is playing a more prominent role in powering transportation. For example, in 2014, BC Ferries, the government-owned ferry service in British Columbia, Canada, announced it would convert two of its largest vessels to operate on natural gas and purchase three new vessels with the same capacity to be ready for 2016/2017. For BC Ferries, this represents a reduction in operating expenses of $9.2M/year and reductions in carbon, nitrogen oxide and sulphur oxide emissions by approximately 25%, 85% and 100% respectively[12].

In the 2014 World Energy Outlook by the International Energy Agency (IEA), even under the most ambitious low-carbon policy scenario, *450ppm*[8], which sees the world on an energy pathway consistent with limiting global temperature rise to 2°C, natural gas demand continues to increase until at least 2040.

The maturity and reliability of natural gas technology also makes it a dependable base load fuel that has the flexibility to support peak-demand response, which is needed due to the intermittency of some renewable energy sources. Although battery and storage technologies continue to improve, the variability of renewable power output remains a barrier to uptake. Natural gas provides a complementary, inexpensive, responsive and low-carbon bedrock for electricity provision.

CHALLENGES

Despite its many virtues, natural gas does face some potential challenges – the most relevant to climate change being the impact of methane emissions. Understanding of methane emissions is advancing through independent academic research[9]. A study published early in 2015 in the journal *Environmental Science and Technology* found that less than 1% of the methane that passes through natural gas gathering and processing facilities in the US is emitted, but roughly one-third of gathering facilities account for 80% of methane emissions[10]. These data indicate significant methane emissions from a facility is not typical, but is isolated and likely attributed to a relatively small group of equipment components. In 2014, the University of Texas published a two-part study offering the most complete information in 20 years on methane emissions associated with unconventional natural gas extraction in the US. Through direct measurement, the study found that 20% of natural gas production sites accounted for more than 80% of measured emissions[11].

The oil and gas industry is managing fugitive methane emissions along the natural gas value chain and addressing methane emissions remains a key priority. Companies are taking independent action to mitigate emissions, as well as participating in collaborative initiatives and voluntary industry groups, including the Global Methane Initiative, the Climate and Clean Air Coalition Oil and Gas Methane Partnership, the Methane Detectors Challenge and the newly founded Oil & Gas Climate Initiative.

With ongoing management of emissions, natural gas will continue to play a pivotal role as a dependable lower carbon fuel in the transition to a low-carbon energy future.

Footnotes

[8] IEA (2014) 450 *Scenario: Method and Policy Framework*. [Online] Available at: http://bit.ly/1GKfcac

[9] See IPIECA's Methane Factsheet for more information.

[10] Mitchell, A. L. (2015) Measurements of methane emissions from natural gas gathering facilities and processing plants: Measurement results. *Environ. Sci. Technol. Lett.* 49(5), 3219-3227.

[11] Allen, D.T. et al (2013) Measurements of methane emissions at natural gas production sites in the United States. *Proc Natl Acad Sci USA*. 110(44), 17768–17773.

[12] BC Ferries (2014) *Commissioner approves plans to convert spirit class vessels to LNG to realize major savings*. [Online] Available at http://bit.ly/1DlXQLM

IPIECA is the global oil and gas industry association for environmental and social issues. It develops, shares and promotes good practices and knowledge to help the industry improve its environmental and social performance.

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