DISPLACING COAL

A bigger role for gas in the EU energy mix?

What contributions should coal and gas offer to the EU's energy mix? *Alex Barnes*, from gas pipeline company Nord Stream 2, gives us his view.

For many years now the gas industry has promoted the fuel as an emission-reducing energy source, particularly in power generation. The US has seen its carbon emissions fall as gas has replaced coal, and global gas demand has increased. So why has this not occurred in Europe, and why is gas' role in the future energy mix still important even when renewables seem to have come of age?

A combination of efficient technology in the form of combined cycle gas turbines (CCGTs) and the chemical composition of gas compared to coal means that gas emits less than half the carbon dioxide of coal per unit of power produced. It also emits considerably fewer other pollutants in the form of particulates, nitrogen oxide and sulphur oxide.

Europe has plenty of gas-fired capacity already connected to the grid, but between 2008 and 2015 utilisation of that capacity fell from 50% to 28%, according to statistics from IHS Markit, and the total capacity also declined as companies mothballed or retired CCGTs (see **Figure 1**). By contrast, coal utilisation remained constant; and even though total coal capacity declined a little, coal's share of power generation only declined from 27% to 25%. Gas' share fell from 24% to 14%, says IHS Markit. Clearly something has gone wrong if the most polluting fuel has retained its share of power generation whilst a less polluting fuel has seen its share decline.

Success and failure

So, what might be accounting for the declining share of gas? In short, it is the result of one failed and one successful EU energy policy.

The failed energy policy is the EU Emissions Trading Scheme (EU ETS). There is nothing wrong with the concept of the scheme *per se*, or how it operates on a day-to-day basis, but in the context of creating a price for carbon that is sufficient to incentivise lower emissions behaviour, it has failed. The number of emissions allowances issued has been more than required and this has pushed down the traded carbon price. Even after adding this cost of carbon, coal is more profitable for power generation than gas because the fuel cost is so cheap.

This highlights the importance of the aforementioned successful EU energy policy, namely the liberalisation of EU gas and electricity markets. EU power markets are now driven by competition between generators, which means the wholesale market price is set by the marginal cost generator. As both renewables and nuclear have the lowest marginal costs, coal and gas have to compete for the remaining demand. And in recent years coal has won because it is cheaper.

Only in the UK has gas successfully displaced coal, and this is because the UK has a Carbon Price Floor which 'tops up' the EU ETS carbon price to a predetermined level, currently £18 per tonne of carbon dioxide, compared to an ETS price of less than £7 per tonne. The impact of pricing carbon effectively is clear: coal fell from a 22% share of power generated in the UK in 2015 to 9% in 2016 and 2% in Q2 2017. Gas rose from 29% in 2015 to 42% in 2016 and was at 41% in Q2 2017. Between 2015 and 2016, 43 TWh of electricity was produced by gas rather than coal, and this saved the UK about 25mn tonnes of carbon dioxide or about 5% of its annual emissions.

Despite the UK experience, some critics fear that greater use of gas, and in particular investing in gas infrastructure, would create a 'technology lock-in' which could result in us becoming tied to using gas which, although cleaner than coal, still emits carbon dioxide. In other words, using gas today would stop us from shifting to a low

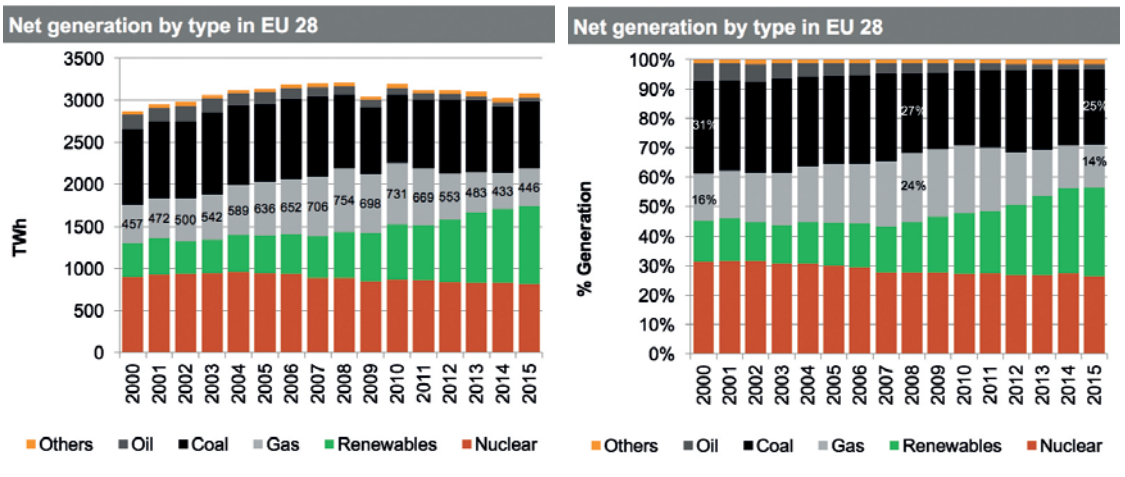

Figure 1. Gas generation dropped by 40% since its 2008 peak, whilst coal still comprises a quarter of Europe's generation

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carbon economy tomorrow.

This is mistaken on two grounds: first, there are distinct benefits from doing as much as we can now to reduce our emissions, and second the idea of a technology lock-in ignores how markets work.

On the first point it is worth remembering that it is the *total* amount of carbon dioxide and other greenhouse gases in the atmosphere that determine the global warming effect. Furthermore, because carbon dioxide stays in the atmosphere for hundreds of years, there is no point having very low emissions in the future if current emissions mean you surpass the atmospheric acceptable total carbon dioxide in the meantime.

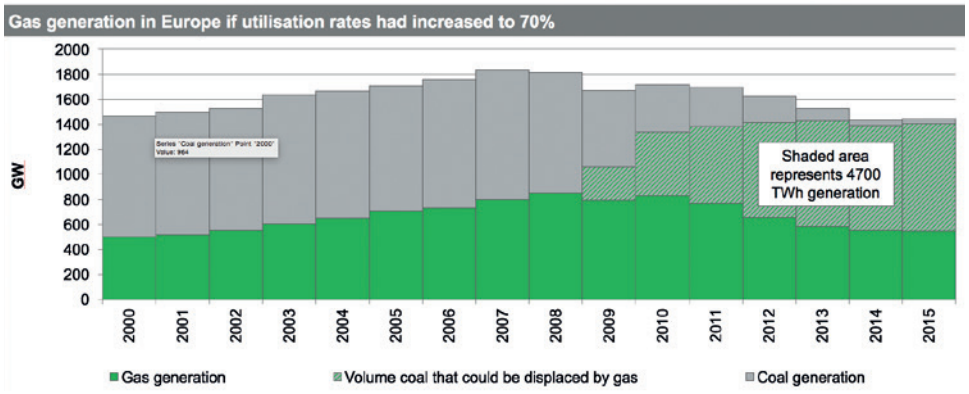

Figure 2. An estimated 4,700 TWh of power could have come from gas rather than coal between 2009 and 2015 in Europe, preventing 2.7bn tonnes of carbon dioxide being emitted

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Budgeting

This is why the Intergovernmental Panel on Climate Change introduced the idea of carbon budgets to show how much time we have left at current emissions rates before we breach our carbon budget. Figures produced by *Carbon Brief* calculate that we have eight years left to have a 50% chance of staying below the 1.5°C target agreed at the Paris Agreement or 27 years to have a 50% chance of staying below a 2°C rise in temperatures.

Given the immense changes still required to switch to low or zero carbon economies, this is not long. For example, although progress is being made, the challenges of storing renewable electricity have not yet been fully overcome, let alone reaching a full commercial roll-out of these new technologies.

It would therefore seem to make sense to do something now which effectively buys us more time, and which can be done relatively easily and at low cost. Greater use of gas in power generation would seem to be an obvious choice. As noted above there is plenty of spare capacity of existing gas-fired plant, given the 28% utilisation rate in 2015. There is plenty of coal that can be replaced given its 25% share of the EU electricity market, too. Not only is the gas-fired capacity already there, but it is by definition already connected to the grid, so unlike either new renewable or nuclear capacity it can make a difference to emissions starting tomorrow.

A simple calculation by IHS Markit shows that increasing the use of gas-fired plant in Europe between 2009 and 2015 could have resulted in an extra 4,700 TWh of electricity being provided by gas rather than coal over that period (see **Figure 2**). Utilisation of gas plant would have been about 70%, so well within its capability, but this would have effectively removed all coal generation from the grid. The reduction in emissions would have been about 2.7bn tonnes of carbon dioxide, equivalent to just under Poland's total emissions during that period, or five times the UK's total emissions for 2015.

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This figure should be considered as a hypothetical maximum because in practice the seasonal nature of demand for power, embedded generation in industry, contractual commitments, and other locational and balancing requirements would have inhibited the ability to switch all coal to gas, but in essence a substantial gain was, and still is, there for the taking.

Infrastructure questions

But would Europe need more gas infrastructure to supply the additional gas required, and would this create 'technology lock-in'? To deal with the latter point first. The experience of gas-fired power plants in Europe over the last few years clearly shows that having infrastructure in place does not mean that it will be used. Basic market economics tells us that it is price that determines demand for a product, and if something is more expensive than an alternative then it will not be used.

As renewables have very low marginal costs, they will win when competing with gas on such a basis, and this is exactly how the liberalised electricity market works. As renewables currently have their income guaranteed via subsidies such as feed-in tariffs, they do not need to worry about recovering their capital cost. And if or when subsidies are withdrawn, renewables' lower marginal costs would mean that renewable plant would keep generating until such time as it needed replacing, so long as it was making a contribution to its fixed costs.

Furthermore, the gas infrastructure to supply the existing CCGTs is already in place. Like the CCGTs themselves this gas infrastructure is underutilised. The only question is whether Europe can access enough gas given its increasing import requirements as its own production declines. However, here the news is also good. Thanks to the creation of a large and liquid gas market, Europe is an attractive destination for imports from other countries.

Investors have ensured that Europe has plentiful liquefied natural gas (LNG) import capacity, whilst traditional pipeline suppliers such as Gazprom are also ensuring that there will be sufficient supply. For example, Gazprom's Nord Stream 2 is a new pipeline capable of transporting 55bn cubic metres of gas a year from Russia to Germany.

Russian gas will have to compete on price with other gas suppliers and with other fuels such as renewables. But should European consumers choose to continue to buy from Gazprom, gas via Nord Stream 2 could save 160mn tonnes of carbon dioxide per year if used to replace coal. Moreover, Nord Stream 2 could save up to 8.2mn tonnes of carbon dioxide per year compared to the Central Russian Corridor pipelines, or up to 44mn tonnes of carbon dioxide compared to the equivalent volume of LNG shipped to Europe.

So if Europe is serious about combatting climate change it should embrace coal to gas switching in power generation as soon as possible. The gains are too big to be ignored. And modern infrastructure such as Nord Stream 2 can help Europe achieve those gains. ●

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