

The role of coal in Europe's power mix

A report by The Economist Intelligence Unit



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Acknowledgements

As part of the research process for this report in-depth interviews were conducted with several experts in the energy policy field. We would like to express our thanks especially to the following for their insights and input:

Steve Brick, Senior Advisor, Clean Air Task Force

Craig Morris, Senior Fellow, Institute for Advanced Sustainability Studies

Kees van der Leun, Director, Energy Consulting at Navigant/Ecofys

Koen Noyens, Manager, Generation, Climate & Environment, Eurelectric

Alistair McGirr, European Affairs Manager, SSE

Dave Jones, Carbon & Power Analyst, Sandbag

Giles Dickson, Chief Executive Officer, European Wind Energy Association



Introduction

In 1951 a treaty establishing the European Coal and Steel Community (ECSC) was signed, bringing together France, Germany, Italy and the Benelux countries into a common market under which the coal and steel industries in the signatory countries would operate. The ECSC eventually morphed into the modern-day European Union (EU), but its formation over six decades ago also reflected the importance of both coal and steel to several European economies at the time. Coal was then Europe's primary source of energy, fuelling over 80% of the region's energy consumption, but the characteristics of European economies and their energy consumption have since changed. Heavy industries, including steel, account for a much smaller share of GDP, and coal's role in supplying electricity has fallen.

Europe's coal consumption has in fact been in long-term decline, but the issue of coal-fired generation in the region is still important. The ECSC was founded to facilitate closer economic integration through coal and steel, but today European energy policymakers focus on reconciling energy security and affordability with the aim of decarbonising the energy sector to tackle climate change. Balancing these objectives impacts the level of dependence on coal generation, and the two main aims of this report are to put coal's role in Europe in context and to assess its future trajectory in supplying the region's power needs. The level of coal dependence in Europe is not as uniformly high as assumed, and it will continue to fall gradually in the EU as a whole (although this process will be uneven among the different member states). However, the EU's long-term goal to reduce emissions by 80 to 95% from 1990 levels by 2050 will be difficult to achieve without an accelerated reduction in unabated¹ coal generation in the short to medium term. This is because power generation from fossil fuels is a significant contributor to Europe's greenhouse gas emissions, most of which is due to the use of unabated coal, and reduction of emissions from the electricity sector provides the most straightforward pathway towards lowering the carbon intensity of the energy system.

The first section of this report puts the recent trends and current state of play of Europe's coal-fired generation in context. Since the early 1990s European coal consumption and coal's share of power generation have been falling, and today both are at much lower levels. There was a modest turnaround in coal generation between 2010 and 2012, but since 2013 the longer-term declining trend has resumed. Dependence on coal generation in Europe also varies greatly, with coal accounting for less than one-third of total power generation in most EU member states but contributing more than 40% in five of them. Coal generation is also heavily concentrated, with Germany and Poland alone accounting for nearly one-half of EU coal generation. Overall, coal's share of the EU power mix is lower compared with other industrialised economies such as the US, Japan, and Australia, and with the emerging economies of India and China.

The second section of this report provides a detailed analysis of the state of coal-fired generation in the UK, Germany, Poland, the Netherlands, the Czech Republic, Italy and Spain (the largest in Europe in terms of coal generation) and their respective policies (if any) that impact the use of coal

¹ According to a Paris-based think-tank, IDDRI (Institute for Sustainable Development and International Relations), unabated coal is defined as power generation by coal-fired plants that are not "equipped with carbon capture and storage technology".



for electricity. The section also outlines recent announcements by other EU countries regarding plans to phase out coal generation. The UK has seen the most significant fall in coal generation since 2014, and of the major economies in the region it is the most strongly committed to phasing out unabated coal. Among other major coal users there have been incremental falls in coal generation but no commitments to phasing it out. Countries that have made phase-out commitments similar to the UK's (notably France and Finland) are not major coal users, but momentum is building to reduce reliance on coal in the Netherlands and Germany. In Poland, however, there is little movement towards reducing dependence on coal generation.

The third section of this report outlines EU policies that have or will impact Europe's power mix. These include the 2020 and 2030 climate and energy targets, the EU Emissions Trading Scheme (ETS), emissions directives, and the recent "Winter Package" of proposals by the European Commission (EC). The EU does not have a specific policy that addresses coal use, but EU-level policies have had an indirect impact on coal-fired generation. In 2016 the EC released a Winter Package that proposes legislation to guide the EU in meeting its 2030 climate and energy targets, and in the same year the Industrial Emissions Directive (IED) came into effect, superseding the Large Combustion Plant Directive (LCPD). These measures, and others, may result in the retirement of some coal generating capacity going forward. EU policies thus set the framework for decarbonisation of the European energy system, but in the short to medium term policies directly impacting coal generation are more likely to be implemented by individual states.

The fourth section of this report provides an outlook for coal-fired generation in Europe in the light of the market trends and policy drivers outlined in the first three sections. Coal generation has been falling incrementally, and this trend will continue, with the temporary increase in coal consumption that occurred earlier this decade not likely to be repeated. The gradual decline in coal generation in Europe overall will be driven by west European states, including the UK, the Netherlands and Germany, while other states have also pledged to phase out coal altogether. EU policies as outlined in the Winter Package, air-quality directives, reforms to the ETS and the application of climate and energy targets will also impact coal generation. That said, while coal use in the power sector is expected to retreat gradually, realising the EU's long-term emissions-reduction goals will require an accelerated reduction in the use of unabated coal generation, especially in states where coal's share of the power mix is still significant.



Section one: Europe's coal dependence in context

Several decades ago, Europe, like most other industrialised economies, relied heavily on coal for power generation. At that time coal was also widely used for heating, in railway transportation, and by heavy industries such as steel and petrochemicals. However, today the power sector accounts for most coal consumption in industrialised economies. According to the International Energy Agency (IEA), thermal coal and lignite (used mainly for power generation and heat) accounted for 82% of OECD Europe's coal demand in 2015, with metallurgical coal (used mainly for industrial purposes) accounting for the remainder. Trends in the demand for coal for electricity therefore heavily influence overall coal consumption trends. This section will show firstly that the importance of coal in supplying Europe's electricity needs has been gradually declining, secondly that there is wide variation in coal dependence among European economies, and thirdly that the use of coal is heavily concentrated in a few of those economies.

Coal's decline

In the 1960s Europe consumed more coal than the US, but while American coal consumption increased in subsequent decades (until recently), in Europe it has been in fairly consistent decline since then. The volume of coal consumed in Europe now lags behind the amounts used in the US, China and India. Similarly, in Europe both coal-fired generation and the share of coal of the power mix have been falling, although there have been ebbs and flows. There was an increase in coal consumption between 2010 and 2012, but this was a temporary phase and the longer-term trend of falling coal use resumed in 2013. Rather than being the renaissance in coal use that it was widely touted as at the time, the period represented a mini-boom that did not last.² The Economist Intelligence Unit in fact made this call in 2014.

As Europe has diversified its sources of power generation its use of coal has fallen, and while there have been periods when this decline has been arrested they have not lasted. In the 1970s, higher oil prices caused a swing back to coal-generated power as the use of oil for electricity production began to be phased out, but coal subsequently lost ground to nuclear power and then to natural gas. More recently, renewables in some European countries have been contributing to lower coal use. Europe's economy—and especially that of eastern Europe in the 1990s—has also shifted away from heavy industrial activity, and this too has reduced the need for coal. As a result, there has been a steady decline in Europe's coal consumption over several decades. According to data from the EU's statistical agency, Eurostat, annual solid fuels³ consumption had fallen to 730,500 tonnes by 2014 from 1.2m tonnes in 1990—a drop of 40%. Consumption increased by 8% between 2010 and 2012, but by 2014 it had fallen back to below its 2009 level, and once official annual data for 2015-16 are available they will show that consumption has since fallen further. Preliminary estimates from Eurostat show that in 2015 EU consumption of hard coal and lignite combined fell by just over 2%. Furthermore, both the

² <http://www.eiu.com/industry/article/741997658/coal-last-gasp-in-europe/2014-07-09>

³ Solid fuels include all types of coal and coal-derived products.



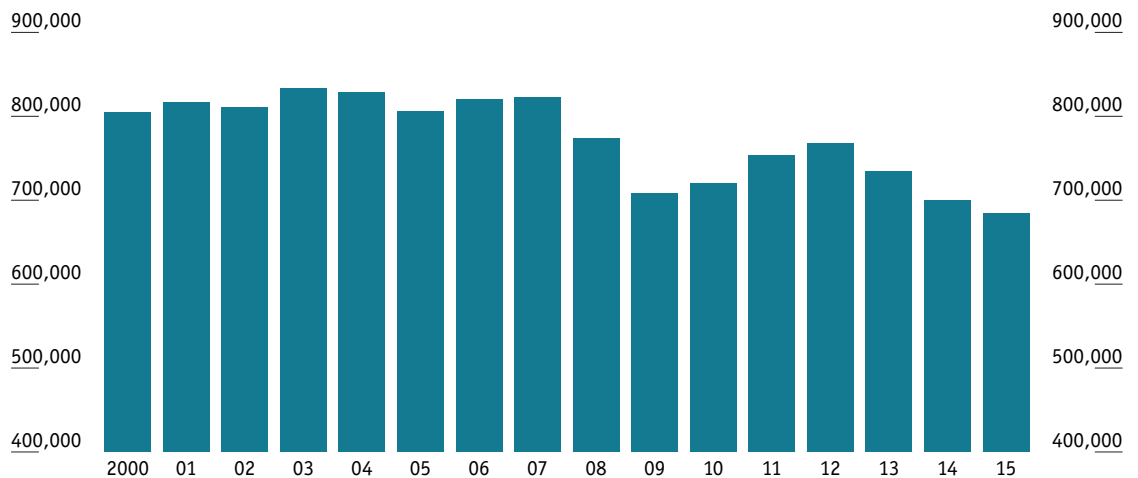
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BP Statistical Review of World Energy 2016 and the IEA have reported that EU coal consumption fell by similar levels in 2015. Reduced coal-fired generation in the UK, Germany, Spain and the Netherlands in 2016 will likely be reflected in lower coal consumption in that year. The EU is the fourth-largest coal-consuming region in the world, but its share of global coal consumption has shrunk as its requirement has fallen at the same time as consumption has dramatically increased in the industrialising world (especially China). In 2015 Europe accounted for 7% of global coal consumption, down from 36% in 1965.

Coal-fired generation in Europe, the main drivers for overall coal consumption, has been declining in terms of both volume and market share. Eurostat data show that gross electricity production from solid fuels in the EU declined by 15% between 2005 and 2014. Full-year Eurostat data for 2015 are not yet available, but estimates from Eurelectric, the body representing the region's power utilities, reveal a fall of around 1.5% in coal generation in 2015. Coal generation in Europe rebounded between 2010 and 2012 (by 9%), driving the increase in coal consumption overall, but this increase too has since been negated. Owing mainly to a dramatic fall in UK coal generation in 2016, we expect data to show a continued drop in European coal generation last year, which would mark the fourth consecutive year in which it has fallen. Coal's share of the European power mix has also shrunk over time. In 1990 coal accounted for 39% of EU power generation, but this had fallen to just over 24% in 2015. The share edged up modestly in 2011-12, but it has subsequently fallen back to below 25%, a share much lower than in Japan, Australia, China and India and slightly smaller than in the US.

EU coal consumption, 2000-15

('000 tonnes)



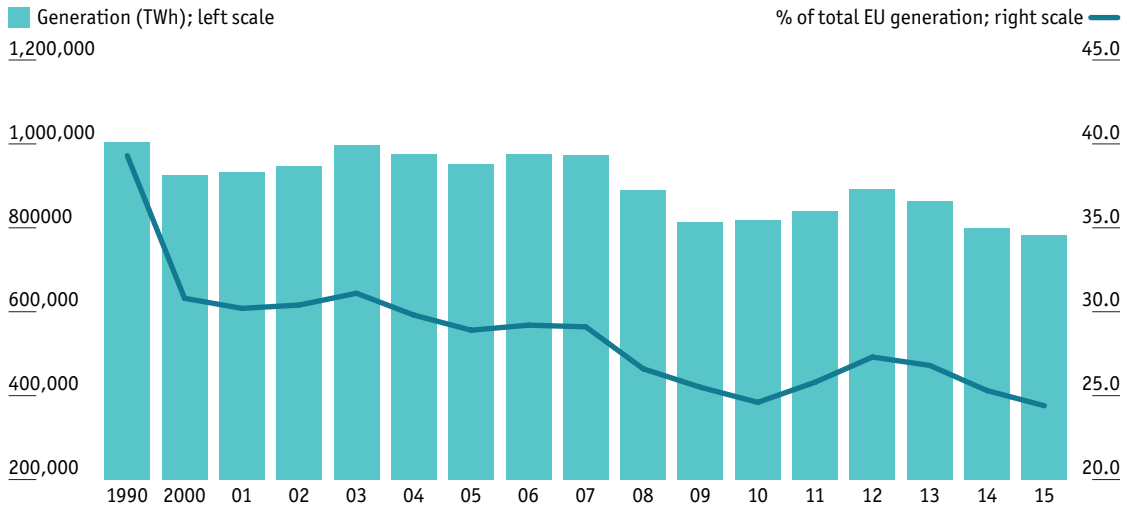
Source: Eurostat.

Note: Total of hard coal and lignite combined

What can be established, therefore, is that coal consumption and generation have been gradually declining since 1990, as has coal's share of the European power mix. There was a modest rebound in the early part of this decade, but in the past few years the longer-term trend of decline has resumed. Owing to policy drivers and market conditions, the latter trend is expected to continue. The EU average



EU generation from coal: Volume and share of total generation



Source: European Environment Agency, Eurostat.

Note: 2015 figure are EIU estimates.

of coal dependence for electricity generation is lower than in other major economies. But the level of dependence varies greatly and coal use is concentrated among a few EU member states.

Europe's coal dependence varies greatly

Coal accounts for one-quarter of EU power generation, but its share of total generation varies widely between different European states. Coal dependence is highest in some east European economies: accounting for more than 80% of generation in Poland and more than 50% in the Czech Republic. In Greece, Bulgaria and Germany coal accounts for over 40% of total generation (Germany is an electricity exporter, so coal accounts for 44% of the power generated for domestic German use), while in the Netherlands coal accounted for 37% of generation in 2015 (with the recent closure of older power plants, this share will since have fallen). In 14 European countries coal accounts for less than 30% of power generation, with coal accounting for less than 10% in Europe's second- and third-largest economies, the UK and France. In a further nine countries coal is not used for electricity generation, or (in the case of Sweden, Switzerland and Norway) is used only minimally. The characteristics of coal dependence therefore vary widely between European states, and often depend on the availability of domestic coal resources (Germany and several central and east European states are significant coal producers). Other states possess alternatives such as natural gas, while promotion of other sources of energy (historically nuclear power, and more recently renewables) has also influenced coal dependence levels. Thus, given the differing characteristics of each country's energy mix, it is important not to generalise about coal dependence in Europe, and reducing the region's reliance on coal overall will depend on changes in the energy mix in fewer than half a dozen European states.

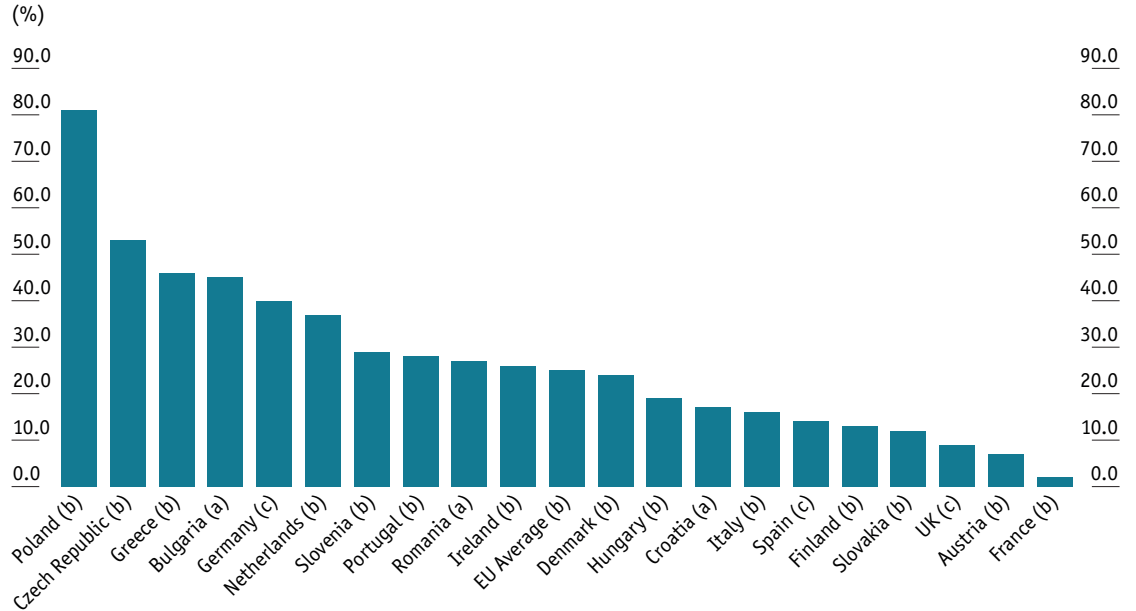
Concentrated coal

European states that are more heavily dependent on coal also generally account for a large share of Europe's total coal-fired generation. Germany and Poland alone account for around 50% of EU coal



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Coal share of generation in EU member states



Note: (a) data is for 2014; (b) data is for 2015; (c) data is for 2016;
 The following countries either do not use coal or coal accounts for less than 1% of generation: Sweden, Switzerland, Belgium, Norway, Estonia, Latvia, Lithuania, Cyprus, Malta;
 Figure for Germany is share of total generation including electricity exports
 Sources: IEA, Carbon Brief (UK), Energiebilanzen (Germany), Red Electrica (Spain)

generation, while these two countries together with four others—Spain, the Czech Republic, Italy and the Netherlands—account for over two-thirds. Policy changes in these top European coal-using countries would therefore make a substantial difference to Europe's dependence on coal generation overall. However, only the UK has made a firm commitment to phase out coal generation within the next ten years; among most of the other major coal users in Europe, the trend in (unabated) coal generation has either been relatively stable or has shown a gradual fall. Other states, such as France and Finland, have pledged to phase out coal generation, but these are not significant users of coal for electricity.



Box story Why did coal rebound in 2010-2012?

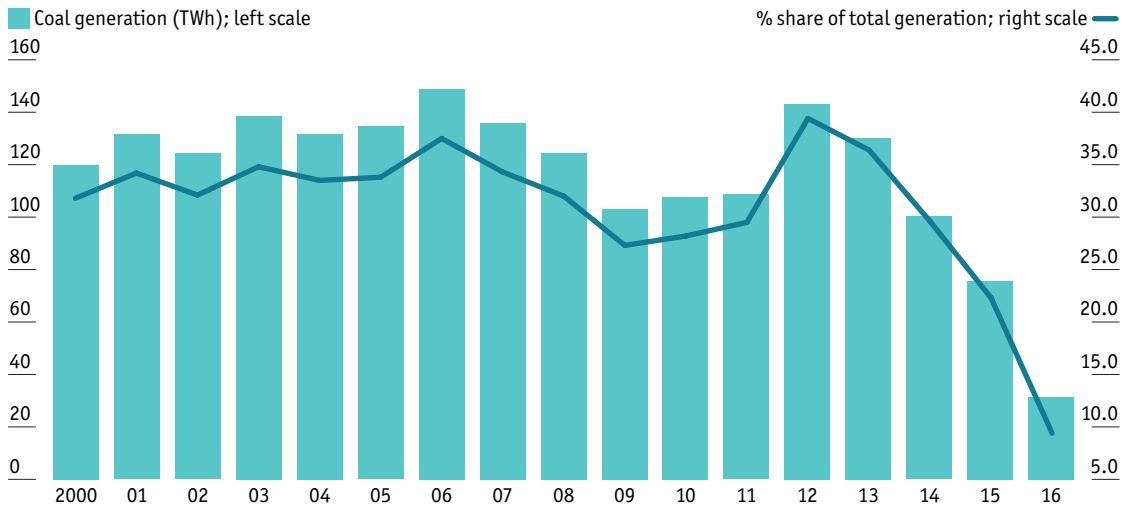
Between 2010 and 2012 there was an increase in coal-fired generation (and as a result coal consumption) in Europe, prompting speculation that coal in the region had entered a renaissance, partly assisted by misguided policies at the EU and national level that worked against the achievement of stated climate targets, such as reducing emissions. Indeed renewables generation, encouraged by EU climate and energy targets and the merit order system, grew rapidly as EU policymakers intended. But the collapsed price of coal, which fell 45% in north-west Europe between 2008 and 2013, allowed coal plants to be more competitive with natural gas plants that relied on a more expensive fuel source. Furthermore, due to the recession and weak electricity consumption the effectiveness of the EU's Emissions Trading Scheme (ETS) was undermined

by its low carbon price, which collapsed in 2008-09. Thus the scheme did little to encourage a shift from the most emissions intensive source of power generation. As a result the increasing penetration of the grid from renewables was coming at the expense of natural gas rather than coal, and coal generation enjoyed a modest comeback. But data since 2013 show that these gains by coal in the power sector in most countries in Europe has been reversed. Natural gas prices, indexed to the price of oil, fell, while the UK established its own carbon price. EU air quality directives have begun to result in the retirement of some capacity, while renewables usage in an environment of low growth in power consumption has been depressing wholesale power prices. With all these factors aligning coal plants are now facing competitive pressures, making a return to the mini-boom in the early part of the decade unlikely. Much of the fall in coal generation since 2014, however, has been in the UK, with smaller falls elsewhere such as in Germany, Denmark and France.



Section two: Trends among Europe's major coal users

United Kingdom: Trends in coal generation and share of total generation



Source: Department of Business, Energy and Industrial Strategy, Carbon Brief estimate (2016)

UK

Once a major coal producer, the UK was until recently a large coal consumer. In 1990 coal accounted for two-thirds of the UK's power generation, but the share had declined to one-third by 2000. Following a temporary rebound in 2012, coal-fired generation has plummeted since 2013, and in 2016 accounted for just 9% of total UK power generation, according to analysis from Carbon Brief, a UK-based climate and energy analysis website. Over the past four years the UK's complement of coal-fired power plants has been cut in half: in 2012 the country had 17 operating plants, but by 2016 this had fallen to eight (four closed in 2016), with capacity dropping by around 9 gigawatts (GW) over the period, to 14 GW. Of the remaining eight plants, all except some units of one plant began operating between 1959 and 1974, indicating that the remaining plants are relatively old. The fall in UK coal power generation has been a key driver in the reduction in total EU coal-fired generation since 2014.

There are several reasons why UK coal-fired generation has been falling:

- In addition to being part of the EU's Emissions Trading Scheme (ETS), power plants in the UK are also required to pay a further price for carbon dioxide (CO₂) emissions under the Carbon Price Support (CPS) scheme, which is set at £18 per tonne of CO₂ until fiscal year 2020/21. Introduced in 2013, the price of CO₂ under the CPS doubled from £9 to £18 in 2015, and this has been one factor, among others, in the retirement of coal capacity. There was speculation that the CPS might be abolished in the 2016 Autumn Statement of the government led by the prime minister, Theresa May, but it has been kept, with the price capped at £18 per tonne of CO₂ until 2020/21. Beyond that fiscal year the future of the CPS is uncertain.



- EU air-quality directives such as the Large Combustion Plant Directive (LCPD), superseded by the Industrial Emissions Directive (IED) in 2016, both of which require power plants to limit the amount of air pollutants that they emit or face closure. In some cases utilities have decided to close plants rather than to invest to make them compliant, especially since the introduction of the CPS. The UK's Emissions Performance Standard will be another factor that will make the construction of any new coal-fired capacity unlikely.
- Natural-gas prices have fallen in tandem with the slump in oil prices. This has made natural gas generation more competitive with coal, helped by the CPS. Furthermore, electricity demand in the UK is not rising, making coal more vulnerable to growth in generation from renewables, which have received state support from measures such as Feed-in Tariffs, Contracts for Difference, and the Renewables Obligation. In 2016 power generation from wind reportedly exceeded that from coal, while generation from natural gas rebounded for the first time in several years. Furthermore, energy and climate policy is being guided by the Climate Change Act, which requires the UK to reduce greenhouse gas emissions by 80% from 1990 levels by 2050. Meeting this target will mean a shift away from unabated coal generation.

In November 2015 the UK announced that coal-fired generation would be phased out by 2025, although this policy has since been qualified and now includes only unabated coal-fired power, or coal plants not using carbon capture and storage (CCS) technology. In late 2016 the UK government released a consultation document on coal generation, stating that under current market conditions the country's remaining coal plants are likely to close in the near term, probably by 2022. But the documents also signalled the government's intention of phasing out unabated coal generation while minimising the impact on electricity supply and providing market certainty for investors to offer low-carbon alternatives. Some coal plants will also continue to operate until at least the end of this decade owing to their participation in the UK Capacity Market, whereby power plants receive payments to operate during peak demand periods. It is not yet completely clear how the UK government will implement its goal of phasing out unabated coal generation by 2025 but coal capacity will continue to edge down: especially from the first part of the next decade as capacity payments will give incentive for some plants to remain open until then. To date the UK has been the most proactive among major coal users in Europe in terms of seeking to phase out the use of coal.

Germany

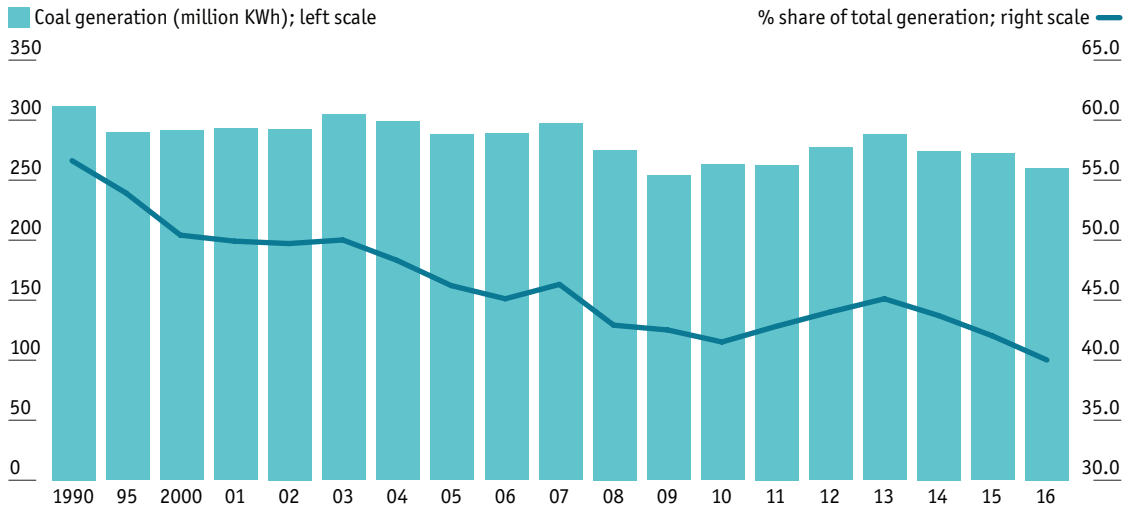
Germany is Europe's largest coal consumer. It accounts for around one-third of Europe's coal-fired generation and 30% of EU coal capacity. Germany is also heavily dependent on coal in its power mix, with coal accounting for 44% of domestic generation in 2016. Coal generation in Germany has fallen slightly in 2014-16, and last year dropped back to around its 2010 level⁴. Germany's coal reliance (in terms of market share) is exceeded in Europe only by Poland, the Czech Republic and Bulgaria. However it is less reliant on the fuel than in the 1990s, when coal accounted for well over 50% of Germany's power supply.

Germany is often held up as an example of a major economy undergoing a clean-energy transition, and, owing to its policy of *Energiewende*, or energy transition, the renewables sector now accounts for

⁴ Data for 2016 based on preliminary estimates from *Energiebilanzen* (AGEB)



Germany: Trends in coal generation and share of total generation



Source: Energiebilanzen

nearly 30% of its power generation. But at the same time coal reliance has been maintained. This has been a feature of Germany's power mix which has been criticised, especially since the sudden decision in 2011 – in reaction to the Fukushima nuclear disaster in Japan – to return to a policy of phasing out nuclear power that had earlier been abandoned by the government of the chancellor, Angela Merkel. The phasing out of nuclear power did contribute to a temporary increase in coal-fired generation, which increased by over 13% between 2010 and 2013, although the extent of this influence is hard to quantify. Falling natural-gas generation also contributed to the coal rebound, as demand for this lower-carbon fuel was squeezed between the push for renewables, cheaper coal and stagnant energy demand. Since 2011 the increase in Germany's renewables generation has exceeded the fall in generation from nuclear power. Therefore even though renewables helped to fill the gap as nuclear plants began to be de-commissioned, one form of low-carbon energy has replaced another with little net impact on Germany's energy-related emissions (estimates for 2016 show that Germany's emissions were about the same as the level in 2009). The country's reliance on coal will also become crucial in the next decade, as nuclear power will be completely phased out by 2022. Once this has happened there may be a period of increased reliance on coal, which if occurs will present a challenge to policymakers who will try to reconcile the management of the nuclear phase out with adhering to emissions-reduction targets.

Germany's coal dependence has recently become an issue of greater concern, reflected in a proposal in 2015 by the vice-chancellor, Sigmar Gabriel, to implement a climate levy to be paid by coal plants that exceed a certain level of CO₂. This proposal was met with strong resistance from the coal industry and unions, and was subsequently withdrawn. In its place, the German government decided to place 2.7 GW of lignite generation capacity (13% of Germany's total lignite capacity) into an emergency standby reserve from late 2016. The plants will be operated only as a last resort for back-up when required for a period of four years, after which they will be permanently retired.

At the end of 2016 Germany released its Climate Action Plan 2050, which confirms the country's



commitment to cut emissions by 80-95% from 1990 levels by that year. In the shorter term the plan also details targets for emissions reduction by 2030 that are to be achieved by various sectors of the economy (in order to achieve an overall reduction of 55% by that year). The energy sector is to reduce emissions by 61-62% from 1990 levels by 2030; if achieved, this would involve a shift away from fossil-fuel-based generation, and especially coal, but the plan does not specify a coal phase-out timetable. Efforts to reduce coal-fired generation are not ambitious in the short to medium term, with the main policy driver being the placement of some lignite power capacity in to a reserve. But there are signs that the coal power sector is struggling with market conditions, as one German utility, STEAG, announced in November 2016 that it may have to close down 5 hard coal units because of “changes to the market environment brought about by energy policy and the persistently low electricity price level.” If this does occur then a further 2.5 GW will be taken offline. In January Berlin-based Clean Energy Wire reported that UBA, Germany’s environment agency, had released a commissioned study which assessed how the country could reach its target to reduce emissions by more than half by 2030. The report stated that achieving this would necessitate a reduction in emissions from coal generation by 50% from 2014 levels over the next thirteen years. Absent appropriate policy drivers, however, it is likely that Germany will still be substantially utilising coal for electricity by then, although net capacity reduction can be expected due to the challenging market conditions for coal plants.

Netherlands

Coal-fired generation in the Netherlands increased substantially in 2014-15, rising by 45%, with coal’s share of total generation increasing to 37% in 2015, from 22% in 2010. The increase was mainly due to the fact that in 2015 three new coal plants with a combined capacity of 3.5 GW began operation, providing a boost to coal generation. However, at the end of 2015 three older coal plants closed, and a further two are scheduled to shut in mid-2017. Once the latter two plants have closed the Netherlands will have five coal plants in operation, comprising the three that opened recently and a further two that were built in the 1990s. Data for 2016 and 2017 are likely to show a retreat in coal generation, taking into account the closure of five plants. In total, 2.8 GW of capacity will have been taken offline, with the additional possibility that the two plants built in the 1990s may close before 2020 or be converted to biomass.

Since 2013 there has been greater policy focus on coal’s role in the Dutch power mix. In 2013 the Energy Agreement for Sustainable Growth outlined the plan to retire five old coal plants by the middle of 2017. In 2015 Urgenda, a Dutch non-governmental organisation (NGO), won an extraordinary case in The Hague District Court, when the court ruled that the Dutch government “must take more action” to reduce greenhouse gas emissions, which must be reduced by at least 25% from 1990 levels by 2020. Although the Dutch government has appealed against the decision, it also stated that it would try to implement it in the meantime. In September 2016 the Dutch parliament, in a non-binding resolution, voted to commit the government to phasing out coal-fired generation in order both to cut emissions by 55% by 2030 and meet its ambitions under the Paris Climate Agreement. The resolution follows a similar one in 2015 that called on the government to phase out coal-fired power generation. While parliamentary resolutions and court decisions may not be binding on government policy, these recent developments reflect a policy climate that is moving towards the phasing out of coal generation: the



Institute for Energy Economics and Financial Analysis states that new “regulatory pressures on coal in the Netherlands are creating headwinds for coal-fired power”. Coal’s share in the Dutch power mix will fall in the short to medium term given the recent plant closures, and if a cut in emissions of 55% by 2030 becomes official policy coal generation could be phased out altogether.

Poland

In 2015 coal accounted for 80% of Poland’s total generation. In the 2000s coal accounted for over 90% of Poland’s electricity, but its share has decreased slightly owing to modest diversification towards natural gas and, to a lesser extent, renewables (especially wind power and biomass). Coal dominates Poland’s power mix, however, and this will not change in the foreseeable future. As in its neighbour, Germany, the presence of domestic coal mining means that the fuel remains a prominent feature of Poland’s energy landscape. Reliance on coal is based on energy security and affordability imperatives, and coal has faced few competitors: nuclear power has not developed, and shale gas exploration efforts have yet to bear fruit. Wind power generation was increasing until 2015, but the election victory of the right-wing Law and Justice Party in that year has resulted in legislation that will severely restrict the use of renewables other than biomass (which can be co-fired with coal). Poland’s coal generation has remained stable since 2009, and the country has just over 4 GW of additional capacity under construction.

Coal utilities and producers are supported by the state, and the EU has permitted Poland some flexibility for its coal sector by awarding coal plants free carbon allowances under the ETS and by delaying the deadline for utilities’ compliance with the IED until 2020. In a recent letter to EU ministers responsible for the environment, Poland’s environment minister stated that the country is willing to achieve the “emission reduction goal of 40% by the year 2030 agreed for the EU, but only on terms that take into account the specificity of the Polish economy”. In the absence of support for alternatives and the firm backing for coal from the current government, Poland’s reliance on the fuel will continue, although the IEA expects coal-fired generation levels to still remain stable over the next five years.

Czech Republic, Spain, Italy

Three other EU countries, the Czech Republic, Spain and Italy, are also significant users of coal. The share of coal-fired generation is relatively high in the Czech Republic (at 53%) but is lower in Spain and Italy (at 14% and 16% respectively). Like Poland and Germany, the Czech Republic is a significant producer of coal, while Italy and Spain import most of their coal needs. In the Czech Republic coal generation has been edging down over the past decade owing to expanded nuclear capacity, and as a result coal’s share of total generation had fallen to just over 50% by 2015, from around 75% in 2000. More recently, renewables capacity has been growing, reaching 24% of Czech generating capacity in 2014. The Czech Republic has a long-term plan to move from coal (and especially lignite) generation to nuclear power and—to a lesser extent—renewables, but shorter-term objectives are to replace older coal plants with more efficient ones and invest in environmental upgrades to improve air quality.

Italy’s coal-fired generation has remained stable since 2005. Although coal’s share of total generation is not large, at 16%, in 2015 Italy’s absolute level of coal generation was the fifth-highest in Europe. Generation from non-hydro renewables in Italy has nearly quadrupled since 2010, but



this has mainly been at the expense of natural gas. According to E3G, an energy and environment consultancy, Italy's Enel, a part-owned state utility, has pledged to become a "carbon-neutral" company and to end its global investment in coal. The utility has pledged to shut down 13 GW of fossil-fuel generation capacity in Italy by 2020, including natural gas and oil facilities as well as three small coal plants. In its Strategic Energy Plan, released in 2013, the Italian government expects coal's share of electricity consumption to remain stable until 2020, and most of its plants are expected to be IED-compliant and remain operating.

In 2015 Spain had the fourth-highest level of generation from coal in Europe, but the trend of coal-fired generation there has been erratic owing to variations in coal use depending on the availability of hydropower. In 2000 coal accounted for 36% of Spain's generation, but this had fallen to below 9% by 2010, with generation dropping from 81 TWh to 26 TWh over that period. Since then coal generation has revived, doubling to 54 TWh in 2015; a fall in generation using higher-priced natural gas partly explains the rebound. However, in 2015 coal generation was still 33% lower than in 2005. In 2016 data from Spain's electricity agency, Red Eléctrica, show a fall in Spain's coal generation of 29% due to the fact that heavier rainfall contributed to an increase in generation from hydropower. Spain has also promoted renewables, with generation from this source rising significantly since 2000, but the current centre-right government has wound back support for solar power. Coal plants also get state support, with such facilities receiving grants to use domestically produced coal (although this will cease in 2018 owing to EU pressure), to make environmental upgrades and to participate in capacity markets. To date Spain does not have a policy to phase out coal, but the winding back of support for fossil-fuel generation may result in the retirement of some capacity.

Coal phase-outs

At the end of 2016 France and Finland announced that they would phase out coal-fired generation by 2023 and 2030 respectively. Both countries have halved their coal generation since 2010, and coal now accounts for just 2% of total generation in France and for 13% in Finland. Belgium closed its last coal plant in 2016. Austria, which had three coal plants in 2014, reportedly closed one in 2016, and a further plant is scheduled to be shut in 2020; the country's last plant will cease operating in 2025. Portugal has two coal plants, and according to research from Climate Action Network Europe, a coalition of non-profit groups, the country's National Programme for Climate Change 2020-30 states that there will be no coal generation by 2030. Closures of Portugal's coal plants could occur once their existing power purchase agreements expire. Denmark has halved its generation from coal in the past five years and is aiming for 100% generation from renewables by 2035. Continued expansion of renewables, and especially wind power, is cutting into generation by fossil-fuel plants, including coal facilities. Therefore in several other European economies coal generation faces reduced market share in the face of competition from renewables or an eventual phase-out altogether.



Conclusion

Among major coal users in Europe only the UK is committed to phasing out unabated coal in the near term, but several smaller users have pledged to end coal-fired generation. In other countries coal generation is falling gradually, owing to market conditions or because of national and EU policies that mandate the promotion of renewables, cuts in emissions and compliance with air-quality directives. Even in countries such as Poland where coal power is fully supported by government policy, coal generation is expected to only remain stable. Coal capacity and generation in the EU overall can be expected to fall in the short to medium term, and this has been mainly due to national-level policies acting on the broader framework set by EU climate and energy-related strategies.

Box story Hard coal and lignite

There are two main types of coal used for electricity: hard or black coal and lignite or brown coal. These types have different qualities, with lignite having lower energy content, containing more moisture, and softer in substance than hard coal. Because of some of these characteristics lignite is not suitable for transport, and is mainly consumed by power stations close to where it is mined. Lignite also emits around 30% more carbon dioxide (CO₂) emissions than hard coal. Hard coal is more commonly used for power generation worldwide but lignite is a significant source of power generation in Europe as the region has ample domestic resources (especially in Germany, Poland, the Czech Republic and in south east Europe). According to DEBRIV, the federation of German lignite producers, in 2013 hard coal accounted for

62% of EU coal generation and lignite accounted for the remaining 38%. Lignite is not commonly used in Western Europe, where hard coal is either produced domestically or imported. But lignite is widely used in countries that have the domestic resources of the fuel. DEBRIV estimates that lignite accounts for nearly 90% of coal generation in the Czech Republic, more than 50% in Germany, and around 40% in Poland. Lignite power is also prominent in Bulgaria, Romania, and the Western Balkans. Europe's dependence on coal is lower compared with other major economies, but a significant share of it is sourced from lignite. Europe's total coal production is also falling, and the region is becoming more dependent on hard coal imports. Total EU coal output has declined 27% since 2005, and in that time the share of imports of the EU market has risen from 31 to 46%, even accounting for declining coal consumption at the same time.



Section three: Are EU policies impacting coal reliance?

The EU sets the framework for European climate and energy policy: it has set targets for emissions, renewables and energy efficiency, has implemented air-quality directives and has established the Emissions Trading Scheme (ETS), and it is currently facilitating closer integration of the European energy market. There is no specific EU policy that directly addresses coal use, but the EU's suite of policies indirectly impact the extent of Europe's dependence on coal.

Climate and energy targets

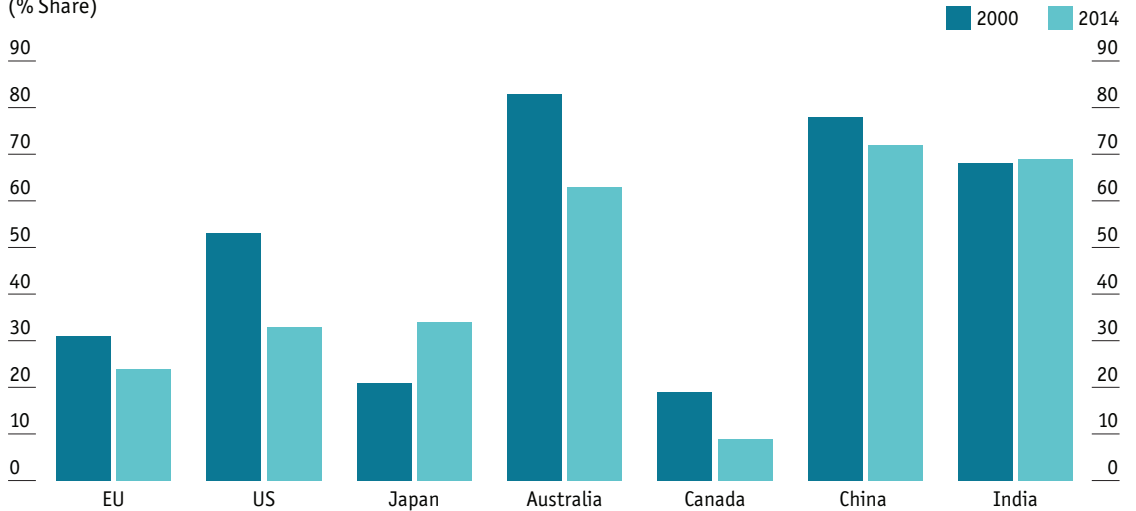
The targets set for 2020 and 2030 require EU member states to cut emissions, expand their use of renewables and improve energy efficiency. In 2014 the EU had already achieved the target of cutting emissions by 20% from 1990 levels by 2020, as in that year emissions fell by a further 4% to 23% below 1990 levels. Weak economic performance since 2008-09 contributed to this fall, so the challenge remains to achieve the targeted 40% cut in emissions by 2030 once economic growth strengthens. The EU is on track to reach its target for renewables to reach a 20% share of energy consumption by 2020 (the share reached 16% in 2014), making the 27% target set for 2030 achievable. The bloc may fall just short of the target of improving energy efficiency by 20% by 2020, and in 2016 the European Commission (EC) proposed a 30% cut in energy consumption by 2030 (raising the original target of 27% set in 2014). Efforts to reduce emissions, increase the use of renewables and improve energy efficiency will have an indirect impact on coal-fired generation going forward in that they have set the broad framework for member states to work towards de-carbonisation of their energy systems.

Renewables consumption in Europe is increasing steadily, as per the 2020 and 2030 targets require, but until recently this has mainly come at the expense of natural gas rather than coal. The EU employs a merit order system for power generation that prioritises the dispatch of electricity from renewable energy before other sources of power, which are then prioritised based on their marginal cost. Natural-gas plants have been pushed to the end of the line, behind coal and nuclear, because of the higher cost of gas compared with coal. The ETS's low carbon prices have not helped the competitiveness of gas-fired generation, and coal capacity has remained competitive despite the problem that this frustrates efforts to achieve its emissions-cutting goals. The recent collapse in natural-gas prices has partially mitigated these circumstances, but gas generation has been a greater casualty than coal in Europe's shift away from fossil-fuel generation. Due to the recent fall in wholesale power prices in several markets, the economics of coal plants are now being affected by renewables penetration in an environment where electricity consumption is stagnant. When economic growth strengthens the challenge will be to stay on the pathway to at least a 40% cut in emissions by 2030, but this will require a more targeted approach that aims to reduce the emissions intensity of power generation, along with steps to reconcile the setting of targets for renewables use with an appropriate level of carbon pricing.



Coal's share of power generation: Global comparison 2000-2014

(% Share)



Note: Data for US and EU is for 2015

Sources: IEA, US Energy Information Administration, The Economist Intelligence Unit (EIU), EIU estimates

ETS

The ETS, which has been in place since 2005, aims to place a limit on emissions from 11,000 installations, such as power stations and manufacturing plants, which account for 45% of EU greenhouse gas emissions. Under the scheme establishments buy and sell allowances, but due mainly to lower industrial activity and power generation caused by weak economic activity since the end of the last decade, emissions are currently below annual caps, resulting in a surplus of allowances and a depressed carbon price. In December 2016 the ETS carbon price was around €5, compared with €29 in July 2008. As a result, the ETS provides little incentive to shift away from emissions-intensive power generation. In 2015 a market stability reserve and a steeper reduction in the number of allowances to be issued annually were introduced to give support to the ETS, while in late 2016 reforms were proposed to improve its performance, such as further reducing the number of surplus allowances from 2021. It is difficult to tell what the impact of recent and proposed reforms will be, however, with far-reaching measures likely to be resisted by some EU member states that are heavily reliant on coal-fired generation. But as the UK has demonstrated an effective price of carbon can have an impact on unabated coal generation.

Air-quality directives

EU air-quality directives have a direct impact on Europe's coal-fired power plants. The Large Combustion Plant Directive (LCPD) was introduced in 2008 and has since been superseded by the Industrial Emissions Directive (IED). These directives aim to limit air pollution from power plants and manufacturing establishments by restricting sulphur dioxide and nitrous oxides emissions. Utilities that own power plants must comply within a given period by investing in environmental upgrades, or face closure. According to the non-profit group, Sandbag, between 2008 and 2015 the LCPD resulted in the closure of 35 GW of thermal power capacity, some of which would have included coal plants. It is difficult to determine the real impact that the LCPD had on Europe's coal capacity, as plants may



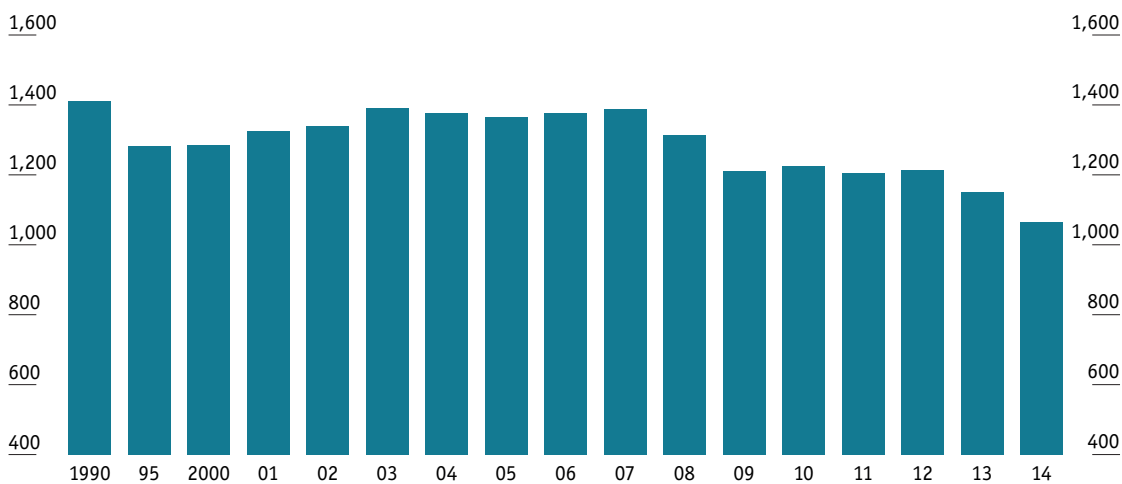
have closed due to age or for economic reasons. However, European coal capacity has been falling. The publication *Boom and Bust*⁵ reports that in the EU between 2003 and 2015 a total of 18 GW of coal capacity was added but that in the same period 33 GW was retired, resulting in a net loss of 15 GW. The IED has applied since January 2016; this directive allows power plants flexibility in complying, in terms of both timing and the amount of investment required. Less coal capacity is expected to be retired by 2020 than originally anticipated, with many of the EU's 280 plants expected to comply with the directive and remain in operation. Still, there will be some further retirements given the combined impact of the IED with market conditions, the age of plants and the impact of other policy drivers, although this level may not be dramatic.

Winter Package

In late November the EC released a "Winter Package," consisting of a set of proposals for meeting the EU's 2030 climate and energy targets. The proposals need to be approved by the EU's council of ministers and the European parliament before they can be adopted. The Winter Package proposes to raise the target for cutting energy consumption to 30%, from 27% at present, and, controversially, to eliminate the priority-dispatch mechanism whereby renewables receive prior access to the grid over fossil-fuel plants. While the latter proposal was criticised for winding back support for renewables, the package also includes proposals for reforming the capacity mechanisms that several EU member states (such as the UK and Spain) have put in place, whereby plants are offered payments to generate power during periods of heavy demand as back-up for variable renewables generation. The package proposes an emissions limit on plants that are eligible for such payments. New fossil-fuel plants will be eligible only if they emit less than 550 g of CO₂ per kilowatt hour—a requirement that rules out new coal plants. Existing fossil-fuel plants will not be covered by this provision until five years after the regulation has come into force, after which any plant whose emissions exceed the limit—that is, most existing coal capacity—would not be eligible to participate. According to several reports this will most likely occur in 2026, after which the impact on coal capacity could be significant. The Winter Package also refers to a target for 50% of power generation to come from renewables by 2030, but does not give details of how this would be achieved.

EU CO₂ emissions from electricity and heat 1990-2014

(million tonnes)



Source: European Environment Agency

⁵ Boom and Bust, Tracking the Global Coal Plant Pipeline, 2016.



Conclusion

EU climate and energy policies have, in the main, not directly addressed Europe's coal-fired generation, although they have had an indirect impact on Europe's power mix by setting the framework for the gradual decarbonisation of the energy system. Partly because of these broader EU efforts, the region continues to edge away from coal generation. At the same time measures such as the ETS have not been effective, and some observers have argued that concurrent policies, such as renewables mandates, have actually undermined the ETS's ability to facilitate a shift away from the most emissions-intensive sources of power generation. It is unlikely that the EU will implement a coal phase-out plan, given that some of the bloc's member states are still heavily reliant on coal generation. However, proposed reforms to the ETS, the eventual cessation of capacity payments to carbon-intensive power plants, implementation of the IED, and the general trends of greater renewables use and improved energy efficiency will ensure that coal generation continues to edge downwards, with this possibly gaining momentum from the second half of the 2020s.



Section four: Outlook for coal-fired generation

Since 2013 there has been a consistent decline in EU coal-fired generation, negating the increase between 2010 and 2012 (driven largely by retirement of capacity in a single country, the UK). Moreover, coal's share of Europe's power mix fell to just below 25% in 2015, back to its level before the modest uptick in coal generation that occurred at the start of this decade. Going forward, the fall in European coal generation is likely to continue over the short to medium term. In the IEA's *Medium-Term Coal Market Report 2016*, EU demand for thermal coal and lignite is forecast to fall by 4.1% a year on average between 2016 and 2021. The temporary increase in coal consumption seen in the early part of this decade is highly unlikely to be repeated, given the market conditions and policy drivers currently taking shape.

In the shorter term, falls in coal-fired generation will be driven by developments in western Europe. The UK is seeking to phase out unabated coal generation by 2025, while France has pledged to withdraw from coal generation by the same year and the Netherlands will see further retirement of older plants in 2017. In Germany the placement of retired lignite capacity into a reserve will take effect, while some utilities are reported to be considering closing coal plant units due to toughening market conditions. The profitability of gas-fired generation is improving, and this, in addition to continued renewables penetration, will lead to another layer of competition for coal plants units that already face the pressures of IED compliance and, potentially, ETS reforms. Electricity consumption has been stagnant and is only expected to grow marginally in the short to medium term, which may lead to overcapacity in some markets.

Coal plants face these pressures at a time when as a group they are ageing: two-thirds of Europe's existing plants are over 30 years old. The case for building further coal capacity in Europe is weak except where the construction of new, more efficient and environmentally better-performing plants replaces older, less efficient capacity. Furthermore, coal plants can contribute to meeting EU climate objectives by being equipped with CCS technology, although this is more likely to feature in the longer term. Currently Europe is not a region contributing significantly to additional coal capacity. According to the Global Coal Plant Tracker⁶, Germany and Poland have a combined 5 GW of coal capacity under construction, but there is little additional capacity being constructed elsewhere in Europe.

In eastern Europe the commitment to decarbonise the energy sector is not as strong. Poland, Bulgaria, the Czech Republic and Greece rely on coal for more than 40% of their power generation, and some states that depend on coal have been able to dilute the impact of broader EU climate and energy objectives in their own national markets. Although coal generation has not actually grown in recent years in key east European economies, the pace of decarbonisation will lag behind that in their west European counterparts. EU efforts to encourage east European states to become more proactive on climate-related goals will need to be reconciled with these countries' interests in maintaining energy security and affordability if their reliance on unabated coal generation is going to be reduced.

⁶ Published by endcoal.org



The role of coal in Europe's power mix

In terms of meeting EU emissions-reduction goals, the gradual retreat from unabated coal-fired generation may be too gradual. Power generation accounts for 25% of the EU's greenhouse gas emissions, and much of this is sourced from unabated coal power (coal generation accounts for 18% of EU greenhouse gas emissions). Cutting power-sector emissions is therefore crucial if the EU is to reach its 2030 and 2050 climate and energy targets. According to a study by a Paris-based think-tank, IDDRI (Institute for Sustainable Development and International Relations), the share of unabated coal in EU power generation must fall by at least one-half between 2010 and 2030 if an ambitious decarbonisation scenario consistent with the EU's low-carbon objectives for 2030 and 2050 is to be realised. Certainly by 2050 any coal capacity in operation would need to be equipped with CCS technology as power sector emissions need to be close to zero.

Although Europe's coal-fired generation has been falling, the current pace indicates that absent more ambition on the policy front it will be difficult to realise longer term emissions reduction goals. But in the latter part of the next decade a steeper reduction in unabated coal generation can be expected if coal phase out policies other than in the UK and proposed reforms to EU energy and climate policies take effect. It will be unlikely that a rebound for coal as occurred some years ago will re-occur, although a sustained sharp rise in natural gas prices or attempts to phase out nuclear power would stall the retirement in coal capacity in countries where it exists.

In the meantime factors such as greater penetration of renewables, competitive natural gas prices, weak growth in electricity consumption, the prospective cost of complying with air quality regulations, and an ageing stock will ensure the continued gradual fall in unabated coal generation. All in all a marked difference to Europe's overall dependence on coal generation could be made with policy measures being undertaken in a handful of states in the region, but few of these appear to have taken up that challenge which would see a significant difference in the near term.

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LONDON

Tel: +44 (0) 20 7576 8181

E-mail: london@eiu.com

NEW YORK

Tel: + 1 212 698 9717

E-mail: americas@eiu.com

HONG KONG

Tel: + 852 2802 7288

E-mail: asia@eiu.com

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LONDON

20 Cabot Square

London

E14 4QW

United Kingdom

Tel: +44 (0) 20 7576 8181

E-mail: london@eiu.com

NEW YORK

750 Third Avenue

5th Floor

New York, NY 10017

United States

Tel: + 1 212 698 9717

E-mail: americas@eiu.com

HONG KONG

1301 Cityplaza Four

12 Taikoo Wan Road

Taikoo Shing

Hong Kong

Tel: + 852 2802 7288

E-mail: asia@eiu.com