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Europe

END OF AN ERA:

WHY EVERY EUROPEAN COUNTRY NEEDS A COAL PHASE-OUT PLAN

This report has been commissioned by Greenpeace UK and Climate Action Network Europe to assess the impact that the 22 EU member states that still rely on coal power have on Europe's ability to ensure that climate change is limited to below 2°C.

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Greenpeace UK

Greenpeace stands for positive change through action. We defend the natural world and promote peace. We champion environmentally responsible and socially just solutions, including scientific and technical innovation. Greenpeace is an independent global organisation with offices across Europe, the Americas, Asia, Africa and the Pacific. We do not accept donations from governments or corporations, giving us the freedom to campaign to ensure a peaceful and sustainable world for future generations.

Climate Action Network (CAN) Europe

The Climate Action Network Europe is Europe's largest coalition working on climate and energy issues. With over 120 member organisations in more than 30 European countries – representing over 44 million citizens – CAN Europe works to prevent dangerous climate change and promote sustainable climate and energy policy in Europe. CAN Europe is a regional node of the Climate Action Network International, a worldwide network of over 900 Non-Governmental Organisations (NGOs).

Executive Summary

Across the world, civil society organisations are calling for fossil fuel emissions to be phased out and for renewable energy to be phased in. Their vision is a 100% renewable energy future, where sustainable power supplies are accessible for all. This future is not only possible, it is essential. If we are to limit climate change to well below 2°C, the global transition from dirty to clean energy needs to happen fast, and no later than 2050.

Discussions about climate change often rightly focus on solutions, exploring the opportunities of a rapidly expanding renewables sector and dramatic increases in energy efficiency. But attention also needs to be given to the problem itself – the burning of fossil fuels.

There is a huge energy transition underway across the world. Countries are committing to build vast amounts of wind and solar capacity to generate clean electricity. But, in Europe, this has not led to as large a fall in greenhouse gas emissions (GHG) as many had forecast.

This report highlights that policy is helping to drive a global transition to a zero-carbon economy, but also shows that policy is needed to drive a transition out of a high-carbon economy too. The report focuses on the 22 EU member states that still rely on coal power stations for electricity generation, and underlines that continuing to burn coal threatens the world's chances of limiting warming. It explains why European countries must lead the way on phasing out coal, setting an example that the rest of the world can follow.

Underlying this report are the results of a year-long exercise to map all the coal power stations in Europe. Coordinated by the Climate Action Network (CAN) Europe, a large and comprehensive database of all Europe's coal power stations was built. This database links power stations to official EU registries to get up-to-date CO2 emissions for 2014, and also to 2013 data on all non-CO2 pollutants. Added to this is a wealth of information at a unit level, including commissioning dates, Megawatt capacity, fuel type and announced closure dates, which have enabled us to perform a comprehensive analysis of the coal situation in Europe.

This is the first analysis of its kind of Europe's coal power stations. Up to now, analysis has focused on either the entire electricity sector (including gas and oil power stations), or the entire coal sector (including coal use for steel and cement), which means the specific impact of coal power stations has never been fully reported until now.

Key findings

Coal power generation is prevalent and polluting. In 2015, 22 EU countries were still burning coal in 280 coal power plants. In 2014, coal power stations produced 18% of total European GHG emissions.

The European coal fleet is inefficient, old and dirty. In 2015, 66% of Europe's coal fleet had been in operation for 30 years or more. A single coal power station produces enough CO2 to matter at a national level. For example, Portugal's two coal power plants contribute 16% of national GHG emissions.

Closing coal power stations represents an enormous opportunity. Even in countries with just one or two coal power stations, phasing out coal could make a significant contribution to reducing emissions and protecting the climate.

European coal emissions must fall three times faster. An International Energy Agency (IEA) model shows that, to limit warming to 2°C, European coal emissions must fall on average by 8% every year until 2040. But CO2 emissions from coal power stations fell on average by just 2.3%, per year, over the last nine years.

A policy gap is failing Europe, and the rest of the world. This report demonstrates the urgent need for a dedicated and managed approach to coal if we are to phase it out at the speed required.

National coal phase-out plans are essential. Countries across Europe must enact strong national coal phase-out plans. Such plans could have a significant impact on reducing national, European and global GHG emissions, and will provide the leadership needed to demonstrate to the rest of the world how to achieve a full coal phase-out.

On 18 November 2015, the UK announced a plan to phase out all its coal-fired power stations by 2025. In doing this, the UK Energy minister had some tough words for coal: 'It cannot be satisfactory for an advanced economy like the UK to be relying on polluting, carbon intensive 50-year-old coal-fired power stations. Let me be clear: this is not the future.' [1]

Section 1:

Why leadership is needed on coal globally

All fossil fuels need to be phased out

The evidence is clear: to avoid catastrophic climate change, we need to phase out fossil fuels. Governments around the world agree that average global warming needs to be limited to 2°C; in fact, many countries want to go further and limit it to 1.5°C to safeguard the most vulnerable.[2] In 2014, the Intergovernmental Panel on Climate Change (IPCC) said, 'to limit warming to below 2°C, it would require substantial emissions reductions over the next few decades, and near-zero CO2 emissions by the end of the century.'[3]

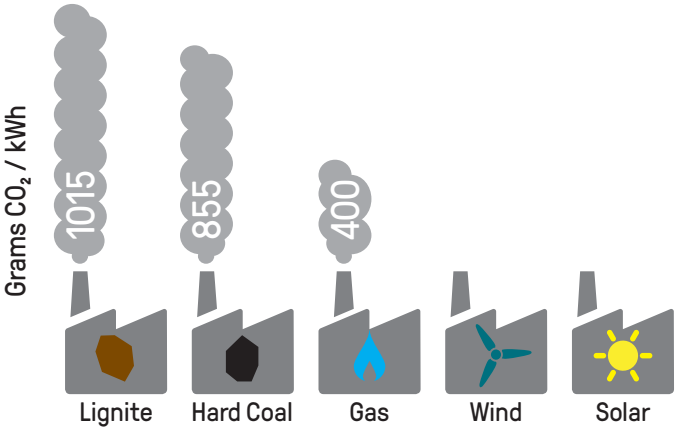
In response, in 2015 the G7 countries agreed, for the first time, that a complete decarbonisation of the global economy is needed over the course of this century. To this end, they committed to strive for a 'transformation of the energy sectors by 2050'.[4]

Under the umbrella of the Climate Action Network (CAN), civil society wants countries to go further, faster. If we are to limit warming to 2°C, and stand a fighting chance of limiting it to 1.5°C, CAN argues that all fossil fuel emissions need to be phased out, and a 100% renewable energy future phased in, as soon as possible, and no later than 2050.

This report shows how continuing to burn coal to generate electricity threatens the global push to limit climate change to below 2°C, and explains why European countries need to take a bold lead on phasing out coal power generation.[5]

Why coal is bad for the climate

CO_2 emissions from coal are significantly higher compared to other energy sources

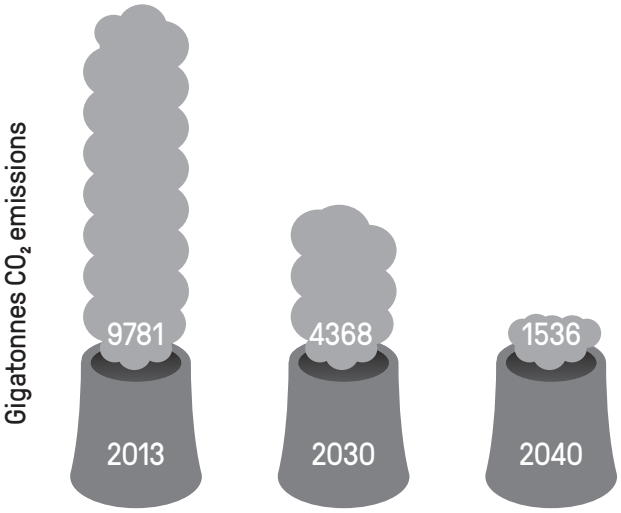


Source: IEA (2014): CO_2 emissions from fossil fuel combustion. Edition 2014, p.60.

88% of global coal reserves need to stay in the ground

Source: See McGlade, C & Ekins, P. (2015): The geographical distribution of fossil fuels unused when limiting global warming to 2°C. Nature.

Drastic emissions reductions by global coal are needed in order to stay below 2°C



Source: See OECD/IEA (2014): World Energy Outlook 2015.

Coal is the dirtiest way to generate electricity

Despite being dirty and inefficient, coal was still used to generate 41% of global electricity in 2013.[6] In fact, coal power stations are the world's biggest emitters of CO_2. The International Energy Agency's (IEA) 'World Energy Outlook 2015' figures for 2013 show that coal power stations account for 31% of all CO_2 emitted from burning fossil fuels, considerably more than is emitted by the entire oil demand for global transport.[7]

In comparison to other forms of power generation, CO_2 emissions from coal are huge. To produce enough electricity for an average European household for one year, 4-5 tonnes of CO_2 would be emitted if the electricity was generated from coal. If the same amount of electricity was generated from natural gas, 2 tonnes of CO_2 would be emitted; if the electricity came from renewables like wind and solar there would be no CO_2 emissions.[8]

Coal is not only more carbon intensive than gas, it is also burned in less efficient power stations. There is little that can be done to make coal cleaner. New 'ultra-supercritical' coal power stations still produce substantially more CO_2 than gas power stations.[9] Also, carbon capture and storage (CCS) technology remains unproven as a fully integrated process. Effective capture technology has not been developed and safe long-term storage on the scale necessary has not been demonstrated. It is hard to see how CCS for coal would ever be able to compete on price with renewables, which are falling in cost every day.[10]

Coal power stations also emit huge amounts of other pollution as well as CO_2. Sulphur dioxide, nitrogen oxides and dust particles can enter the human body and cause a range of health issues – mostly breathing problems such as asthma and bronchitis, which can be fatal. Heavy metals like mercury are also released into the atmosphere and water, which can impact the immune system, with babies most at risk.[11]

2013 CO_2 emissions from fossil fuels by sector

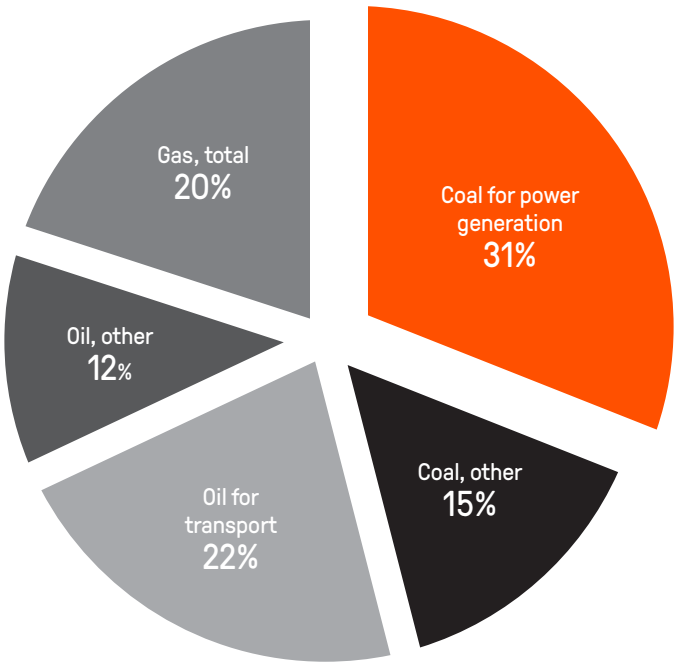


Figure 1, Source: Published in the IEA 'World Energy Outlook 2015'

Emissions by sector to limit climate change to 2°C

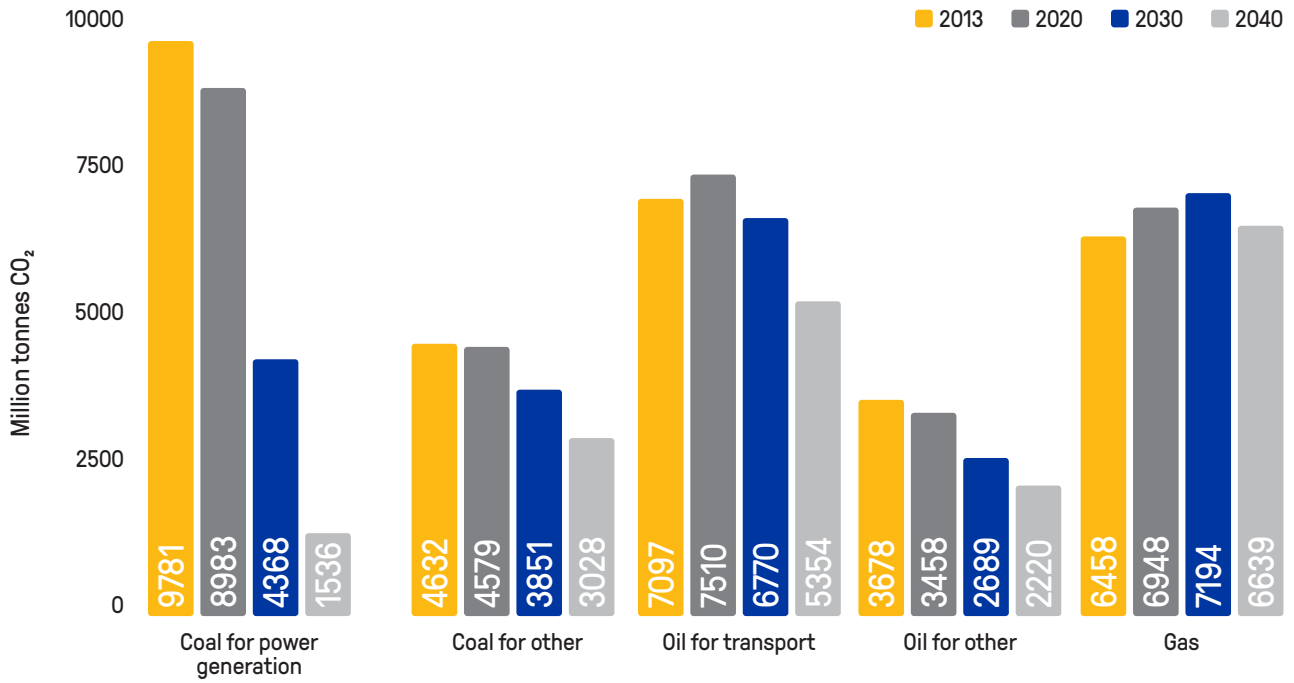


Figure 2, Source: IEA scenario from 'World Energy Outlook 2015'.

Coal emissions need to collapse to limit climate change to 2°C

The IPCC has calculated how much CO2 can be emitted after 2014 if we are to limit warming to 2°C. In response, the IEA has concluded that globally we must not emit more than 980 gigatonnes of CO2 from energy use after 2014.[12]

The IEA has also modelled the global energy system, showing how to most efficiently constrain CO2 emissions to 980 gigatonnes. This model is published in its 'World Energy Outlook 2015' (see figure 2).[13]

The IEA model shows that:

- By 2030, global CO2 emissions from coal must halve.
- By 2040, the global phase-out of coal generation must be 85% complete.
- In total, global CO2 emissions from coal must fall 6% every year for 27 years.

The IEA finds that coal power emissions must fall much more aggressively than any other sector – coal power emissions must fall by 6%, per year, compared to an average of 1%, per year for all other sectors. This is because the IEA modelling implies replacing coal with zero-carbon generation is the quickest and cheapest way to reduce global CO2 emissions. Its modelling shows a huge growth in all types of non-fossil generation, especially solar, wind, biomass and hydro, but it also shows growth in power generation from nuclear and coal using carbon capture and storage.

Replacing coal with renewables is viable. Bloomberg's respected New Energy Finance analyst group publishes updated costs for all power generation types every quarter. In October 2015 it said, 'onshore wind and solar PV are both now much more competitive against the established generation technologies than would have seemed possible only five or 10 years ago'.[14] It is not, therefore, surprising that the IEA believes that a significant reduction in global emissions will come from phasing out coal power generation and replacing it with renewable technologies.[15]

The outcomes of the IEA's 2°C model are supported by one of the most authoritative research papers on this subject, which also shows that coal burn needs to collapse. Research by University College London (UCL), published in Nature in January 2015, uses the same IPCC carbon target as the IEA and, using a global model to create 'an economically-optimal solution', it shows how much of each fossil fuel can be burned. It then compares these results to the known reserves of fossil fuels. It concludes that 88% of global coal reserves must stay in the ground. For Europe, the research estimates that 89% of its 313 gigatonnes of coal reserves needs to stay in the ground.[16]

The IEA is not over-dramatising the situation. In fact, its model is conservative and emissions from burning fossil fuels will likely need to fall even further than it suggests. First, the IEA model assumes emissions will fall rapidly from 2013, yet emissions were unchanged in 2014.[17] Second, the IEA assumes large amounts of 'negative emissions' after 2050, which is when CO_2 is sucked out of the atmosphere, but no technology currently exists to do this at a large scale. Third, the IEA assumes a 50% chance of limiting climate change to 2°C, which still leaves a 50% chance of higher warming.

Global change in coal consumption

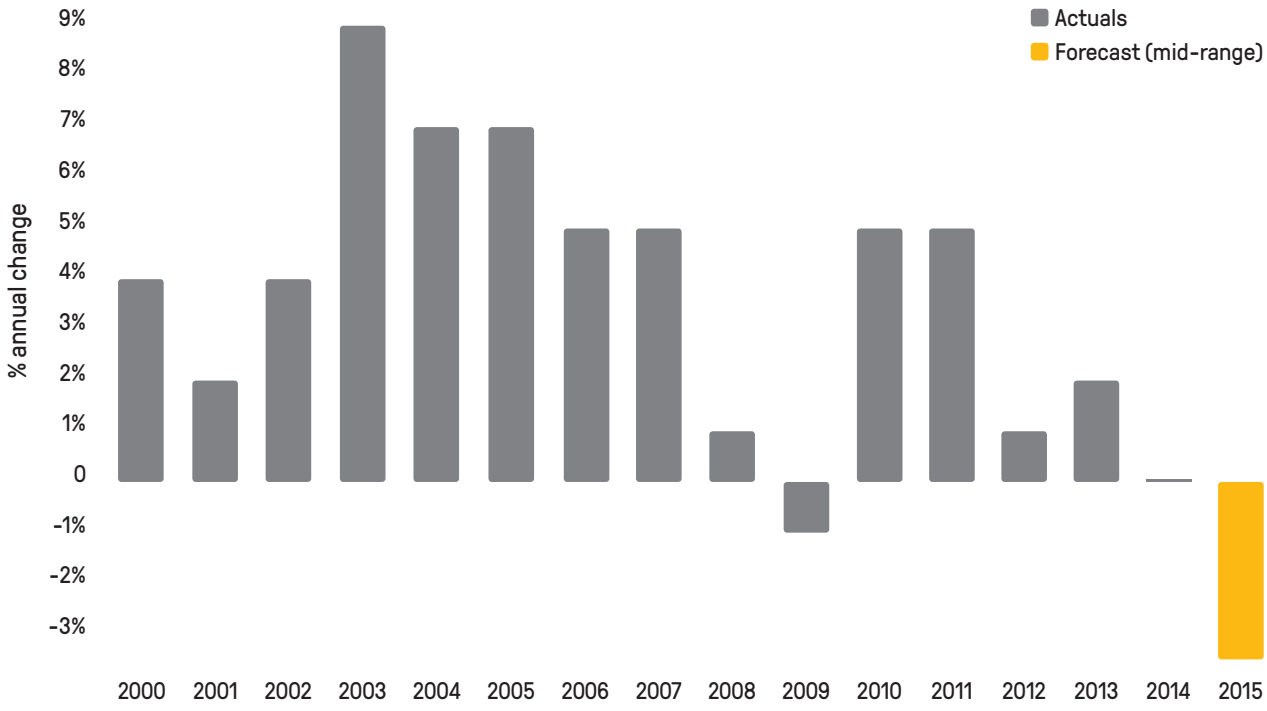


Figure 3, Source: 2000 to 2014 from BP Statistical Review of World Energy; 2015 is from Greenpeace forecast from report 'Coal is in Terminal Decline'.

The tide has turned against coal

In 2015, however, global coal consumption fell significantly. It is likely to fall by the largest amount in history: a drop of between 2.3 – 4.6% from 2014, according to research by Greenpeace.[18] This is because renewables and better energy efficiency are reducing the need to burn coal for power generation.

The Greenpeace research shows that coal use in China fell by 4.6% from January to September 2015 versus the same period last year, much of which was from the electricity sector. Electricity consumption growth fell to almost zero as the economy shifted towards less energy-intensive sectors, and huge amounts of non-fossil generation capacity were built including wind, solar, hydro and nuclear, which enabled coal generation to see unprecedented falls. China has an added incentive: pollution from coal is estimated to cause 1.2 million premature deaths there per year.

In the United States, coal generation is on target to fall by 9% this year, as renewables and gas replace coal. Coal's share of the electricity mix has dropped to 35% this year, compared to 40% last year, and 50% a decade ago.

The same factors are driving down coal burn throughout the world. For example, Japan, Indonesia, Mexico and Turkey are all expected to post falls in coal generation, according to the same Greenpeace research.

But the long-term fall in coal use is not guaranteed. Figure 3 shows recent changes in coal consumption: 2015 will be the first fall since 2009, and even record falls in 2015 do not meet the 6% needed globally per year until 2040.

In addition, the threat that new coal power stations will continue to be built remains, especially in Asia. Research led by CoalSwarm shows that if all the new coal power plants planned or under construction went into operation, they would use 25% of the remaining IEA CO_2 budget that can be emitted by all fossil fuels.[19] These extra emissions would come on top of those from the already existing global coal fleet.

However, the global frenzy to build new coal power stations has receded: since 2010, for every coal project completed, two projects are cancelled.[20] In the US and the EU, the age of building many new coal power stations is over.

European countries need to lead on phasing out coal generation

Emissions from the world's coal power stations must halve by 2030, and be almost phased out by 2040. This is an incredible challenge. It requires a change of mindset: that generating electricity from coal is unacceptable. For it to happen, the world needs to plan how to phase out coal.

European countries must take a lead on phasing out coal. They are in a strong position: electricity demand is falling and renewables targets are already in place. Europe's coal power stations are also mostly old, inefficient and uneconomic. For many countries, phasing out coal would not be a big step. In each one, including those entrenched in coal generation like Germany and Poland, a national coal phase-out plan will be necessary to guide the energy transition over the coming years.

For every European country that commits to a coal phase-out, the message becomes louder and clearer: every country across the world needs a plan to get to zero coal.

Section 2:

EU countries' coal emissions are not falling fast enough

European emissions from coal generation need to collapse

Section 1 highlighted that global CO_2 emissions from coal generation need to collapse. The situation for Europe is no different. According to modelling by the IEA, emissions must drop to 20% of 2013 levels by 2030. By 2040, emissions should be only 10% of what they are now – see figure 4. In total, this means European coal power emissions must fall on average by 8% every year until 2040.

State of play: the large coal fleet of European countries

Our research for this report has uncovered, for the first time, the true picture of electricity generation from coal power stations in every European country.

In 2015, 22 EU countries were still burning coal in a total of 280 coal power plants. Only six countries are coal power free: Cyprus, Estonia, Latvia, Lithuania, Luxembourg and Malta.[21]

These 280 coal power stations produced 18% of total European greenhouse gas (GHG) emissions in 2014.[22] This is similar in magnitude to all road transport, which represented 21% of emissions.[23]

In five countries, the contribution of coal power stations to total national GHG emissions was over a quarter or more, with 44% of GHG emissions produced by coal power stations in Bulgaria, followed by 34% in Greece, 33% in the Czech Republic, 33% in Poland and 28% in Germany.

EU coal power emissions to limit climate change to 2°C

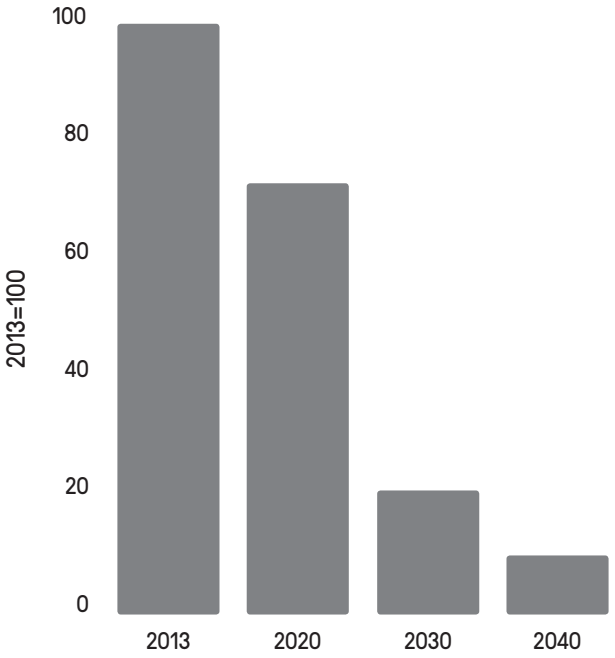


Figure 4: Source: IEA scenario from 'World Energy Outlook 2015'

Austria: Europe's role model

KEY FACTS

Coal power capacity: 697 MW
Number of coal power stations in 2015: 3
GHG emissions from coal: 3 %

Of three coal-fired power plants in operation in Austria at the beginning of 2015, only 1.5 will remain in operation in 2016.

The closure of a power plant in Riedersbach, and the shutdown of Block I of Dürnrohr by Austria's biggest utilities company, Verbund, has effectively signalled the end of coal in Austria. Verbund has also publicly committed to cancel the contract of a power plant in Mellach, at the earliest possible date, in 2020. Although this commitment does not make use of the word 'closure', it is unlikely any other company would be willing to take on a power plant that is over 30 years old, once Verbund exits in 2020.

This leaves the remaining Block II of Dürnrohr, which is operated by the lower-Austrian utilities company EVN. EVN announced in November 2015 that it will close this last unit in 2025, at the latest, and then exit coal completely.

Importantly, Austria is showing that closing power plants does not have to lead to job losses. In addition to Block I of the coal-fired power plant in Dürnrohr, Verbund has also closed an oil-fired power plant in Neudorf and two gas-fired power plants in Pont-sur-Sambre and Toul in France. It has done so without creating any unemployment. All staff from the closed plants have been successfully integrated into other parts of the company.

In short – given the closures in 2015 and those planned for 2016, alongside publicly announced phase-out dates – coal is clearly on the way out in Austria. It is hoped that a phase-out date for the remaining block of Dürnrohr can be achieved much earlier than 2025. A 2020 closure is possible. Austria, once a coal mining country and soon to be coal power free, can now act as a role model both in Europe and beyond.

Even a single coal power station produces enough CO_2 to matter at a national level. The two coal power stations that operate in Portugal – Sines and Pego – contribute 16% of its national GHG emissions. In Slovenia, two coal power stations produce 25% of national GHG emissions. While in Ireland, the GHG emissions from one coal power plant – Moneypoint – contribute 6% of national GHG emissions. The 44% of GHG emissions from coal in Bulgaria are produced by just 12 power stations, while only seven plants in Greece emit 34%.

This represents an enormous opportunity. It shows that, even in countries with just one or two coal power stations, a coal phase-out could make a significant contribution to climate protection, something not easily achieved through other means.

Most coal power stations in Europe are old. By 2015, 66% of Europe's coal fleet had been in operation for 30 years or more. Several EU countries rely almost exclusively on older power stations. For example, the United Kingdom has 11 large coal power stations; 10 of these have been operating for at least 43 years.

Old coal power stations are 'sub-critical', which means they emit around 30% more than new power stations to produce the same amount of electricity. Old also means a plant is more prone to break-downs – for example, during a recent emergency situation in the UK power system, 35% of the UK coal fleet was offline.[24] And old often means inflexible: many lignite power stations cannot be turned off overnight, which means they often operate for more hours than new power stations.

Europe's coal power stations are also very dirty. In addition to emitting CO_2, they are responsible for around half of the air pollution emitted by European industry. Figure 5 shows that in 2013, coal power stations emitted 52% of all sulphur dioxide (SO_2) from Europe's industry, 40% of nitrogen oxides (NO_x), 37% of all dust particulates (PM), and 43% of all reported mercury emissions.

EU's fleet of coal power stations

22 countries across the EU still use coal power for electricity generation

Coal plants: number of power plants in 2015
Coal power plant emissions: % of national GHG emissions 2014

Air pollutants by sector

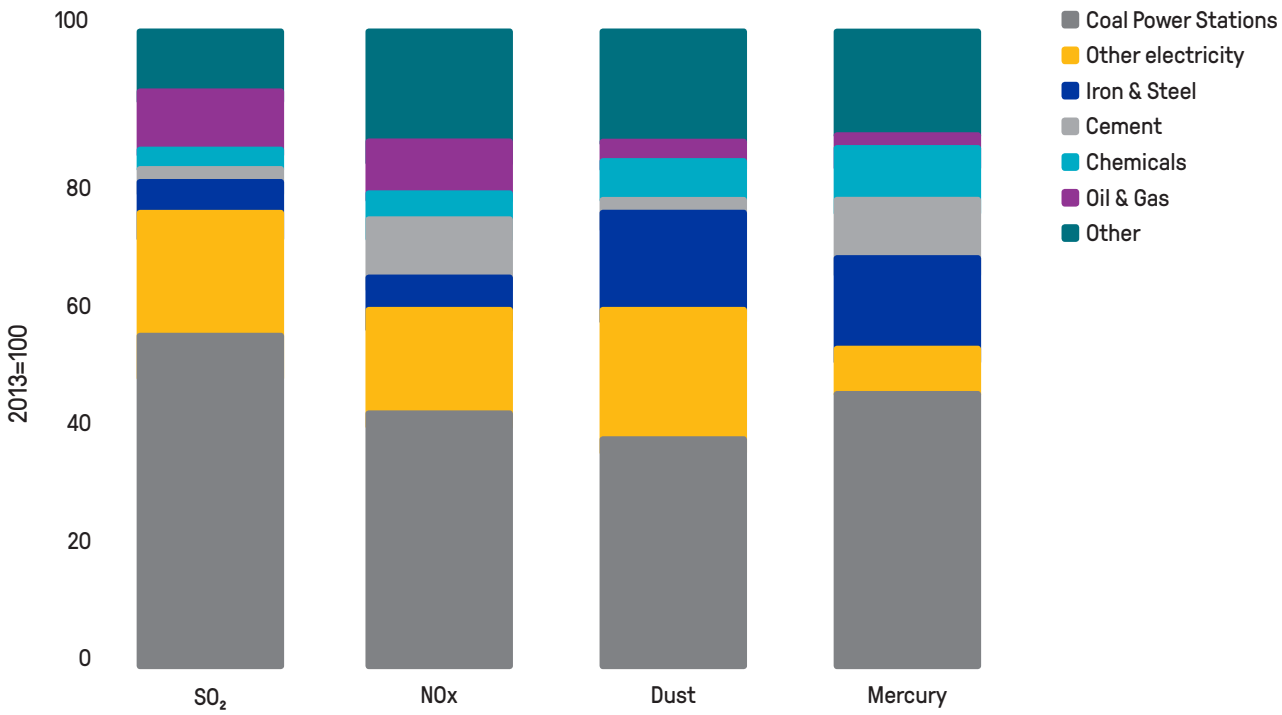


Figure 5, Source: own calculations, based on 2013 pollution data for installations from E-PRTR (The European Pollutant Release and Transfer Register)

Pollution from coal is costing Europe dearly. The European Environment Agency (EEA) says of the top 30 most damaging installations on its industrial installation list, 26 are fired by hard coal or lignite.[25] In 2013, the Health and Environment Alliance (HEAL) estimated the health impacts of coal-based air pollution. It found that, in the EU, coal causes 'more than 18,200 premature deaths, about 8,500 new cases of chronic bronchitis, and over 4 million lost working days each year. The economic costs of the health impacts from coal combustion in Europe are estimated at up to €43 billion per year.'[26]

Table 1 shows the results aggregated for each of the 22 coal burning countries in the EU.

In January 2016, new air pollution limits under the EU Industrial Emissions Directive will apply to the coal fleet in the EU. Our analysis of the latest pollution, which is from 2013, shows 78% of the existing coal fleet do not meet these new limits for 2016, and require upgrading (see table 1). This means that many power plant operators are now facing the decision of whether to invest in life extensions or opt for closure. The key question is: what signal is the current policy framework and the energy market sending to operators, to invest in coal or to phase it out?

Table 1: Coal facts for EU countries in 2015

	Coal power stations				Coal power sector				
	Number	MW	% 30 years or older	% not met 2016 air quality limits in 2013 [27]	% of total emissions from coal (2014)	CO_2 (2014, mt)	Change vs 2008	CO_2/ person (2014, tonnes)	% electricity demand generated from coal (2014)
EU	**280**	**162,671**	**66%**	**78%**	**18%**	**762**	**-12%**	**1.5**	**24%**
Austria	3	697	0%	54%	3%	2	-47%	0.3	4%
Belgium	1	556	100%	0%	2%	3	-41%	0.3	2%
Bulgaria	12	5,674	67%	100%	44%	26	-5%	3.6	53%
Croatia	2	308	37%	100%	9%	2	0%	0.5	13%
Czech Republic	39	8,737	92%	91%	33%	42	-16%	4.0	62%
Denmark	8	3,689	54%	57%	19%	10	-40%	1.7	31%
Finland	10	2,269	74%	77%	13%	8	-15%	1.4	13%
France	7	3,766	99%	100%	2%	11	-53%	0.2	2%
Germany	70	47,795	51%	58%	28%	256	-4%	3.1	45%
Greece	7	4,028	57%	80%	34%	34	-17%	3.1	44%
Hungary	3	1,095	100%	100%	13%	7	-25%	0.7	14%
Ireland	1	842	33%	100%	6%	4	-4%	0.8	24%
Italy	11	8,069	31%	36%	9%	39	-7%	0.6	12%
Netherlands	8	7,393	17%	47%	11%	20	3%	1.2	24%
Poland	46	30,074	77%	100%	33%	129	-7%	3.4	80%
Portugal	2	1,820	33%	35%	16%	10	8%	1.0	21%
Romania	14	4,644	64%	100%	18%	19	-39%	1.0	29%
Slovakia	5	857	92%	100%	7%	3	-38%	0.6	11%
Slovenia	2	1,236	55%	100%	25%	4	-32%	2.1	26%
Spain	15	9,747	92%	100%	13%	43	-9%	0.9	16%
Sweden	3	501	79%	100%	2%	1	44%	0.1	0%
UK	11	18,873	97%	100%	17%	87	-21%	1.3	29%

Source: own analysis, based on reported data in the EU Transaction Log, Eurostat, E-PRTR.

Field	Definition	Source
Number	Number of operational coal power stations in 2015	CAN database
MW	Megawatt net capacity of these operational coal power stations	CAN database
% 30 years or older	Proportion of capacity that was commissioned 30 years or more ago, as of 2015	CAN database
% not meeting 2016 air quality standards in 2013	Air quality rules get stricter from 1st Jan 2016. Preliminary research shows the proportion of capacity of coal plants operational in 2015 that did not yet comply, and would have to upgrade based on their 2013 pollution data.	CAN database, calculated from SO_2 and NOx emissions from E-PRTR.
% of total emissions from coal, 2014	2014 CO_2 Coal emissions divided by national GHG emissions for coal power stations operational in 2014	CAN database, National emissions European Environment Agency's "Approximated EU GHG Inventory 2014".
CO_2 (2014, mt)	Million tonnes CO_2 from all coal power stations in 2014	CAN database, EUETS actual emissions.
CO_2/person (tonnes, 2014)	Tonnes of CO_2 emitted by coal power stations divided by population in 2014	CAN database, Population from EUROSTAT.
% electricity demand generated from coal (2014)	TWh coal generation, divided by TWh (terawatt hour) final consumption	EUROSTAT

Europe's coal emissions are not falling fast enough

The EU still has a lot of coal power stations, but closures have taken place. Are European countries bringing down coal emissions sufficiently fast?

Our research shows that CO2 emissions from coal power stations have fallen from 934mt in 2005 to 762mt in 2014 – see figure 6. This means CO2 emissions have fallen an average of 2.3%, per year, over the last nine years.

Coal emissions are falling because the low-carbon transition is already underway in all European countries. Generation from renewables is increasing across Europe as new wind and solar capacity is built. Also, electricity consumption is falling in almost every country as appliances – from air-conditioning units to televisions – become more energy efficient, driven by technological advances and energy efficiency policies. It is possible that, due to this improvement in efficiency, European electricity consumption will fall by 10% this decade.[28]

Renewables and falling electricity demand has led to a collapse in conventional electricity generation from coal, gas, oil, nuclear and hydro. But since 2010, it is mostly gas generation that has been falling, not coal generation. In fact, only 8% of the fall in conventional generation came from burning less coal (see figure 7). Therefore, while coal emissions have indeed fallen, they have done so only modestly.

The policy framework and market forces at work are currently not leading to a substitution of coal power stations with renewables capacity and electricity efficiency wins, and therefore the full benefits of renewables and energy efficiency are not being realised.

EU coal power station emissions

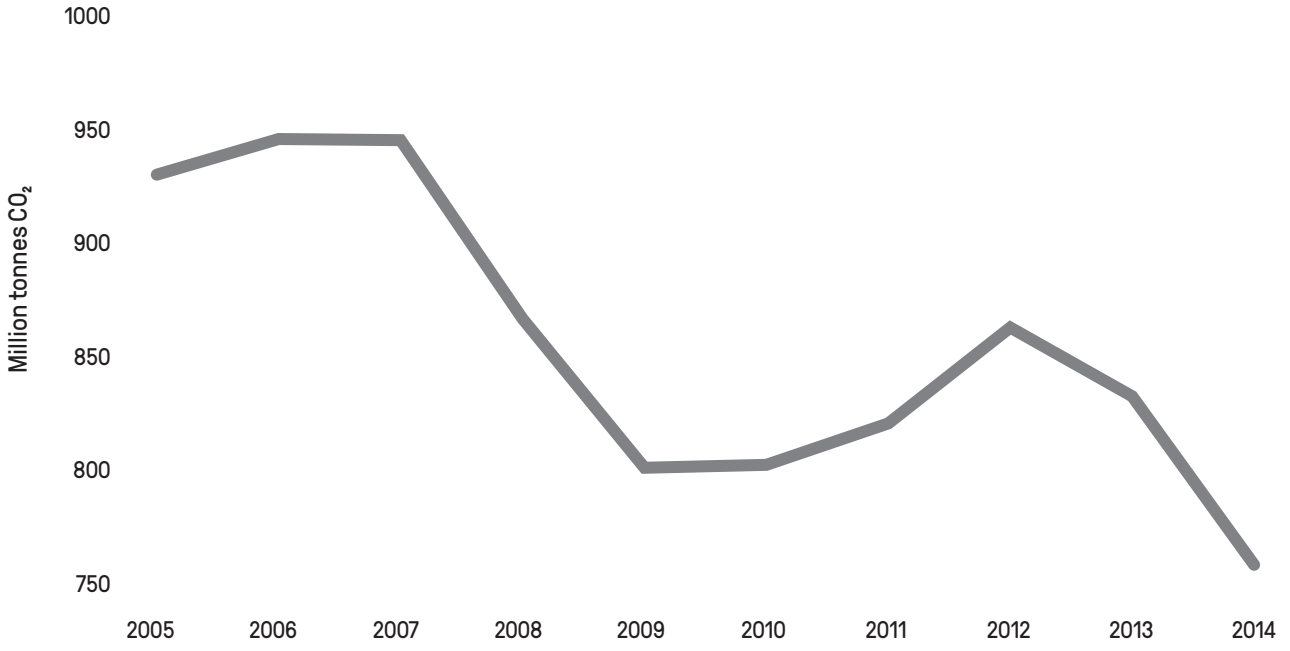


Figure 6, Source: own calculations, based on official EU ETS CO_2 data in the EU Transaction Log reported for coal power stations.

Portugal: coal free by 2021?

KEY FACTS

Coal power capacity: 1820 MW
Number of coal power stations in 2015: 2
GHG emissions from coal: 16 %

The recently approved National Programme for Climate Change 2020/2030 states that no coal power plants will be producing electricity in Portugal by 2030. During the last decade, the country has increased its electricity production capacity from renewable sources, particularly wind and solar, complementing the existing hydropower available, with renewables now providing around 60 % of total national consumption. The country has also invested in combined cycle natural gas power plants, which are currently underperforming since an expected growth in demand did not occur.

Portugal has two major coal power plants: 1192 MW in Sines and 628 MW in Pego. The contracts between the state and these plants will end by 2017 in Sines and by 2021 in Pego. After those dates, without the subsidies that have been supporting this industry, the power plants will have to work under much harder competitive conditions within the electricity market. If no government support is made available, both plants will have to shut.

Several factors should see the pressure to close coal plants rise: the carbon price in Europe is set to increase with new emissions trading rules; an electricity system dominated by renewables will need to be more flexible than a coal power plant allows; and the opportunity to improve interconnections between Portugal, Spain and France will allow a more efficient management of the network, through which these countries can share generation capacity across borders. If the government makes the decision to stop subsidising coal – a measure that makes economic sense, and will protect the climate and improve air quality – Portugal has an excellent opportunity to be coal free by 2021.

Change in conventional generation, 2010 to 2014

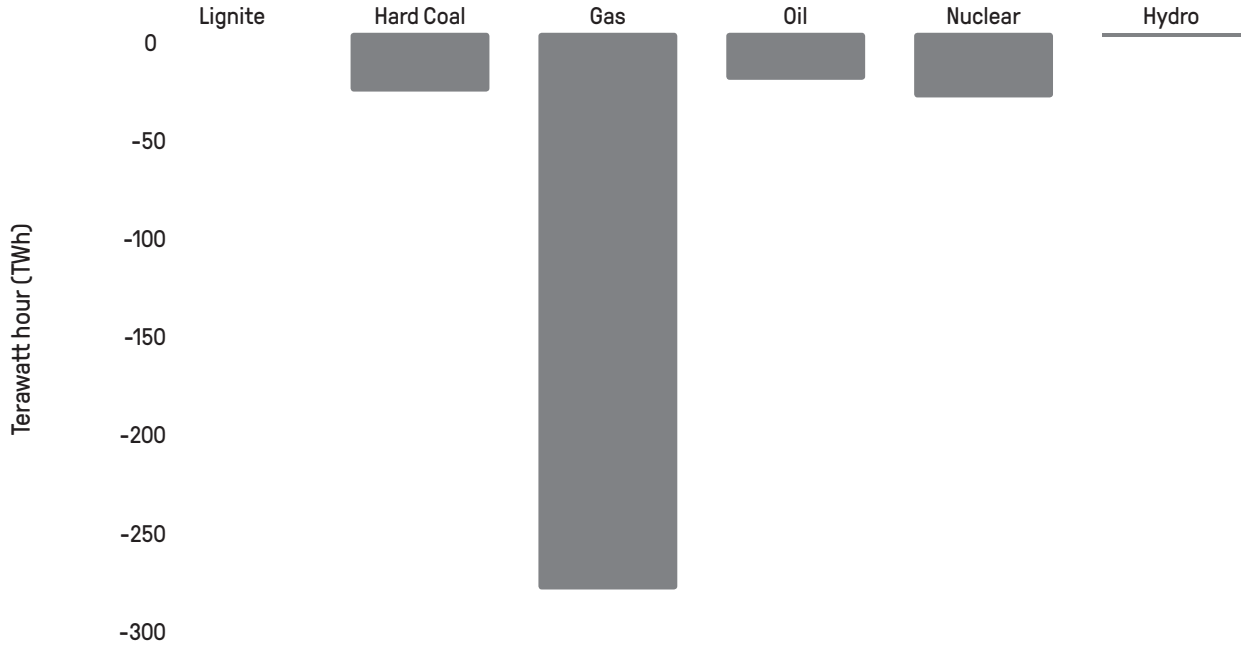


Figure 7, Source: EUROSTAT, Sandbag

A shift from gas generation to coal generation is becoming hard to reverse, as gas power stations are shutting. In 2012 and 2013 alone, 10 European utilities announced that 41 gas power units, with a capacity of 21GW, would be mothballed or closed.[29] Closures are leading to tighter margins across Europe, which, in turn, are discouraging coal capacity from retiring.

There is a policy failure here, which is preventing the phasing out of coal power stations at the speed that is required. Right now, coal emissions are not falling nearly fast enough. Coal emissions fell by 2.3%, per year from 2005 to 2014. But the IEA has calculated that European coal emissions need to fall on average by 8% every year until 2040.

Coal emissions must, therefore, fall three times faster than compared to the average rate of emission reductions during the last decade, in order to limit climate change to 2°C.

Governments need to take decisive action to ensure that coal power stations are closed at the rate required to limit climate change.

Coal emissions need to fall 3 times faster

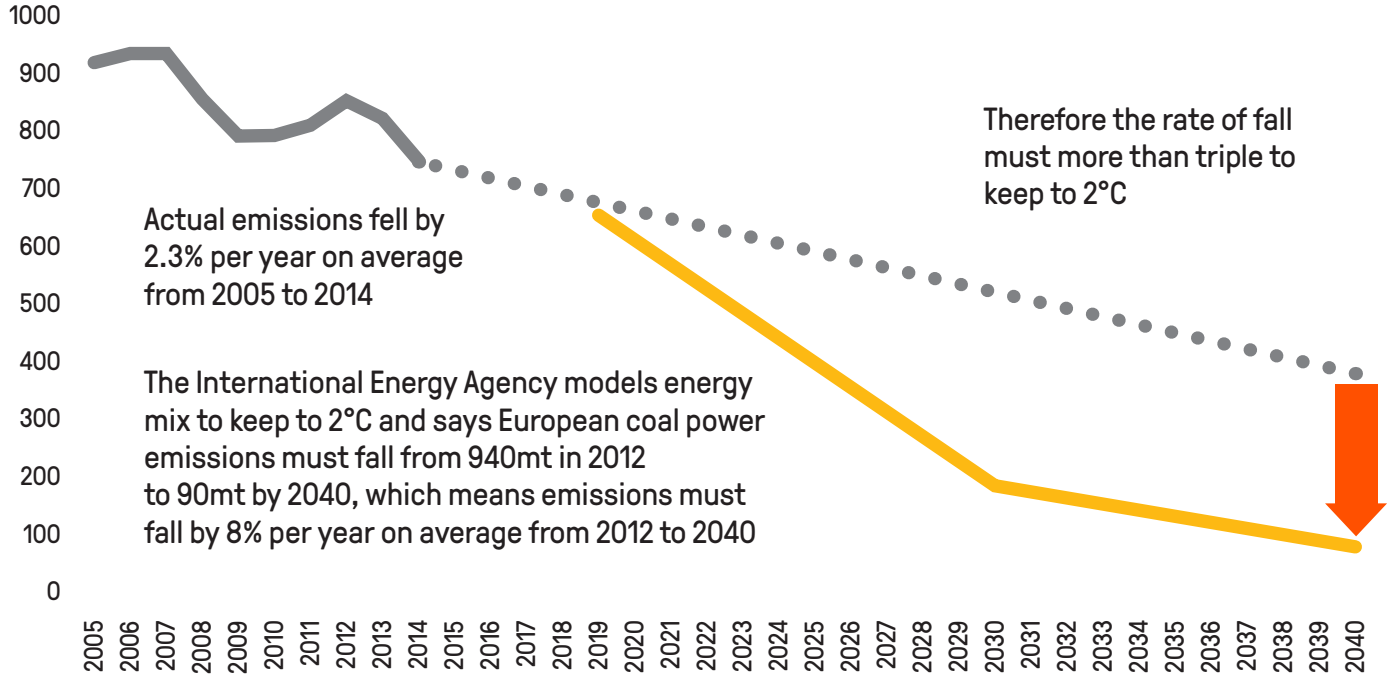


Figure 8, Source: own calculations, based on EU Transaction Log, IEA WEO 2015

Section 3:

Every European country needs a coal phase-out plan

The transition to a zero-carbon electricity system is also a transition out of a high-carbon electricity system. Currently, policy is focusing only on scaling-up renewables and energy efficiency, hoping coal power stations will just close, with no plan in place to ensure that happens.

The EU Emissions Trading Scheme – the flagship EU policy to reduce CO_2 emissions – has failed to deliver a meaningful carbon price. This makes coal less expensive than expected. It means renewables generation has been displacing gas, not coal generation.

There is a huge policy gap: how does a country transition out of coal generation?

Adverse policy measures and conflicting energy objectives often lead to political lingering rather than decisive action. The case studies for Finland and Portugal in this report (see page 15, 13) all demonstrate the need for a dedicated and managed approach to coal. Even Austria, a country on track to become coal free, could phase out coal earlier than is likely to happen. In most countries, even those with national coal phase-out ambitions, early closure dates for plants have not been secured. The IEA model shows a dramatic fall in coal emissions is needed, which means every year of less pollution counts and coal power stations need to close as soon as possible.

The answer to this policy gap is to put in place a coal phase-out plan. This would be a national government plan to phase out each coal power station by a defined date, similar to the German nuclear phase-out plan. Each government should decide for itself how quickly it is able to phase out coal generation, as part of its overall energy transition.

On 18 November 2015, the UK announced a plan to phase out its remaining coal-fired power plants by 2025. This was a historic moment, making the UK the first G20 country to announce a coal phase-out. This case study is discussed on page 17.

Finland: time to walk the talk

KEY FACTS

Coal power capacity: 2269 MW
Number of coal power stations in 2015: 10
GHG emissions from coal: 13 %

In September 2014, at the UN Climate Summit in New York, Finland's president Sauli Niinistö announced that Finland is heading for a phasing out of coal in power plants by 2025.

Coal phase-out should not be hard to achieve for three reasons: coal plays a relatively small role in Finland's energy mix (about 10 % of total energy and 13 % of electricity); there's plenty of energy efficiency and renewable energy potential to replace it; and the increase of renewable energy in the Nordic electricity market is already pushing coal out.

Nevertheless, more than a year after president Niinistö's announcement, Finland is still lacking a clear roadmap and measures to achieve its goal. In fact, the new government that took office in April 2015 has moved the goalposts by five years, now aiming to phase out coal 'during the 2020s'.

Coal is the main fuel in 10 power plants, mostly owned by three companies: Fortum, PVO and Helen. In addition to those plants, coal is burned as a supplementary fuel in a few municipal plants. Two of these 10 plants are on their way out, because they have become too expensive to run. The challenge lies with phasing out those power plants that produce both power and heat for big cities. Substituting coal-fired heat production with clean and smart alternatives can be done, but not overnight. That is why decisive action by national government is now needed, in cooperation with local governments whose energy systems will be affected.

Finland's coal phase-out goal faces its first true litmus test in winter 2015, as Helsinki decides whether or not to close down its two big coal plants. As the last Nordic capital city that hasn't yet set a course towards 100 % renewable energy, it is a high time for Helsinki to change.

What are the benefits of a national coal phase-out plan?

A coal phase-out plan would bring huge benefits, making the transition to a 100% renewables based electricity system significantly cheaper and quicker, while providing pro-active measures to help affected communities who are currently dependent on the coal industry.

The reasons for introducing national coal phase-out plans are compelling, and most apply to some extent in every country in Europe:

Securing new investment – a coal phase-out plan gives investors the confidence to support replacement capacity. Renewables companies will have the certainty they need to scale up operations and invest in jobs and equipment, and so bring down the cost of building new renewables. A phase-out plan also gives clarity about how much other capacity is needed to replace coal – interconnectors, demand response, storage and peaking plants – as well as when. This will give people confidence that closing coal power stations will not result in power shortages.

Managing coal power station closures – a coal phase-out plan will enable power plants to close in a controlled, well-managed way. Many regions have a high concentration of jobs in coal mining and coal power stations. A phase-out plan would enable the transition to begin early and with as little impact on communities as possible. Coal power stations are currently considering large, costly upgrades to comply with tighter air quality standards in the future. A phase-out plan will also avoid over-investment, saving costs that would ultimately be borne by the consumer.

Decarbonising electricity – a coal phase-out plan will provide a pathway to a 100% renewables based electricity system. The electrification of transport and heat are vital components of the decarbonisation of Europe, but coal's current place in the electricity mix undermines the rationale.[30] Therefore, a coal phase-out plan would not only give confidence in the decarbonisation of the electricity sector, but also confidence that it will act as an enabler for the further decarbonisation of other sectors. It would give the green light to begin the deployment of electric cars and heat pumps.

Adopting a national coal phase-out plan is essential to help a country decarbonise as cheaply and quickly as possible.

UK: first G20 economy to announce a coal phase-out

KEY FACTS

Coal power capacity: 18,873 MW
Number of coal power stations: 11
GHG emissions from coal: 17 %

On 18 November 2015, the UK Energy Minister Amber Rudd announced plans to close all coal-fired power stations by 2025. A consultation is due in spring 2016, which will presumably propose how this will be legally implemented. The government has also said restrictions will apply from 2023.

Announcing the phase-out, the minister was tough on coal: 'It cannot be satisfactory for an advanced economy like the UK to be relying on polluting, carbon intensive 50-year-old coal-fired power stations. Let me be clear: this is not the future.'

With its ageing coal fleet (the average age of a UK coal plant is 41 years), and all but one of the 11 remaining plants currently failing to comply with stricter EU air pollution regulations, this decision is hugely important. It is significant in terms of the emissions that will be saved by ending the use of the dirtiest fossil fuel. It is also symbolic that the country where the Industrial Revolution began is evolving beyond the need for coal.

The government's announcement was less clear about how coal generation will be replaced. It said that gas capacity urgently needs to be built, although that doesn't necessarily mean that there will be more gas generation. Gas and renewables work together to maintain system security in the short term. Government estimates from last year – which anticipated coal generation falling to 1% of the mix by 2025 – suggested new gas capacity was needed as back up but, importantly, it did not lead to an increase in generation.

The UK government is still unclear on whether enough renewables will be built to avoid increasing gas generation. It has said it will increase offshore wind to 10GW and solar to 12GW by 2020, if the cost is cheap enough. This battle is yet to be fought.

The UK government must now clearly set out how coal will be phased out of the UK system by 2025, and provide leadership to the world, showing that it is possible even for a large economy to transition from producing over a third of its electricity from coal to zero in just 10 years.

UK: "More Gas" means more capacity, not more generation

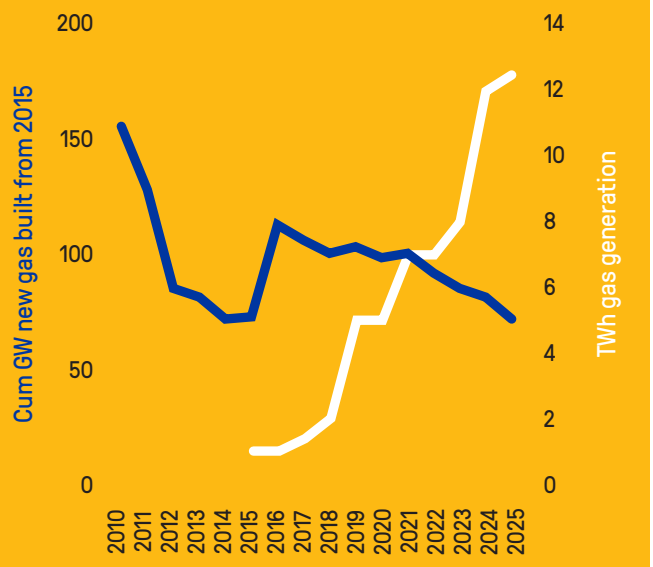


Figure 13. Source: Department of Energy and Climate Change base case forecast

What needs to happen next?

Every government in Europe urgently needs to develop and implement a national coal phase-out plan.

The plan should include:

- **A statement that all coal power stations need to close.**
- **A date, as early as possible, by which all of the nation's coal power stations will close.**
- **A pathway to that date, to ensure that coal emissions fall aggressively beforehand.**
- **A closure date for each coal power station, with a legal means of enforcing this.**

Such a plan should include measures to ensure a just transition for affected, coal industry dependent communities, and a plan for sufficient capacity to prevent future power shortages. The German government's nuclear phase-out is an example of how this can be done.

Every country should also consider how to aid coal phase out globally. First, by ensuring their state-owned utilities have a plan to close their foreign-owned coal power stations. Second, to put an end to any public investment flowing to coal power stations, mines and infrastructure abroad. Third, by sharing experiences on the world stage about how to phase out coal power generation.

All fossil fuels need to be phased out to make way for a future powered by renewables, and we need to start with coal, the dirtiest of all the fossil fuels. Every country needs to phase out coal, regardless of whether it only has one coal power station, or whether most of its electricity is dependent on coal. Policy must be put in place to make this happen, it cannot be left to chance.

European countries should lead the way on phasing out coal, providing a strong example that the rest of the world can follow. Only by doing this do we stand a chance of limiting climate change to 2°C.

Endnotes

1 See DECC (2015): Amber Rudd's speech on a new direction for UK energy policy: https://www.gov.uk/government/speeches/amber-rudds-speech-on-a-new-direction-for-uk-energy-policy

2 UNFCCC Cancun Agreements from 2010, see: http://cancun.unfccc.int/cancun-agreements/main-objectives-of-the-agreements/#c33

3 Emphasis added. IPCC (2014): Climate Change 2014. Synthesis report. Summary for Policy Makers, p.20: http://www.ipcc.ch/pdf/assessment-report/ar5/syr/AR5_SYR_FINAL_SPM.pdf

4 See the official G7 2015 communique: Leaders' Declaration G7 Summit, 7–8 June 2015, p.15 https://www.g7germany.de/Content/EN/_Anlagen/G7/2015-06-08-g7-abschluss-eng_en.pdf?__blob=publicationFile&v=3

5 While this report speaks of 'Europe' or 'European Union' or 'European countries' interchangeably for sake of readability, please note that the analysis was done for member states of the European Union only.

6 OECD/IEA (2015): World Energy Outlook 2015: p.587 https://www.iea.org/bookshop/700-World_Energy_Outlook_2015

7 Ibid

8 Uses conversion factors from the IEA (2014): CO2 emissions from fuel combustion, p. 60: http://wds.iea.org/wds/pdf/co2_Documentation.pdf

9 See reference in IEA document to ultra-supercritical coal efficiency: http://www.iea-coal.org.uk/site/2010/publications-section/dev-newsletter/is-switching-from-coal-to-gas-better-for-the-climate?

10 Bloomberg New Energy Finance (2015): Wind and Solar boost competitiveness versus fossil fuels: http://about.bnef.com/press-releases/wind-solar-boost-cost-competitiveness-versus-fossil-fuels/

11 For more background see HEAL (2013): The unpaid health bill. How coal power plants make us sick: http://www.env-health.org/IMG/pdf/heal_report_the_unpaid_health_bill_how_coal_power_plants_make_us_sick_final.pdf; Greenpeace (2013): Silent Killers: http://www.greenpeace.org/international/en/publications/Campaign-reports/Climate-Reports/Silent-Killers/

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15 For achieving a 100% renewables future, see also Greenpeace (2015): Energy [R]evolution 2015 scenario: http://www.greenpeace.org/international/Global/international/publications/climate/2015/Energy-Revolution-2015-Full.pdf

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17 IEA (2015): Newsroom article: Global energy-related emissions of carbon dioxide stalled in 2014: http://www.iea.org/newsroomandevents/news/2015/march/global-energy-related-emissions-of-carbon-dioxide-stalled-in-2014.html

18 This section gathers evidence from Greenpeace (2015): Coal is in Terminal Decline: http://www.greenpeace.org/international/Global/international/publications/climate/2015/Coals-Terminal-Decline.pdf. See Bloomberg article "Global Coal Consumption heads for biggest decline in history": http://www.bloomberg.com/news/articles/2015-11-08/global-coal-consumption-headed-for-biggest-decline-in-history

19 CoalSwarm tracks the plans to build new coal power stations. They calculate that those planned would emit 242GT throughout their lifetime, compared to the 980GT IEA 2°C budget. See "Country-by-Country Summary": http://endcoal.org/global-coal-plant-tracker/

20 See report from Sierra Club/CoalSwarm (2015): The worldwide coal boom is going bust: http://content.sierraclub.org/press-releases/2015/03/worldwide-coal-boom-going-bust-sierra-club-and-coalswarm-report-details-new

21 Estonia burns oil shale, which in CO2 intensity even exceeds coal. See OECD/IEA (2013): Estonia 2013: http://www.iea.org/publications/freepublications/publication/Estonia2013_free.pdf What little coal is burned in Estonia is chiefly for district heating or heating of individual houses. See Global Energy Network Institute: Energy Overview of the Republic of Estonia: http://www.geni.org/globalenergy/library/national_energy_grid/estonia/EnergyOverviewofEstonia.shtml

22 Between 2014 and 2015, approximately 12 plants have either closed or been deactivated or are expected to still close (Germany, Romania, France, Italy, Poland), in addition to the closure of a few individual units. Approximately six plants went into operation or test phase (Germany, Netherlands, Slovenia), in addition to a few new units. The decision to construct these additions in new capacity was taken prior to 2007/8, when investors still thought that was an economically sound decision.

23 See European Environment Agency estimates for 2014: http://www.eea.europa.eu/publications/approximated-eu-ghg-inventory-2014

24 See Sandbag's blog (2015): Coal is too old to be useful: https://sandbag.org.uk/blog/2015/nov/5/coal-too-old-be-useful/

25 Based on data for 2008-2012. For the full EEA list go to: http://www.eea.europa.eu/data-and-maps/daviz/industrial-facilities-causing-the-highest-damage

26 See HEAL (2013): The unpaid health bill. How coal power plants make us sick: http://www.env-health.org/IMG/pdf/heal_report_the_unpaid_health_bill_how_coal_power_plants_make_us_sick_final.pdf, p5

27 The preliminary analysis is based on installation data captured in the European Environment Agency's (EEA) pollutant register E-PRTR from 2013: plants are either completely or at least slightly above the new limits based on their 2013 pollution data. More detailed analysis at a plant-by-plant level will be needed, to see whether some of these plants have been retrofit since 2013 and will be able to meet the new 2016 limits under the IED; other plants are probably able to use already installed equipment more to meet these limits; while others will be making use of options to be exempted from these limits, at least temporarily. Even then, the percentage of plants that will need to see investments to be able to continue to operate is very high, especially given that even tighter clean air limits will come into force in the near future.

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