LIGNITE

Green Germany's dirty secret

One of the world's largest bucket-wheel excavators digging lignite in an open-pit mine in Hambach, Germany

Photo: Shutterstock, Corlaffra

A world leader in the development of renewables, Germany nonetheless remains heavily dependent on brown coal, or lignite, for its energy needs. This apparent contradiction means the nation will continue to rely on fossil fuels for decades to come, reports *David Appleyard*.

Germany, quite rightly, enjoys its well-deserved reputation as a global leader in renewable energy development. With renewables supplying more than 30% of the total electricity used by the country in the first half of this year, according to figures from the BEE renewable energy association, the renewable energy contribution to German capacity continues to increase. This growth in renewables is occurring under the auspices of the *Energiewende* or energy transition policy. Introduced in late 2010, the *Energiewende* sets out a 60% renewable energy target for total energy by 2050 as well as a dramatic 80% cut in greenhouse gas emissions by then too.

What is perhaps less well known is the country's continued reliance on brown or soft coal, also known as lignite, to provide a large proportion of its energy requirements both now and for decades into the future. The country's Federal Statistical Office notes in the latest available figures that some 40% of German electricity came from coal in 2016. While this is a significant decrease on the 57% of power coal supplied in 1990, it still sees lignite alone contributing more than 23% of the total in 2016, some 150 TWh. This is down from the more than 25% seen just two years' previously but nonetheless marks the high sulphur fuel as the single largest source of energy.

Hard coal provides around 17% while the next largest contributions come from nuclear at more than 13%, followed by natural gas and wind power at around 12% each.

There's no doubt that renewables are on the ascendant. Renewable energy sources accounted for just under 4% of total energy production in 1990, but their combined share had risen to as much as 29% by 2016, or around 188 TWh collectively. Nuclear power, in contrast, is contributing less. In 1990, 28% of the total gross electricity produced came from nuclear plants, but that figure was down to 13% by 2016, providing just shy of 85 TWh. Overall, Germany intends to phase out nuclear power by 2022, inevitably placing greater reliance on alternatives.

The challenge of grid stability

Based on the *Energiewende* plan, the share of power generated from renewable sources is set to increase to 40% to 45% by 2025 and to more than 80% by 2050. Most of this growth is expected to come from variable resources like wind and solar. Indeed, the variability of PV and wind, which already supply around 18% of Germany's power, present a number of challenges which – the coal industry argues – predicate the continued use of domestic brown coal.

The country lacks the necessary infrastructure to transport renewable energy from its production sites in the north for wind to the load centres located in the southern part of the country. This means Germany is sometimes required to export large volumes of energy, even at negative prices – effectively paying someone to take the energy away. Such a situation not only presents challenges for grid stability in Germany but for the grids of its neighbours too.

In May for example, the Austrian regulatory authority E-Control and the Germany federal network authority the Bundesnetzagentur agreed to introduce a congestion management scheme for the exchange of electricity at the border between Austria and Germany as from 1 October 2018. Commenting, Jochen Homann, Bundesnetzagentur President, said: 'We expect the congestion management scheme to provide noticeable relief in the context of re-dispatch actions. This will also lead to a decrease in the costs for measures to stabilise the network.'

And there are significant costs associated. The Federal Ministry for Economic Affairs and Energy found that the cost of preventing bottlenecks in the German grid and ensuring that the country's electricity supply remains stable has totalled almost €1bn per year and the country has identified almost 4,000 km of new transmission lines required to support its energy transition.

The case for coal

While new transmission links are a necessary solution to renewable energy expansion, their development attracts considerable opposition from the public and municipal authorities. As a result, the stability offered by thermal plant such as coal remains an attractive proposition, despite the stated intention to switch to renewables.

Olaf Winter, a spokesman for RWE Power, comments: 'If security of supply is to be guaranteed, we need conventional power generation systems to compensate for the fluctuating generation from sun and wind, as power storage units are still in short supply. It is fair to say that the flexibility of conventional power plants make the expansion of renewable energies possible and thus enable the energy turnaround in the electricity sector.'

Winter points to 24 January this year. Cold and overcast with almost no wind, demand in Germany was at very high levels as heating and power demands soared. At the same time, renewable capacity was at a minimum. 'The entire portfolio of conventional power plants –

including lignite power plants – had to take over in order to maintain the power supply. Such a reliable interplay between different energy sources is indispensable. The example shows how conventional power plants, albeit with a new task as back-up capacity, will continue to be crucial for our energy system,' says Winter.

As coal import trade group Verein der Kohlenimporteure (VdKi) observes: 'Since renewable energy sources alone cannot guarantee a secure supply, thermal power plant output will continue to be a critical pillar for a longer period of time.' Bolstering the case for coal, VdKi also notes rising emissions of carbon dioxide in Germany, despite the rise in renewable energy production, observing that the strongest growth in carbon dioxide emissions in 2016 came from the use of natural gas, with a 9.5% increase.

RWE argues that the economics of lignite and gas-fired installations differ substantially, as gas is being traded on markets worldwide, whereas lignite is a domestic energy source that lacks price volatility. Lignite power plants have high fixed costs and low variable costs. In contrast, gas power plants have considerably lower fixed costs but higher variable costs, especially due to the relatively high price of gas. All this makes lignite-based electricity the economically obvious choice to guarantee security of supply in Germany.

As VdKi observes: 'Sector coupling will lead to a growing need for backup capacities to an even higher level than today so that the fluctuating supply from renewable energy sources can be compensated. It is economically efficient to use existing power plant capacities for this purpose, whether they are fired by coal or natural gas.'

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Flexible coal?

This comment follows a recent study from energy think tank Agora Energiewende which found that coal-fired power stations are not necessarily a barrier to the expansion of renewable energy. The study, published in June, concludes that older coal-fired plants can be made to operate more flexibly at a reasonable cost, allowing countries with a high percentage of coal-based electricity to make a smooth transition to a climate-friendly energy system.

The report states: 'Coal-fired power stations can adapt their electricity generation to the fluctuating output of wind and solar power stations far more flexibly than was generally assumed to date. Only minor modifications are required for this, even with old coal-fired power stations.'

However, the report also adds that in electricity systems which also feature gas-fired power stations, flexible coal-fired power stations can lead to more greenhouse gases. 'Relatively climate-friendly but more expensive gas-fired power stations are still being ousted by polluting coal-fired power stations, for example in Germany,' the Agora analysis says.

The study, developed by consulting firms Prognos and Fichtner on behalf of Agora, cites Germany as an example of successful modification of a coal-fired power station, noting that the country now operates such stations almost as flexibly as gas-fired power stations.

Other factors also boost the case for coal. For example, the issue of security of energy supply. According to the European Association for Coal and Lignite (Euracoal), Germany has considerable reserves of hard coal and lignite, making these the country's most important indigenous sources of energy. However, in the case of hard coal, there remain only approximately 20mn tonnes to be extracted following a decision to end subsidised German hard coal production in 2018. For lignite, there are long-term prospects for about 5bn tonnes of mineable reserves in existing and approved surface mines, Euracoal says.

In 2015, German lignite production totalled 178mn tonnes. It was centred in four open cast mining areas: the Rhenish area around Cologne; the Lusatian area in south-eastern Brandenburg and north-eastern Saxony; the Central German area in the south-east of Saxony-Anhalt and in north-west Saxony; and the Helmstedt mining area in Lower Saxony. Nearly 90% of domestic lignite production is used for power generation.

Another consideration for policy makers is the German steel industry. One of the world's largest steel manufacturers, this industry is heavily dependent on coal. It also employs large numbers of people, as does the mining industry. According to DEBRIV, the German lignite producing company association, at the end of 2016 nearly 20,000 people were employed in the lignite industry, though this is around 900 fewer than at the end of 2015.

Germany's lignite future

Germany's continued reliance on fossil fuels has prompted the ire of environmental campaigners. For example in late August thousands blocked mining infrastructure in the Rhineland coalfields, aiming to shut down operations at the open cast Garzweiler mine near Cologne by blocking the tracks of a coal shuttle for nine hours. As a consequence, the coal-fired power plant Neurath had to reduce its operations by 37%, the Ende Gelände demonstrators claim. Last May 4,000 activists blocked mining infrastructure in the Lusatia coalfields in East Germany.

'The German government is famous for its rhetoric about energy efficiency and mitigation,' says Insa Vries, Ende Gelände spokesperson. 'However, it is impossible to protect the climate without phasing out coal. As long as politicians ignore the elephant in the room, the energy transition remains a hoax.'

Nonetheless, as a part of the 'Climate Action Programme 2020', some 2,700 MW of lignite-fired power generation capacity is being transferred to standby reserve status in a programme due to run through to late 2023. In the meantime, more efficient lignite-fired power production is being developed. For example RWE, which has around 10 GW of lignite-fired capacity in its generation portfolio, commissioned two new lignite-fired units (BoA 2 and 3) at Neurath in August 2012 with a gross capacity of 2,200 MW and with thermal efficiency of 43%.

RWE's Winter says: 'As a growing amount of assured capacity is leaving the market because it is no longer commercially viable, security of supply will have to be given more weight in the future. That's why lignite remains an important factor for affordable and safe energy. Of course the lignite industry must contribute to climate protection.'

He points to a public road map that indicates, among other measures, a 15% reduction in carbon dioxide emissions as a result of the standby programme that is targeting smaller generation units. Perhaps Winter is correct when he concludes: 'To generate electricity from both conventional and renewable energy sources is no contradiction.' ●

David Appleyard writes on energy matters.