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Will Natural Gas Demand Soar as Emissions Reduction Intensifies?

In December 2015, nearly 200 countries signed the Paris agreement to limit the global temperature increase to well below 2°C higher than preindustrial levels, by 2100. Already, 170 developed and developing countries committed to intended nationally determined contributions (INDCs) to substantially reduce their greenhouse-gas emissions. Yet these initial commitments are likely to fall short. Indeed, emissions of carbon-dioxide equivalent would have to fall by an additional 11 to 13 gigatons by 2025 for the emissions level to be consistent with meeting the 2°C objective.

How might greater emphasis on emissions reduction affect demand for natural gas—a relatively clean-burning fuel that is more economical than other fossil fuels in many sectors? Natural gas is projected to see the strongest increase in demand among fossil fuels over the next decade, with global demand rising by 1.5% annually, versus 0.3% for coal.

But that estimate might be conservative if nations and industries adopt natural gas more aggressively to meet their emissions commitments. Looking at the role natural gas can play in the power generation, industry, and transportation sectors enables us to gauge the prospects for emissions-related demand growth over the next decade.

Power Generation

The burning of fossil fuels to produce electricity and heat is the single largest source of global greenhouse-gas emissions, accounting for more than 40% of emissions from fuel combustion. Gas currently represents 33% of total fossil-fuel consumption in the power generation sector, while coal and oil products represent 60% and 7%, respectively.

Consequently, most of the INDCs include initiatives aimed at expanding renewable power generation capacity: together, wind and solar technologies are expected to account for more than 50% of the anticipated global increase in total generation capacity between 2016 and 2025.

Increased reliance on natural gas represents another way to cut power-generation-related emissions. Natural gas emits roughly half the CO_2 for the same amount of energy than coal, and produces less sulfur dioxide, nitrogen oxides, and particulate matter.

Gas-fired generation also has substantial operational and cost advantages over renewable generation. Unlike most renewable sources, combined-cycle gas turbine plants (CCGTs) are a programmable technology, resulting in cost advantages for power systems.

Despite rapidly falling prices for many renewables, natural gas generally remains less expensive. According to the US Energy Information Administration (EIA), the levelized cost of energy for advanced CCGTs in the US is $57.30 per megawatt hour, compared with $242.00 for solar thermal generation and $85.00 for solar photovoltaic generation[1].

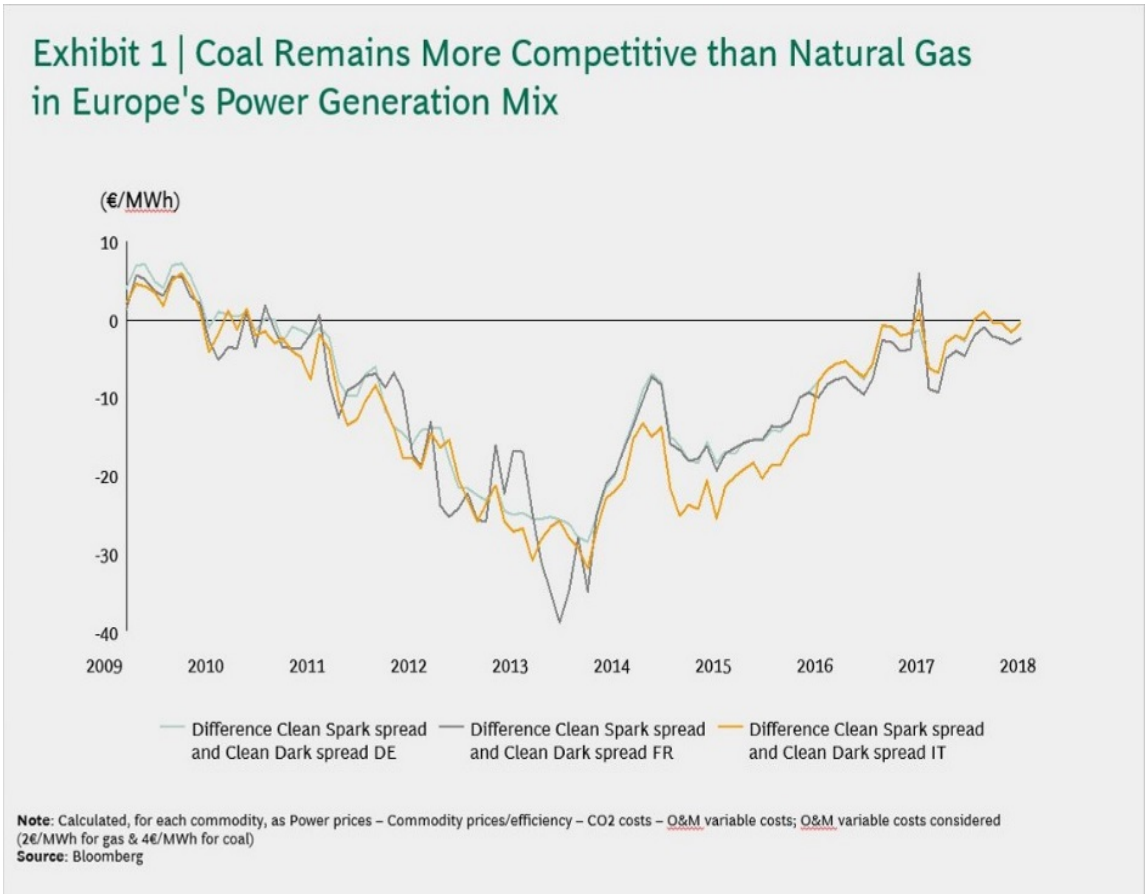
Whether natural gas assumes a larger role in reducing power-generation emissions may hinge on the economics of gas versus coal in different regions.

- United States. The substitution of natural gas for coal in power generation is increasing in the US, driven largely by low natural-gas prices resulting from the shale-gas boom. In 2016, natural gas surpassed coal in the mix of fuels used for US power generation, with natural gas accounting for 34% versus 31% for coal.

- European Union. Due to excess installed generation capacity, natural gas and coal compete largely on the basis of marginal costs. Natural gas's recent loss of competitiveness versus coal is shown by changes in the relative economic advantage of the *clean spark spread* (the difference between the sale price obtained by a gas-fired plant for its electricity and the plant's marginal cost of production, including the cost of CO_2 emissions certificates) versus the *clean dark spread* (the difference between the sale price obtained for the same amount of electricity produced by a coal-fired plant and that plant's marginal cost of production, including the cost of CO_2 emissions certificates). A positive value indicates that gas-fired plants are more economically efficient than coal-fired facilities; a negative value indicates the opposite. (See Exhibit 1.)
  As the exhibit shows, the clean spark spread's advantage went from positive in 2010 to negative in 2011, as coal became more competitive than natural gas due to worldwide coal oversupply. In Europe today, coal still holds an advantage over natural gas on this measure, but much more limited than in the past. The future evolution of gas and coal in Europe will depend on the price of natural gas relative to coal, the cost of carbon emissions and the

[1] Without Tax credits

evolution of the regulation (policies may change the relative competitiveness of the respective technologies).



- Developing Countries. Significant opportunities exist to increase the substitution of natural gas for coal in power generation in developing markets, where natural gas competes with coal to satisfy demand for more capacity. Many countries where coal is more competitive than natural gas have opted to build coal-fired plants. Reliance on coal for power generation is causing policymakers to take action to curb health and environmental problems. China's current 13th Five Year Plan (2016-2020) includes a cap to energy consumption at 5 billion tons of coal equivalent by 2020.

  If non-OECD countries aggressively adopted natural gas so as to reach the same fossil-fuel generation mix as that of OECD countries today, global greenhouse-gas emissions over the next decade would be reduced by 1 gigaton per annum and natural-gas demand would rise by about 400 bcma (billion cubic meters per annum). Furthermore, if countries worldwide were to collectively substitute natural gas for 100% of their current coal use in power generation, global emissions would fall by approximately 5 gigatons of CO_2 equivalent, a reduction equal to about 10% of current emissions.

The flexibility that natural gas brings to an energy systems also makes gas a good fit for the development of renewable energies like wind or solar in the near term. And in the long term gas is even more relevant considering that renewable energy deployment will take time and that cost effective zero carbon options can be harder to find in certain parts of energy systems.

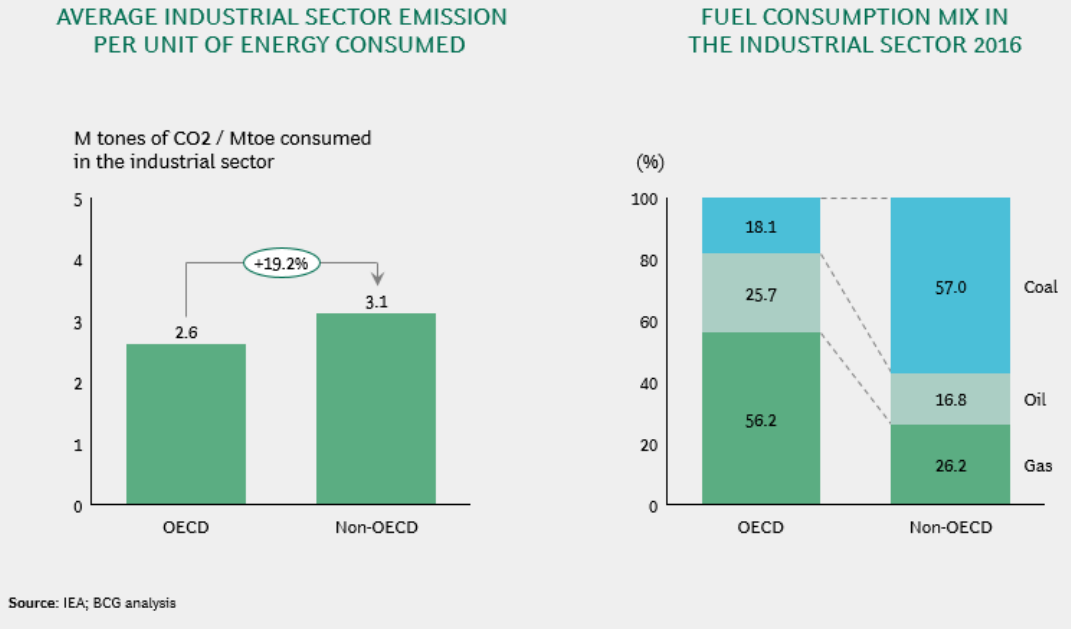
Industry

Industrial sector emissions, mainly from industrial boilers, represent about 18% of total global greenhouse-gas emissions. Natural gas represents about 34% of the fossil fuels consumed by the sector globally; coal and oil represent about 47% and 19%, respectively.

Increased substitution of natural gas could meaningfully reduce global emissions. Already, natural gas accounts for about 60% of fossil-fuel consumption in OECD countries due to tightening environmental standards.

But in the developing world's industrial sector, there is greater scope for substitution of natural gas (See Exhibit 2.) In non-OECD countries, coal accounts for almost 60% of fossil-fuel consumption.

Exhibit 2 | Average emission rate and fuel consumption mix in the industrial sector: OECD vs. non-OECD countries



Source: IEA; BCG analysis

The average industrial-sector rate of emissions per unit of energy consumed is about 20% greater in non-OECD countries than in the OECD, mainly due to coal. Policymakers in some of these countries are already taking action to reduce their reliance on coal.

If the industrial sector in non-OECD countries were to match the performance of OECD countries on this metric, the countries' emissions would decline by 1 gigaton of CO_2 equivalent, more than 2% of current global emissions.

Transportation

Transportation sector emissions represent more than 15% of global greenhouse gas emissions. Currently, oil products account for more than 90% of the energy that the sector consumes, with natural gas accounting for less than 4%.

There is a strong environmental argument for substitution in the road transportation subsector, especially with large commercial and freight vehicles. But economic and logistical constraints limit the potential substitution of natural gas. According to the Center for Climate and Energy Solutions, replacing diesel fuel with natural gas could reduce fuel life-cycle greenhouse-gas emissions from heavy-duty vehicles by up to 29%.

The switch requires a substantial initial investment, however: natural-gas-fueled trucks currently cost 35% to 40% more than traditional diesel-fueled alternatives. And consumers must rely on lower relative fuel costs to recover their investment.

In addition, the annual cost saving of using natural gas instead of oil has diminished significantly due to the drop in oil prices. According to the International Energy Agency, the payback period in the US for long-haul trucks fueled by liquefied natural gas (LNG) is currently more than five years, versus three years in 2014.

Similarly, the economics of LNG vs. oil alternatives, in the marine transportation subsector, to comply with IMO's MARPOL regulations is still very tight.

An upturn in natural-gas adoption in the transportation sector will depend on a further decrease in gas prices relative to oil or on policy changes altering the relative competitiveness of these technologies. It would also require substantial infrastructure investment to ensure adequate supply. It should be noted that several efforts are already underway. For example in Europe, a substantial increase in the number of LNG refuelling stations is expected.

GAS PRODUCTION AND EMISSIONS REDUCTION

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The Role of Natural Gas in Emissions Reduction: Implications

Natural gas, with its relatively clean environmental footprint and its current economic competitiveness versus other fossil fuels, stands to get a significant boost in deployment in the next decade as countries collectively strive to reach their COP21 targets and as individual nations seek to mitigate the effects of greenhouse gas emissions on their local environments.

The power generation sector and the industrial sector, in particular, have ample scope for increased reliance on natural gas, and the effects of such change on emissions could be large. If non-OECD countries were to reach the same fossil-fuel generation mix in the power generation sector that OECD countries have achieved, and if the industrial sector in non-OECD countries were to match the emissions rates of OECD countries by substituting natural gas for coal, then global energy-related emissions would decline by about 2 gigatons of CO2 equivalent—an amount equal to roughly 20% of the additional emissions reduction that must be reached by 2025 to meet the COP21 objectives, as mentioned above.

Implementing these measures will increase initial natural gas demand forecasts for 2025 from 3,800 bcma to 4,500-5,000 bcma, which is perfectly achievable given the vast amount of natural gas reserves.

The role that natural gas can play in the future of global energy is linked to its ability to help address critical environmental and social challenges. Society has growing concerns about air quality and climate change, while there is also a critical need to expand access to affordable energy sources. Natural gas offers many potential benefits by expanding energy access while displacing more polluting fuels. But while the sustainable development and growth cases for gas are strong, we cannot take these for granted as there are ample misperceptions and misinformation about gas. Gas is not a transition energy, gas is here to stay and will represent a substantial part of our energy mix going forward.

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