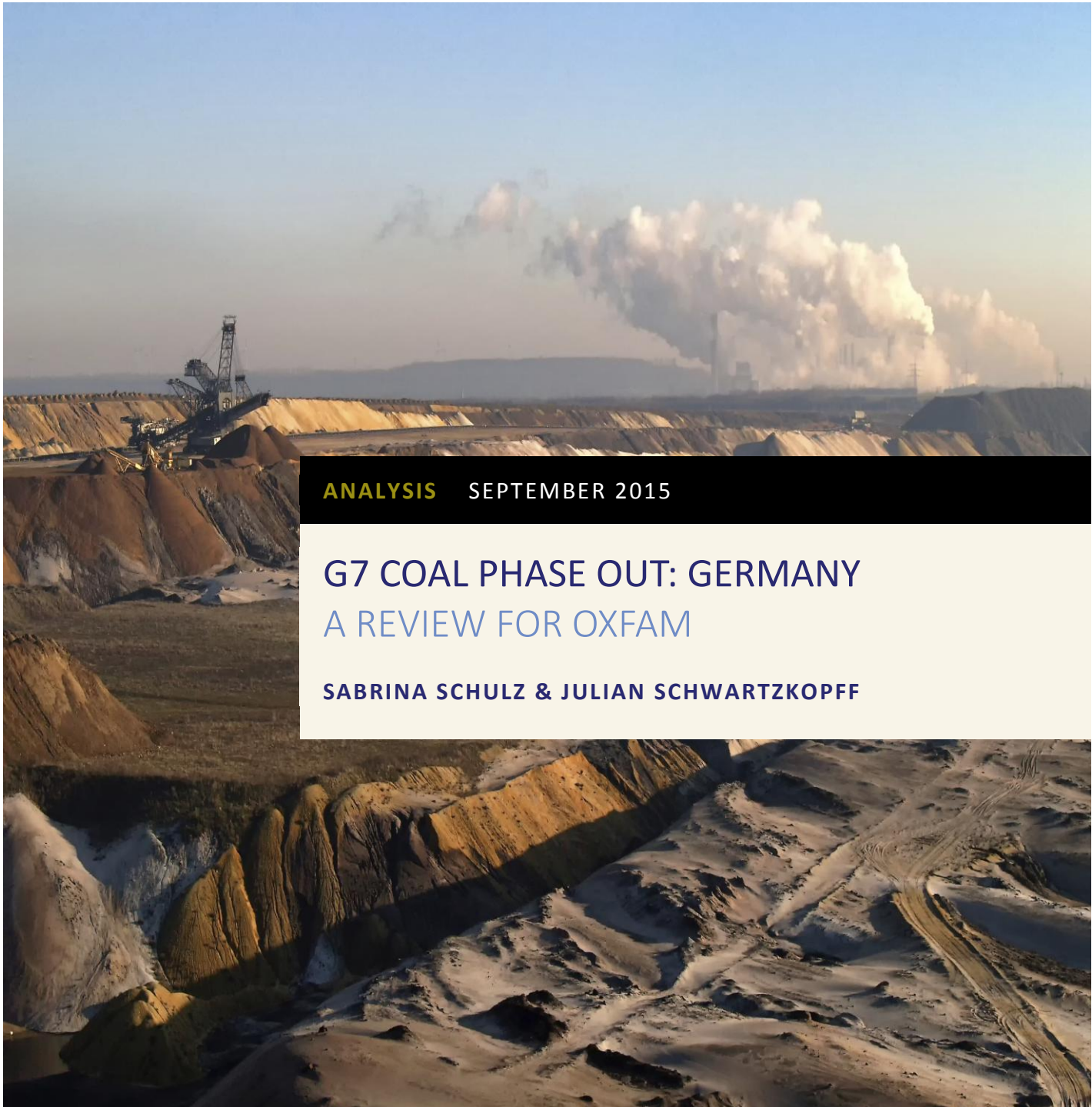




E3G



OXFAM



**ANALYSIS** SEPTEMBER 2015

# G7 COAL PHASE OUT: GERMANY A REVIEW FOR OXFAM

**SABRINA SCHULZ & JULIAN SCHWARTZKOPFF**

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Cover image: Thinkstock. Garzweiler open pit mine in North-Rhine Westphalia with a production of 35–40 Mt lignite per year. Operated by RWE.

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# G7 COAL PHASE OUT: GERMANY

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## Introduction

On 8<sup>th</sup> June 2015, G7 members agreed that the decarbonisation of the global economy should be completed over the course of this century and that it must include a transformation of their own energy sectors by 2050. The G7 communiqué failed to mention any particular fossil fuel, but the implication is clear: there is no future for unabated coal in a world that is acting to avoid dangerous climate change.

This analysis looks at the current context of coal use in Germany and identifies how a coal phase out can be accelerated. It is one of a series of reviews of each of the G7 countries.<sup>1</sup>

## Headline messages

The political debate on Germany’s transition away from coal took off with unexpected dynamism during 2015. The positive opening move from the German government was a proposed new ‘climate levy’ policy measure to reduce CO<sub>2</sub> emissions from the most carbon-intensive coal plants, in order to put Germany back on track to meet its domestic CO<sub>2</sub> emissions reductions by 2020. But the proposal was scrapped in the face of opposition from energy utilities, trade unions and local politicians from affected regions.

As a consequence, the Federal government instead agreed to implement a 2.7GW capacity reserve for lignite plants which will pay plant operators to put their power stations on standby and subsequently shut them down after 2020. The reserve lightens the emissions reduction burden of the power sector, with increased use of Combined Heat and Power plants and improved energy efficiency deployment supposed to close the gap towards achieving Germany’s 2020 targets. Instead of being fined for polluting by the proposed new climate levy, utilities will instead get

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<sup>1</sup> A previous version of this paper was prepared in advance of the G7 summit, as an analytical input to Oxfam’s report ‘**Let them eat coal**’. This revised version integrates a new Figure 4 that incorporates updated data on plant retirements and the status of the coal plant development pipeline across the G7 countries. This version also updates the analysis of the German debates following decisions on the proposed climate levy and capacity reserve that were announced on 1 July 2015.

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paid for keeping their oldest and most inefficient lignite plants on standby, which amounts to a golden handshake for utilities at the expense of taxpayers and consumers. It is far from clear that this new approach will reduce emissions sufficiently.

As a result of the heated political debate in the first half of 2015, a coal phase-out in Germany is now increasingly being recognised as inevitable. However, there is no agreement on a timetable let alone on how to ensure an orderly transition that offers a fair deal to workers in the coal sector.

Multiple analyses have repeatedly shown that accelerated plant retirements will be required to secure a complete phase out of coal in line with Germany's climate commitments. This will need to be achieved by 2040 at the latest:

- > Germany is Europe's largest user of coal, which was responsible for 35% of its total CO<sub>2</sub> emissions in 2014. 86% of these CO<sub>2</sub> emissions come from close to 50 GW of coal-fired electricity generating capacity.
- > Over recent years, the largest utility companies in Germany have been slow to react to the risks of climate change and the shift to renewables instigated under the Energiewende policy framework since the early 2000s. Instead they sought to maintain and expand high-carbon assets rather than reducing their exposure to a changing power sector. This has undermined their own business model and led to significant financial losses.
- > Germany already imports the majority of its hard coal supplies, with the remaining domestic mines due to close by 2018 following decades of heavy subsidisation. Domestic production of lignite (brown coal) from massive open cast mines is becoming the focus of attention, not least due to its negative impacts on the climate, public health, and cultural landscapes.
- > The tide has already turned against new coal. Since 2010, 24 GW of proposed new coal plants have been cancelled. Close to 8 GW of new coal capacity has been built since 2010 and 3.6 GW is currently still under construction. These new plants are unlikely to recoup their investment costs, and are prime candidates to become stranded assets. Since 2011, 39 coal units have been retired.
- > Despite positive progress with the deployment of renewables, hard coal and lignite power plants have continued to operate at high load factors, squeezing out lower-carbon gas plants and exporting large amounts of electricity. German lignite power plants comprise 4 of the top 5 biggest emitters in Europe.
- > By the end of 2022, Germany's power sector will be nuclear free. By 2035, the aim is for 55 to 60% of Germany's electricity to be generated from renewable sources, largely wind and solar. Given current market structures, in particular the merit order effect, and in the absence of new policy instruments, the production of electricity from coal will likely remain cheaper than using gas.
- > The proposed new 'climate levy' legal instrument would have required additional reductions in emissions from old coal and lignite power stations by 2020 as a

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means of addressing the risk that Germany might not meet its own domestic CO<sub>2</sub> reduction target. This measure would have provided a first stepping stone towards an accelerated retirement of existing coal and lignite power plants under a revised electricity market framework.

- > The aggressive push back by utilities and unions to the proposed law highlights the importance of prioritising efforts to ensure a managed and fair transition for regions and workers. At the centre of the debate are fears over job losses, electricity prices, and security of supply – but the real stakes are about the timeframe of the transition to a clean energy system. Whilst there is currently no firm timetable for an accelerated phase-out of coal, the debate about the future of coal in Germany has gained significant momentum.
- > Our analysis finds that applying a 35-year lifetime filter to Germany's coal fleet would see 17.3GW of the oldest capacity immediately scheduled for retirement in 2015. 12.3GW would follow in the period 2016-2025, and 7.2GW between 2026-2035. Beyond this date, 7.8GW of the newest coal plants would be at risk of facing early closure or the imposition of strict emissions limits in order to meet Germany's climate objectives.
- > During her hosting of Germany's G7 Presidency in 2015, Chancellor Merkel was expected to live up to her reputation as the 'Climate Chancellor' and back her government's own proposed policy measures. Instead, she showed leadership internationally but stayed out of the domestic debate regarding the proposed climate levy measure. This had led to a clear discrepancy between what the Chancellor has promised internationally on the one hand and what she is willing to do to cut emissions in Germany on the other.
- > In the run-up to the Paris climate negotiations in late 2015 Chancellor Merkel will have to return to the topic. In order to maintain credibility on her climate policy she will need to be able to confirm that Germany will deliver an orderly coal phase-out over the coming two decades.
- > As the primary beneficiaries of past fossil fuel use, G7 countries have historical, moral, and economic responsibilities that they must respond to by leading global action on climate change. By working in an aligned way with its G7 peers, Germany can accelerate its domestic coal transition and increase its international impact.



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## Introduction to role of coal

Hard coal mining (2013)	7.5 Mt
Lignite mining (2013)	182.7 Mt
Coal consumption (hard coal + lignite) (2013)	247 Mt
Hard coal imports (2013)	50.1 Mt (76% of total use)
Lignite reserves (2014)	40.3 Gt
Hard coal reserves (2012)	2.50 Gt
Hard coal mining jobs (direct) (2012)	17,613
Other hard coal jobs (indirect) (2012)	22,897
Lignite mining jobs (direct) (2012)	16,622
Other lignite jobs (indirect) (2012)	5,802
Change in coal mining jobs 1990-2012	-256,575 (-86.8 %)
Coal subsidies (2012)	€3bn <sup>2</sup>
CO <sub>2</sub> emissions from coal combustion (2014)	321.4 Mt CO <sub>2</sub> (35.4% of total)

**Sources:** Eurostat, Ecofys, IEA, Euracoal

Germany has long been a major producer of coal,<sup>3</sup> which played an important role in the country's post-war reconstruction and economic ascent. Coal is mainly used for power generation, but also for iron and steel production. In 2013, electricity generation accounted for 86% of German coal consumption, while iron and steel production accounted for 7.5%.<sup>4</sup> Coal combustion in total is responsible for over a third of Germany's GHG emissions.

German coal production fell by 56% between 1990 and 2013. While lignite production has roughly halved over this period, hard coal production collapsed by almost 90%. After 2018, there will be no more hard coal mining in Germany. Today already, Germany produces almost exclusively lignite. Even so, Germany is still the largest producer of coal in the EU, with its mining output accounting for 37% of all EU coal production.<sup>5</sup> Globally, Germany ranks 7<sup>th</sup> amongst the top coal producing countries,<sup>6</sup> and it is the world's top producer of lignite.<sup>7</sup>

The German coal mining workforce has reduced in line with the decline in domestic coal production. Between 1990 and 2012, about a quarter of a million coal mining jobs were lost, which equals a reduction in the workforce by 87%. Today, around 63,000 jobs in Germany still depend directly or indirectly on coal.<sup>8</sup> The hard coal sector employs around 17,600 miners and 22,900 people in hard-coal related fields like power generation, equipment supply and services. Lignite mining provides around 16,600 jobs directly and 5,800 jobs indirectly, mostly in power generation.

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<sup>2</sup> Ecofys

<sup>3</sup> This review uses 'coal' to refer to all types, with a differentiation between 'hard coal' and 'lignite' where necessary.

<sup>4</sup> Eurostat 2015

<sup>5</sup> Eurostat 2015

<sup>6</sup> WCA 2015

<sup>7</sup> IEA 2015

<sup>8</sup> Euracoal, 2012 figures

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The decline in the hard coal sector after 1990 came as a result of increasing international competition through the rise of low-cost producers, as well as a legacy of uncompetitive mining operations in East Germany after reunification. A massive and sustained subsidisation effort by the German government delayed the collapse of hard coal mining, but proved unable to reverse the trend. Since 1970, Germany alone has been responsible for 71% of all cumulative EU coal subsidies.<sup>9</sup> The vast majority of these went to hard coal mining, but lignite mining was granted some state aid in the form of tax benefits as well.<sup>10</sup> In 2012, Germany still spent roughly €3bn on coal subsidies. This amounts to about 30% of all EU coal subsidies.<sup>11</sup>

The German government fought hard for exemptions and delays before applying the EU's prohibition on state aid to its coal industry. It finally agreed a deal that allows subsidies to uncompetitive underground hard coal mines to remain in place until 2018, on the condition that closure plans are developed. The 2007 Hard Coal Financing Act accordingly stipulates that Germany's remaining eight hard coal mines are to be shut down by 2018. This means that Germany's 17,600 remaining hard coal miners face the imminent prospect of losing their jobs. This will have significant regional impacts as seven of the remaining hard coal mines are located in North Rhine-Westphalia, Germany's industrial heartland.<sup>12</sup>

The situation is different for lignite which can be mined much more cheaply in open pit mines. Because it is uneconomic to transport lignite over long distances, lignite-fired power plants have traditionally been built close to mines with dedicated infrastructure to transport lignite to the plant, locking both into a captive market. As lignite is the most polluting form of coal, it is under particular pressure from air quality and environmental regulations. But despite its high CO<sub>2</sub>-intensity, the use of lignite has not yet been adequately challenged by climate policy as the low price of carbon under the EU Emissions Trading System (ETS) has not been sufficient to trigger fuel switching to lower-carbon alternatives.<sup>13</sup>

Lignite production has however been the focus of growing civil society opposition and the attention of divestment campaigners and financial analysts alike. This raises a particular challenge to RWE (Germany's biggest utility) and Vattenfall (the Swedish state-owned company) as the largest owners of lignite assets. Vattenfall is currently seeking to sell its lignite assets and power plants, rather than deliver a managed retirement plan. This poses a significant challenge to Swedish claims of climate leadership.<sup>14</sup>

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<sup>9</sup> Ecofys (2014) **Subsidies and Costs of EU Energy – Final report**

<sup>10</sup> <http://www.foes.de/themen/stein-und-braunkohle/>

<sup>11</sup> Ecofys (2014) **Subsidies and Costs of EU Energy – Final report**

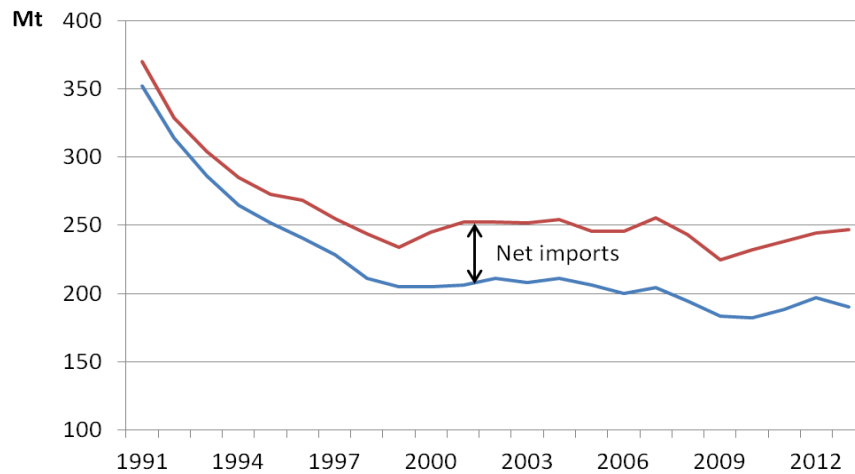
<sup>12</sup> It should however be noted that employment in the renewable energy sector, estimated at 371,400 in 2013, already far surpasses this (see BMWi (2014) **Bruttobeschäftigung durch erneuerbare Energien in Deutschland im Jahr 2013**).

<sup>13</sup> It is notable that lignite owners such as RWE have been among the most vociferous interest groups calling for the ETS to be the sole policy instrument used to drive CO<sub>2</sub> reductions, and have aggressively argued against the introduction of more direct regulations such as emissions performance standards.

<sup>14</sup> See <http://gofossilfree.org/sweden/>



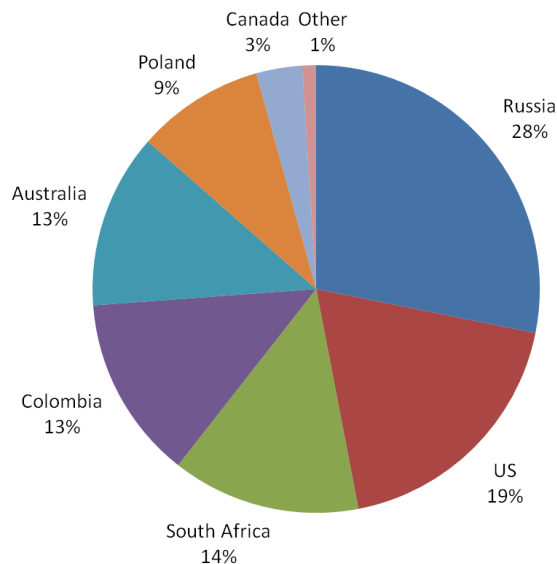
Figure 1: Coal consumption and production (1991-2012)



Sources: EIA, Eurostat — Production — Consumption

Due to the decline of hard coal production, Germany has had to import significant and rising amounts to supply its fleet of hard coal-fired power stations, as shown in Figure 1 below. Hard coal imports have risen from around 20 million tons in 1990 to over 50 million tons in 2013,<sup>15</sup> covering 76% of its hard coal consumption, with a cost to the economy of €4.1 billion.<sup>16</sup>

Figure 2: Hard coal imports by country of origin (2014)



Germany has a diverse array of coal suppliers from five different continents, as shown in Figure 2. The single biggest source of hard coal imports is Russia, with a share of almost 30%, followed by the US, with about 20%. South Africa, Colombia and Australia also supply a significant share of imports with close to 15% each. Hard coal exports, on the other hand, only amounted to about 250,000 tons in 2013. Lignite exports were negligible.

Source: Eurostat

<sup>15</sup> Eurostat 2015

<sup>16</sup> [https://www.destatis.de/DE/PresseService/Presse/Pressemitteilungen/2014/04/PD14\\_141\\_51.html](https://www.destatis.de/DE/PresseService/Presse/Pressemitteilungen/2014/04/PD14_141_51.html)

## Coal use in electricity sector

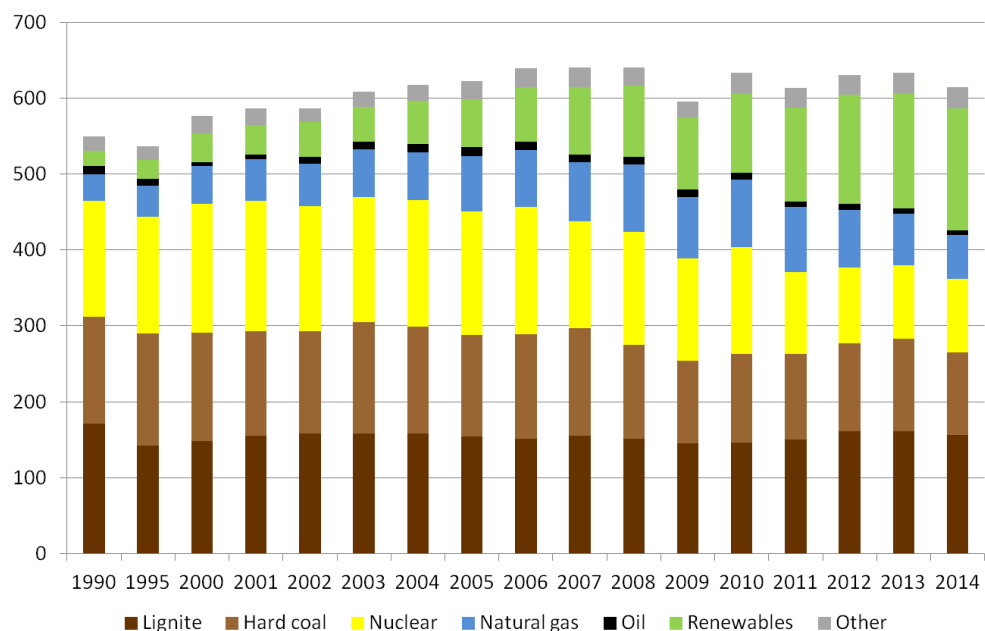
Total installed capacity (2014)	192 GW
Installed lignite capacity (2015)	20.5 GW (10.9% of capacity)
Installed hard coal capacity (2015)	28.3 GW (13.8% of capacity)
Peak electricity demand (2014)	83.1 GW (43% of total capacity)
Electricity generation lignite (2014)	156 TWh (26% of total)
Electricity generation hard coal (2014)	109.9 TWh (18% of total)
Average retirement age of coal plants (2014)	52 years
CO <sub>2</sub> emissions from coal power generation (2014)	258.8Mt CO <sub>2</sub> (28.4% of total)

**Note:** Coal capacity figures include planned additions and retirements for 2015.

**Sources:** Bundesnetzagentur, Eurostat, Agora, EEA

Coal has long played an important part in Germany's electricity mix, with annual electricity production remaining stable at around 300TWh since the reunification of Germany in 1990. In relative terms, however, coal-fired electricity production has decreased by 15% in this period due to the increase in electricity production from other generating sources. Coal's share in the electricity mix therefore declined from 56.7% in 1990 to 43.2% today. Most of this reduction has come from hard coal, which has declined consistently since 2007, mirroring the decline in domestic production. Electricity generation using lignite has, in contrast, remained relatively stable, as shown by Figure 3.

Figure 3: Electricity generation by energy source



**Source:** Bundesnetzagentur

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In 2014, lignite accounted for 25.4% of electricity generation, while the share of hard coal was 17.8%. 2014 was also the year where electricity generation from renewables surpassed lignite for the first time, with a share of 26.2%. However, the combination of lignite and hard coal still dominates Germany's electricity mix.

Coal-fired power generation increased between 2009 and 2013 following the reduced demand that had resulted from the economic crisis. This was mainly because the EU Emissions Trading System (ETS) has been ineffective due to a structural oversupply of emissions allowances.<sup>17</sup> In an environment of relatively low coal prices, and gas prices rising between 2011 and 2014, the ETS failed to provide a strong enough carbon price to make gas more competitive than coal.

A particular challenge for policy makers is posed by this merit order structure of the German electricity market that sees coal generation cheaper than gas.<sup>18</sup> The share of renewables is set to increase to 55-60% by 2035,<sup>19</sup> and the question is where the remaining shares come from. Over recent years continued deployment of renewables has more than matched the reduced generation from nuclear power plants which will be phased out completely by 2022. But lower wholesale prices (due to the growth of renewables) have increased the economic attractiveness of electricity exports to neighbouring countries, resulting in additional coal generation and increased CO<sub>2</sub> emissions during the same period.<sup>20</sup>

As a consequence, Germany is struggling to deliver on its domestic emissions reduction target of 40% by 2020.<sup>21</sup> One of the main reasons is that neither the ETS nor any domestic regulation constrain coal-fired power generation which was responsible for almost 30% of Germany's GHG emissions in 2014. Hard coal accounted for 10.5% of this and lignite for 17.9%.<sup>22</sup> Within the EU, Germany is home to four of the five most polluting coal power stations – all run on lignite.<sup>23</sup>

Since lignite is the cheapest conventional power source in Germany, it gobbles up most of the continued demand for 'baseload' power generation as nuclear energy falls away.<sup>24</sup> This is a direct result of the merit order effect. With over 26% renewables in the electricity mix, fossil power plants generally run with increasingly lower load factors. However, this has primarily affected gas and hard coal plants. Lignite power stations, on the other hand, had an average utilisation rate of 75% in 2012, second

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<sup>17</sup> Formally known as 'European Union Allowance' (EUA), each allowance represents 1 tonne of CO<sub>2</sub>.

<sup>18</sup> The merit order refers to the sequence in which power stations contribute power to the spot market. Lignite plants have lower fuel costs than hard coal and gas, so are typically the first thermal plants to enter the market after renewables. This gives them the greatest running time ('load factor') and highest margin between costs and wholesale prices. In Germany this has meant that higher-cost but lower-carbon options such as gas generation have been squeezed out between renewables and lignite, resulting in higher CO<sub>2</sub> emissions overall.

<sup>19</sup> BMWI 2014

<sup>20</sup> Agora (2014) **Das deutsche Energiewende-Paradox**, Heinrich Böll Foundation (2014) **The German Coal Conundrum**

<sup>21</sup> FÖS (2014) Klimaschutzplan lässt zu viel offen; DIW (2014) Wochenbericht Nr. 47

<sup>22</sup> ETS emissions data for 2014

<sup>23</sup> Sandbag (2014) **Europe's failure to tackle coal**

<sup>24</sup> Lignite is currently the cheapest electricity source in Germany, although wind power has already achieved parity with it in some areas <http://www.ise.fraunhofer.de/en/publications/veroeffentlichungen-pdf-dateien-en/studien-und-konzeptpapiere/study-levelized-cost-of-electricity-renewable-energies.pdf>

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only to the 89% utilisation rate of nuclear power. Hard coal and gas, which only become competitive in times of higher electricity prices, had utilisation rates of 44% and 35%, respectively.<sup>25</sup>

## Recent new coal plants: last of the dinosaurs

Recent years have seen a pulse of new coal plants coming online in Germany. These have undermined perceptions of Germany's climate leadership and the success of the Energiewende. Close to 8GW of new coal capacity has been built since 2010.<sup>26</sup> Around 3.6 GW is currently still under construction.<sup>27</sup> Taking power plant closures into account, Germany will have seen a 2.2GW net addition of coal capacity between 2011 and 2015.<sup>28</sup>

This has led some commentators to speak of a 'coal renaissance' in Germany, supposedly driven by the nuclear phase out. But the reality is that the investment decisions for these new plants were taken in 2007-09, when free CO<sub>2</sub> allowances (EUAs) were offered to coal plants by the German government, presenting the prospect of protection from carbon prices and the potential for windfall profits. Since then, the situation has changed significantly. 27 proposed coal power plants, amounting to a capacity of over 24GW have been cancelled since 2010. Only 1.58 GW is still being planned, awaiting government approval.<sup>29</sup> Those that did proceed to construction suffered delays due to legal challenges or technical problems like defective steel components in boilers.

Now, upon entering operation, these new plants will struggle to ever recover their investment costs. The recent coal power expansion has contributed to overcapacities of around 10GW in conventional power generation, which will likely persist for the foreseeable future,<sup>30</sup> despite the mothballing of gas plants that have been pushed out of the market. Together with the increasing influence of low-marginal-cost renewable generation, this overcapacity has placed further downward pressure on the wholesale price of electricity. This has affected the profitability of gas power stations particularly badly, as they face higher fuel costs. But new coal and lignite plants were hit as well. Thus, it is very likely that these new coal power stations will not be able to recoup their investment costs and will become stranded assets as Germany forges ahead with its energy transition.

Analysis by Poyry for the UK's Department of Energy and Climate Change found that these plants will struggle to make a return of between 0 and 7%. Even the CEO of Vattenfall has been forced to admit that their investment in the new Moorburg power plant amounted to a '€3bn mistake'.<sup>31</sup> Indeed, Vattenfall has already accepted close

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<sup>25</sup> BMWi 2014

<sup>26</sup> FÖS (2015) [Factsheet: Entwicklung von Stein- und Braunkohlekapazitäten im deutschen Kraftwerkspark](#).

<sup>27</sup> E3G calculations

<sup>28</sup> FÖS (2015) [Factsheet: Entwicklung von Stein- und Braunkohlekapazitäten im deutschen Kraftwerkspark](#)

<sup>29</sup> Endcoal [Plant Tracker](#)

<sup>30</sup> <http://foes.de/pdf/2015-03-Factsheet-Entwicklung-Kohlekraft-Kapazitaeten.pdf>

<sup>31</sup> Drieschner (2015) [Die Schlotlösung](#). *Die Zeit*, 13 February 2015.

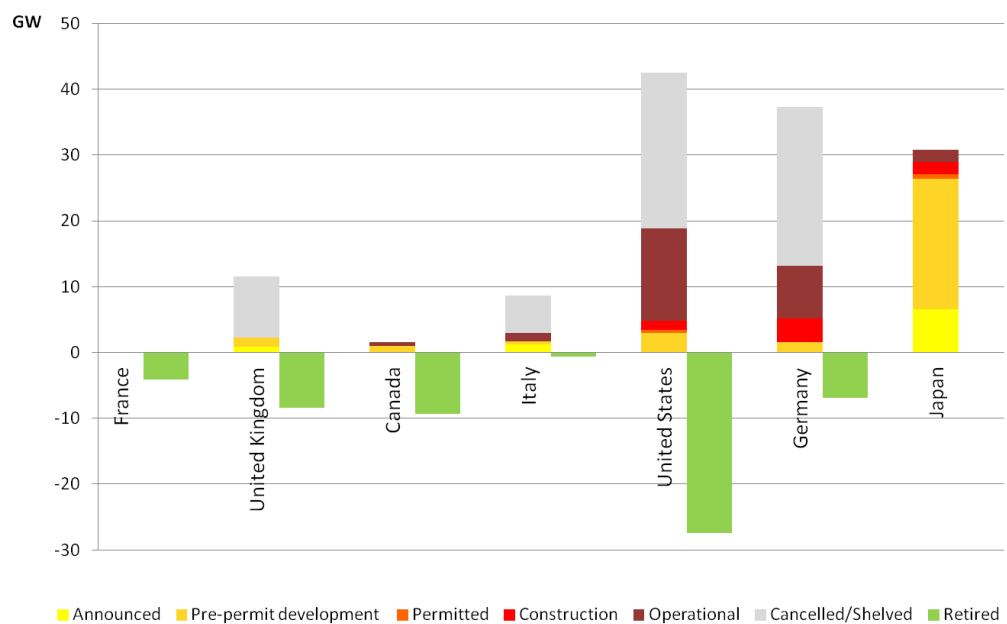
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to €1bn of financial impairments to its accounts,<sup>32</sup> and recent analysis suggests it is likely to generate a negative net present value (NPV) of €3.3bn to €4.4bn over the plant lifetime.<sup>33</sup> The risk of any further new coal in Germany is therefore extremely low: Poyry concluded that the currently perceived “surge” in coal plant construction was due to “highly unusual historical reasons”, and that they saw “no major unabated coal or lignite projects in Germany for the foreseeable future”.<sup>34</sup>

## Germany in the G7 spotlight – no more new coal

Figure 4 below illustrates the positioning of Germany among its G7 peers in respect to the coal expansion plans realised since 2010. Similarly to the USA, Germany has seen significantly more cancellations of proposed plants than have continued through to construction. The anti-coal campaign led by German NGOs organised under the umbrella of the Klima-Allianz has been a major factor in preventing the construction of new coal plants. They have brought many successful legal challenges and mobilised local protests on a plant-by-plant basis.<sup>35</sup>

Figure 4: G7 coal dynamics 2010-2015<sup>36</sup>



Source: Endcoal *Global Coal Plant Tracker*, additional figures for Japan from *Kiko Network*, retirement calculations by E3G.

As discussed above, the smaller number of recently commissioned plants in Germany that did complete construction now carry a significant risk of becoming stranded assets given their high levels of emissions and expected poor financial performance.

<sup>32</sup> [http://corporate.vattenfall.com/Global/corporate/investors/interim\\_reports/2014/q3\\_report\\_2014.pdf](http://corporate.vattenfall.com/Global/corporate/investors/interim_reports/2014/q3_report_2014.pdf)

<sup>33</sup> Carbon Tracker (2015), *Coal: caught in the EU utility death spiral* Other German utilities have been equally badly hit.

<sup>34</sup> Poyry (2013) *Outlook for new coal-fired power stations in Germany, the Netherlands and Spain*

<sup>35</sup> See <http://www.die-klima-allianz.de/keine-neuen-kohlekraftwerke/rueckblickerfolge/> for an overview of their work.

<sup>36</sup> Canada retirement profile includes 1 plant closed in 2005 as part of the Ontario coal phase out programme.

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Germany was slow to turn off the tap of new coal plants, and is already paying the price for this through the impact on utility economic losses and future profitability.<sup>37</sup> This serves as a warning for Japan, which is the only G7 country still considering a significant expansion in unabated coal capacity.

In both Germany and the USA, new coal plant additions have occurred in the context of retirements of existing capacity, however this leaves increased levels of lifetime CO<sub>2</sub> emissions. While the USA has seen a net reduction in capacity, over the past five years Germany has had a net increase of 2.2GW. As we explore further below, the presence of these new plants means that Germany's coal phase-out will require policy makers to engage with the challenge of stranded assets and utility losses as well as ensuring the effective retirement of ageing plants.

While the Energiewende has spurred job creation and technical innovation in Germany, strong resistance from vested interests remains to ending Germany's addiction to coal power. However, the cancellation of planned new power plants marks the turning of the tide away from the central role of coal and lignite in Germany, and the influence of the dominant utilities. The challenge that policy makers and industry alike are now facing is how to manage the transition out of an overreliance on coal given perceived pressures around security of supply, affordability, and employment.

When viewed alongside its G7 peers, the uncomfortable reality for Germany is that it has been a poor performer over the past 5 years in respect to new plant construction and limited retirements of existing plants. Germany's large remaining coal fleet will require an accelerated rate of retirements in order to reduce CO<sub>2</sub> emissions in line with its climate commitments. The USA's rapid rate of plant retirements shows that more can be achieved – but also that Germany has a lot of catching up to do.

## Poor choices by big utilities, opponents of energy transition

While it has been clear since the entry into force of the German Renewable Energy Act in 2000 that the power sector would undergo significant change, Germany's 'Big Four' utilities (RWE, E.ON, Vattenfall and EnBW) continued to invest heavily in fossil fuel power while largely shunning renewables. E.ON's recent announcement that it would spin off its traditional core business into a new company (now named 'Uniper') whilst refocusing on renewable energy and demand side solutions is a belated recognition of changed realities.<sup>38</sup>

The remarkable growth in renewable power in recent years has instead been driven by private citizens and farmers, who own 46% of Germany's renewable generation capacity. The Big Four – even though they own 56% of all installed generation capacity

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<sup>37</sup> See Carbon Tracker (2015), **Coal: caught in the EU utility death spiral**

<sup>38</sup> See Greenpeace (2014), **Locked in the past: Why Europe's big energy companies fear change**. There was an immediate acknowledgement of the changed context from Vattenfall, see: <http://corporate.vattenfall.com/press-and-media/news/2014/greenpeace-utilities-are-stuck-in-the-past/>



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in Germany – own merely 5% of renewable generation capacity.<sup>39</sup> The inability of the utilities to respond to changing circumstances wasn't limited to their failure to invest in renewables. Despite their huge exposure to high-carbon assets (including the ownership of lignite mines), the major utilities also failed to positively engage on carbon capture and storage (CCS), which at one point seemed to offer the prospect of a low-carbon future for coal. Vattenfall did make significant investments in Research and Development and sought to take forward demonstration-scale projects as part of the EU CCS programme. But none of the utilities were willing to support a CCS framework that would have put an end to new unabated coal and lignite – preferring instead to hide behind CCS while continuing business as usual.

The utilities' limited efforts on CCS were therefore perceived as an excuse for continued coal and lignite extraction, and met heavy opposition by civil society groups. As a consequence, Germany's CO<sub>2</sub> storage legislation was finally passed in 2011, but with CO<sub>2</sub> storage only allowed for demonstration projects. The utilities' failure to deliver CCS on new power plants has since seen them criticised for their 'CCS lies'.<sup>40</sup>

The utilities thereby failed to secure both new growth opportunities in renewables and an exit strategy from high carbon assets. The biggest utilities, E.ON and RWE, reported record losses in 2014 and 2013, respectively. Both have seen profits from conventional power generation decline and face increasing difficulties raising capital for new investments. They have accordingly slashed capital investment to maintenance-only levels.<sup>41</sup> Given that the German utilities find themselves with their backs against the wall, they are now incapable of delivering investment in CCS even if they were to suddenly rediscover interest. In early 2015, RWE led the power sector's exit from the EU's CCS technology platform.<sup>42</sup> They left behind them a record of opposition and delay. Their own actions contributed to ensuring that there is no longer a CCS escape route available for the big utilities in Germany.<sup>43</sup>

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<sup>39</sup> Agora (2015) **Report on the German Power System**, 2012 figures

<sup>40</sup> Greenpeace (2015) **Klimazerstörung made in Hamburg**

<sup>41</sup> RWE and EON annual reports 2014, 2013

<sup>42</sup> See <http://www.modernpowersystems.com/news/newsfour-utilities-drop-zep-membership-4495175>

<sup>43</sup> Any future consideration of CCS in Germany would therefore have to be targeted at industrial processes such as steel and cement, where smaller volumes of CO<sub>2</sub> for utilisation and geological storage could potentially offer greater value to Germany's deep decarbonisation pathway to 2050.

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### From climate levy to lignite reserve: a sudden policy shift

Germany's domestic target to reduce its GHG emissions by 40% on 1990 levels by 2020 is proving difficult to achieve, in large part due to increased coal use despite the growth in renewables. A wide-ranging Climate Action Programme was announced in December 2014 in an attempt to close the gap. Within this, the power sector was assigned an emissions reduction contribution of 22 Mt of CO<sub>2</sub>. Vice-Chancellor and Minister of Economy and Energy Sigmar Gabriel took forward the development of a plan to deliver on this level of emissions reductions. As leader of the Social Democratic Party (SPD) he has particular interest in securing an orderly transition for workers in the coal sector.

In the first half of 2015, Gabriel's legal proposal, the *Klimabeitrag* ('climate levy'), failed to garner the necessary political support. The law was designed to deliver 22 Mt of CO<sub>2</sub> by imposing financial penalties on the oldest and hence most inefficient coal plants – largely lignite. Yet the proposal was met with immediate severe opposition by utilities, trade unions, and parliamentarians in Germany's lignite regions: North Rhine-Westphalia in the West, as well as Saxony and Brandenburg in Eastern Germany. These actors jointly argued that the measure would cause massive job losses through cascading effects as newly unprofitable lignite plants would not be able to cover the costs of lignite mining any longer. However, there are currently around 22,400 jobs in lignite mining and power generation.<sup>44</sup> According to Germany's Federal Environment Agency only 4,700 of them would be affected by the measure – a far cry from the 70,000-100,000 jobs that opponents claimed would be at risk.<sup>45</sup>

As a result, the original proposal was scrapped and an approach similar to one put forward by the IGBCE trade union was brought forward instead. This proposes to close the 22Mt gap through a 2.7GW capacity reserve for lignite power plants, to be put in place from 2017 to 2020, as well as additional use of combined heat and power (CHP) and energy efficiency deployment.<sup>46</sup> This reduces the emissions reduction burden of the power sector to 11-12.5Mt CO<sub>2</sub> until 2020, which slows down Germany's transition out of coal significantly. It is far from clear that this new approach will reduce emissions sufficiently to close the gap to the domestic 2020 target. The government has already agreed that there will be a review of the new approach in 2018 – so expectations are already growing that further actions are likely to be required.

Instead of being fined for polluting, the change to the proposed policy approach means that utilities will instead get paid for keeping their oldest and most inefficient lignite plants on standby, which amounts to a golden handshake for utilities at the expense of taxpayers and consumers. Independent analysis has

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<sup>44</sup> Euracoal

<sup>45</sup> UBA (2015) [Klimabeitrag für Kohlekraftwerke: Wie wirkt er auf Stromerzeugung, Arbeitsplätze und Umwelt?](#)

<sup>46</sup> Eckpunkte für eine erfolgreiche Umsetzung der Energiewende- Politische Vereinbarungen der Parteivorsitzenden von CDU, CSU und SPD vom 1. Juli 2015

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shown that this package of measures will be much more costly than the climate levy would have been.<sup>47</sup> €230m a year of taxpayers' money will go towards capacity payments<sup>48</sup> while higher consumer electricity prices resulting from the measure are estimated to cost €500m per year.<sup>49</sup> Recent E3G analysis found that Germany's largest polluter RWE will in particular benefit from receiving payments for ageing lignite plants that are already making losses.<sup>50</sup>

The new lignite capacity reserve still requires a Parliamentary vote, and it also has to clear a hurdle in Brussels before it can become law. In April 2015, the European Commission announced a sectoral investigation into proposed capacity mechanisms spanning 11 EU member states, including Germany. The Commission is keen to ensure that national capacity measures do not distort market signals, and are compatible with EU decarbonisation objectives. It is highly uncertain whether the proposed capacity reserve will meet that test. But whatever the outcome of the Commission's investigation, the genie is out of the bottle. The debate on phasing out German coal has started, and a complete coal phase-out is increasingly recognised as inevitable.

#### **Political differences:**

Chancellor Merkel (CDU) managed to stay out of the debate completely. There was nothing to be gained for her from entering this fight which highlighted a split in the SPD, her party's main political rival, and forced leading SPD politicians to go up against trade unions, which form part of the party's core constituency. While she did not invest any political capital, Vice-Chancellor Gabriel (SPD) initially defended the plan strongly. But when the backlash from industry, trade unions and his party's base in North-Rhine Westphalia grew substantially, he had few political allies left and eventually gave in.

German Environment Minister, Barbara Hendricks (SPD), had not engaged in the debate initially. However, after the dust had settled, she entered the fray and criticised the agreement with unusually forceful language.<sup>51</sup> She deplored the political obstructionism of the levy's opponents as an expression of "political incompetence" and "denialism with regard to future trends". Furthermore, she said a phase-out of coal in the next 25 to 30 years is now inevitable. She also pointed out the incoherence between Chancellor Merkel proclaiming a climate-neutral world economy at the G7 summit in Elmau in June, while acting as if this did not apply to Germany's coal regions. In her words, halting the coal phase-out policy now increases the risk of social and economic upheaval in the wake of a disorderly transition.

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<sup>47</sup> <http://www.klimaretter.info/politik/hintergrund/19098-renaissance-des-klimaschutzbeitrages>, [http://www.diw.de/sixcms/detail.php?id=diw\\_01.c.509353.de](http://www.diw.de/sixcms/detail.php?id=diw_01.c.509353.de)

<sup>48</sup> <http://www.reuters.com/article/2015/07/02/germany-energy-reserve-idUSB4N0Z800620150702>

<sup>49</sup> <http://www.wwf.de/fileadmin/fm-wwf/Publikationen-PDF/WWF-Stellungnahme-Ein-neues-Klimaschutzinstrument-fuer-den-Stromsektor.pdf>

<sup>50</sup> <http://e3g.org/library/are-rwes-lignite-plants-set-for-a-taxpayer-bail-out>

<sup>51</sup> <http://www.welt.de/debatte/article143486201/Der-verbissene-Kampf-um-die-Kohle-muss-aufhoeren.html>

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## A coal phase-out before 2040: feasible, but needs direction

The German coal power plant fleet is 30 years old on average, which is relatively young compared to the US or the UK. The proposed climate law (see box above) would have targeted emissions from the oldest plants. Over recent years, some plants have remained open well beyond 50 years of operations, giving a recent average age at decommissioning of 52 years.<sup>52</sup>

While growth in coal capacity will most likely stall after the recent uptick of construction, coal power will not go offline without further government intervention or a significant strengthening of the ETS. An accelerated retirement of coal plants is required to deliver on Germany's climate commitments (covering CO<sub>2</sub> emissions, renewables and energy efficiency).<sup>53</sup>

It is thus clear that the German federal government needs to accelerate the pace of the phase-out of coal power if it wants to deliver on its GHG emissions target. The current market structure does not deliver such a shift. The carbon price is too weak to affect the profitability of coal, while EU air quality regulation will not have a significant effect on German coal either. Recent analysis shows only 4.6 out of 47.4GW of coal capacity in Germany is expected to not be able to comply with the incoming pollution control requirements of the EU's Industrial Emissions Directive (IED).<sup>54</sup>

However, the Government's White Paper on Germany's future electricity market design is proof of its commitment to a renewables-based power system which accommodates decentralised, flexible energy generation.<sup>55</sup> Flexible solutions like demand side management, energy storage and electricity trading are to be treated as alternatives to baseload power generation, which will create a more advantageous playing field for renewables. At the same time, the government is resisting calls from utilities to create a capacity market, which would create additional subsidies for old coal power stations. It is likely that the government will choose to introduce a strategic reserve to guarantee supply security in emergency situations, for example if renewables are unable to cover peak demand.

While the government is still dithering on the form, scope and timing of the necessary coal phase-out, independent analyses by a range of stakeholders from academia, NGOs, the energy sector, and the Federal Environment Agency have concluded that a transition out of unabated coal is both necessary and achievable. The majority of the studies reviewed for this paper point to the feasibility of a complete German coal phase-out by 2040 at the latest.<sup>56</sup> There is general agreement that lignite would need

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<sup>52</sup> FÖS 2015

<sup>53</sup> FÖS (2014) Klimaschutzplan lässt zu viel offen; DIW (2014) Wochenbericht Nr. 47

<sup>54</sup> BDEW (2013) *Energie-Info: Kraftwerksplanungen und aktuelle ökonomische Rahmenbedingungen für Kraftwerke in Deutschland*. Kommentierte Auswertung der DEW-Kraftwerksliste 2013.

<sup>55</sup> BMWI (2015) *Weißbuch: Ein Strommarkt für die Energiewende*

<sup>56</sup> See e.g. Enervis (2014): *Der „ideale Kraftwerkspark“ der Zukunft; Flexibel, klimafreundlich, kosteneffizient – Maßstab für einen optimierten Entwicklungspfad der Energieversorgung bis 2040*, Greenpeace/Ecofys (2012): *Kohleausstiegsgesetz - Verteilung der Reststrommengen und Folgenabschätzung für den Kohlekraftwerkspark*, FVEE (2010): *Eine Vision für ein nachhaltiges Energiekonzept auf Basis von Energieeffizienz und 100 % erneuerbaren Energien*, UBA (2010): *Energieziel 2050 – 100% Strom aus erneuerbaren Quellen*, Sachverständigenrat für Umweltfragen (2011): *Sondergutachten: Wege zur 100 %*

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to go first, with its exit completed as early as 2030. Several studies have also modelled the economic implications of shutting off large amounts of coal capacity (10-15 GW) in a short time frame and found that consumer electricity prices and security of supply would not be negatively affected.<sup>57</sup> The appendix to this paper provides further detail on the studies reviewed here.

The central political challenge is to provide the direction necessary to create an orderly, managed transition that can anticipate and address structural shifts resulting from the coal phase out (e.g. in employment or the location of energy production). The alternative is that policy makers end up being on the receiving end of a disorderly transition at an unknown future date, with greater economic and social disruption as a consequence of having not acted earlier to reduce CO<sub>2</sub> emissions. We therefore agree with Agora's recent assessment that *"Germany needs a coherent transformation strategy for its coal sector. A new Coal Consensus that brings together power producers, labour unions, the government and environmental groups to manage the transformation would be the best way forward."*<sup>58</sup>

The fate of the climate levy proposal points to the necessity of political leadership to reaffirm the inevitability of the coming transition away from coal. Without this, it will be very difficult to create the basis for a more positive way forward. Chancellor Merkel will therefore need to set out clearly her own stance on the topic, rather than staying detached from the debate.

## Applying a plant lifetime retirement filter

To illustrate the impact of a coal phase-out in Germany, we extrapolated from current data how coal capacity retirements could be spread out over the coming decades if plants were decommissioned after 35 years of operations. After 35 years, coal power plants can reasonably be assumed to have recovered their investment costs, so shutting them down to achieve climate objectives would generally not result in losses for the operator.

This approach is very similar to that of the German NGO BUND, which has argued for a law requiring the closure of Germany's oldest lignite plants after 35 years of operations as an immediate action to reduce emissions in the period to 2020 and enable a continuing phase out programme.<sup>59</sup>

As shown by Figure 5 below, much of German coal power capacity is outdated. If a 35-years cut-off was enforced, 15 GW of capacity would be closed immediately in 2015. 15.4 GW would follow in the period 2016-2025, and 7.7 GW between 2026-2035. Beyond this date, 10.4 GW of the newest coal plants would be at risk of facing early closure or the imposition of strict emissions limits.

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**erneuerbaren Stromversorgung**, WWF (2009): Modell 2050 – Klimaschutz vom Ziel her denken, BUND (2015): **Abschaltplan: Laufzeitbegrenzung für die ältesten Braunkohleblöcke bis 2020**

<sup>57</sup> DIW (2014) Szenarien einer nachhaltigen Kraftwerksentwicklung in Deutschland, Greenpeace/Brainpool (2015)

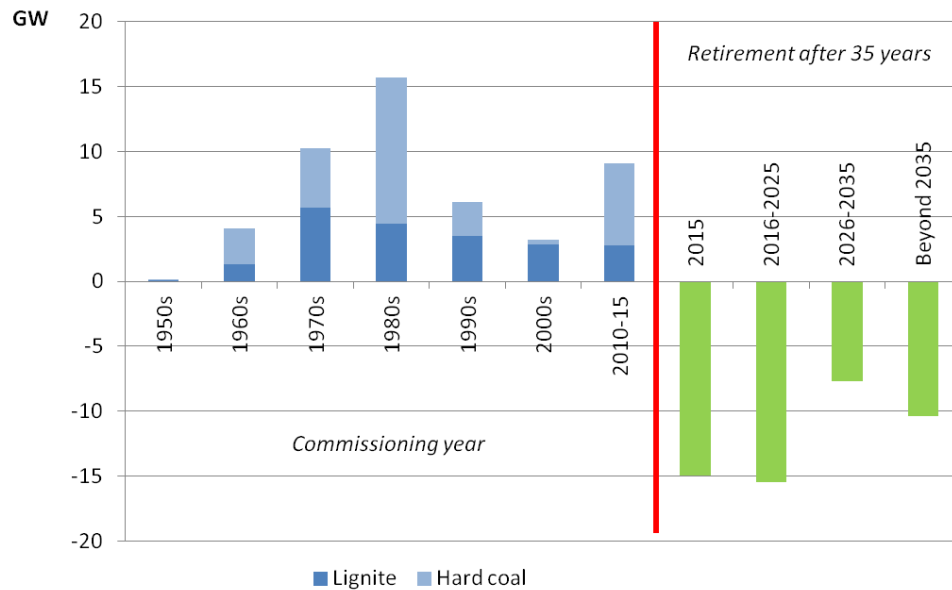
**Auswirkungen eines partiellen Kohleausstiegs**

<sup>58</sup> Agora Energiewende (2014) The German Energiewende and its Climate Paradox

<sup>59</sup> BUND (2015): **Abschaltplan: Laufzeitbegrenzung für die ältesten Braunkohleblöcke bis 2020**.

It must be noted that a 35-year lifetime limit would represent a step change in retirement age as current German government projections assume that coal plants will on average shut down after 55 years of operations. This is an obvious area for reconsideration by policy makers, as the continuation of such long lifetimes is not compatible with climate objectives going forward. Additionally, a 35-year lifetime should not be automatically assumed for plants where investment decisions had been taken subsequent to the agreement of domestic and EU climate targets.

Figure 5: Germany's coal fleet and retirement profile



Source: Bundesnetzagentur (2015) *Kraftwerksliste* and *Kraftwerksstilllegungsanzeigenliste*

Germany can take heart from the speed and scale of the coal retirements already underway in the USA, and in the experience of Ontario in retiring all its coal plants over a 10-year period. Canada has likewise put in place a retirement pathway for its existing coal plants via its Emissions Performance Standard framework, albeit with an overly lengthy timeframe of 50 years of plant operations.

To reaffirm the climate commitments made at the G7 summit on 7-8 June, Germany could take the first steps towards the creation of an aligned set of phase-out actions by its G7 peers and European neighbours. By confirming their intentions to exit from the use of unabated coal, governments can set expectations for an orderly transition and increase the market opportunity for clean technologies. Chancellor Merkel has a central role to play in making this happen, both in Germany's domestic debates and on the global stage.



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## Appendix – Analyses of the German coal phase out challenge

The Intergovernmental Panel on Climate Change (IPCC) has highlighted that CO<sub>2</sub> emissions from the electricity sector must approach zero by around 2050 in order to meet the internationally agreed aim of limiting global warming to below 2°C.

Germany has also set its own objectives for the deployment of renewables and the phase out of nuclear power. This has resulted in many studies considering the future of the electricity generation sector. Some of these analyses have specifically looked at the timescale over which a retirement of existing coal plants can be achieved in order to meet Germany's CO<sub>2</sub> emission reduction goals.

We provide brief details here of study findings of relevance to our analysis:

- > In 2012, **Ecofys** prepared a study on behalf of **Greenpeace** to analyse a potential coal phase-out law that Greenpeace developed.<sup>60</sup> The proposed measure would mandate a lignite power phase-out by 2030 and a hard coal power phase-out by 2040.
  - > Power plants without combined heat and power generation (CHP) would be forced to shut down first. The study analyses the resulting emissions reductions and concludes that the measure would be feasible and an efficient way to reduce power sector emissions.
- > A number of earlier studies by the **WWF**<sup>61</sup>, the government-appointed **German Advisory Council on the Environment**<sup>62</sup>, **research institutes**<sup>63</sup> as well as the **Federal Environment Agency**<sup>64</sup> have modelled development paths of the German power system towards exclusive or near-exclusive reliance on renewable energy generation. They all confirm the 2030-2040 range for a possible coal phase-out as feasible and environmentally responsible.
- > A 2014 study conducted by the **German Institute for Economic Research (DIW)** analyses the effects of an accelerated scaling back of coal power by 2020.<sup>65</sup> The study uses a detailed model of the German power sector to simulate the effects of coal plant closures. The main scenario consists of the closure of 3GW hard coal capacity and 6GW lignite capacity by 2020, additional to planned retirements.
  - > The analysis finds that this would lead to 23Mt in avoided CO<sub>2</sub> emissions through shifts in power generation. Lignite power generation would reduce while natural gas and to some extent hard coal would increase generation. An increase in wholesale electricity prices would help shore up falling profits from electricity generation, which would benefit utilities. At the same time,

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<sup>60</sup> Greenpeace/Ecofys (2012): Kohleausstiegsgesetz - Verteilung der Reststrommengen und Folgenabschätzung für den Kohlekraftwerkspark

<sup>61</sup> WWF (2009): **Modell 2050 – Klimaschutz vom Ziel her denken**

<sup>62</sup> Sachverständigenrat für Umweltfragen (2011): **Sondergutachten: Wege zur 100 % erneuerbaren Stromversorgung**

<sup>63</sup> FVEE (2010): **Eine Vision für ein nachhaltiges Energiekonzept auf Basis von Energieeffizienz und 100 % erneuerbaren Energien**

<sup>64</sup> UBA (2010): **Energieziel 2050 – 100% Strom aus erneuerbaren Quellen**

<sup>65</sup> DIW (2014) Szenarien einer nachhaltigen Kraftwerksentwicklung in Deutschland

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the renewables surcharge would decline, so that effects on consumer prices would be negligible.

- > While the study does not provide a specific coal phase-out date, it provides evidence that a substantial reduction of coal power in the short to medium term would improve the electricity market situation without raising electricity prices for consumers while at the same time contributing to Germany's emissions reduction commitments.
- > Another 2014 **DIW** study considers the merits and feasibility of a phase-out of lignite mining and power generation in Germany.<sup>66</sup> The authors find that "a lignite phase-out is economically efficient, environmentally necessary, and feasible from the energy system perspective". Given the current situation of weak ETS prices, the study concludes that additional national measures are necessary. An emissions performance standard (EPS), such as it has been introduced in the UK, the US or Canada, is put forward as an appropriate instrument to achieve an expedited lignite phase-out.
- > Current government-sponsored analyses and projections generally avoid the coal phase-out question, as does the Climate Action Plan adopted by the German parliament in December last year. The **Federal Environment Agency's** most recent projections<sup>67</sup> anticipate that under existing policy measures, lignite and hard coal would still make up 26% (each accounting for about 13%) of electricity production by 2035. The assumed average life span for coal power stations is 55 years. Assuming that no new coal plants will be built except for those currently under construction, this would equal a coal phase-out date of 2071, which is clearly not compatible with Germany's climate objectives.
- > Consultancy **enervis** undertook a 2014 study for the utility **Trianel** considering what the German power plant fleet of the future would have to look like to reconcile climate protection, supply security and cost efficiency.<sup>68</sup>
  - > The consultancy modelled how the development path of the German power plant fleet could be optimised to achieve those goals, starting from the government target that renewable energy should cover around 60% of electricity consumption by 2040.
  - > They found that in an optimised model, coal power generation capacity would be cut by more than half by 2023, before continuing to decline gradually out to 2040. By 2040, only slightly above 10GW of coal capacity would remain – this is less than 6% of the currently installed capacity. Only about a third of that would be lignite.
- > Another 2014 study conducted by **Öko-Institut** and **Fraunhofer Institute**<sup>69</sup> looks into pathways towards achieving an 80-90% reduction of Germany's CO<sub>2</sub>

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<sup>66</sup> DIW (2014): **Braunkohleausstieg – Gestaltungsoptionen im Rahmen der Energiewende**

<sup>67</sup> Projektionsbericht 2015

<sup>68</sup> Enervis (2014): **Der „ideale Kraftwerkspark“ der Zukunft; Flexibel, klimafreundlich, kosteneffizient – Maßstab für einen optimierten Entwicklungspfad der Energieversorgung bis 2040**

<sup>69</sup> Öko-Institut and Fraunhofer ISI (2014) Klimaschutzszenario 2050

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emissions by 2050. This study was commissioned by the Federal Environment Ministry and uses outdated government projections which include a 45 years life span for coal power plants. Whilst the study does not specifically analyse coal phase-out dates it does stress the crucial role of the power sector in reducing CO<sub>2</sub> emissions.

- > It finds that a front-loading of emissions in the power sector is essential to achieving Germany's ambitious climate goals, so as to compensate for sectors like agriculture, industry and transport, where near decarbonisation will be much more difficult to achieve. Coal-fired power generation especially should be substantially reduced.
- > The report still foresees some coal capacity to remain online after 2050, even in the most ambitious reduction scenario, due to dependence on the ETS. The study calls for additional measures specifically targeting coal (such as the proposed climate levy) as a failure to reform the ETS could jeopardise the necessary power sector emissions reductions.
- > A recent **Greenpeace**-commissioned study by consultancy **Energy Brainpool**<sup>70</sup> models the effects of shifting 15GW of the oldest and most inefficient German coal-capacity into a strategic reserve. This amounts to half of all lignite power plants and one-fifth of hard coal plants. For practical purposes, this means taking them off the grid except in times of supply shortages.
  - > The study finds no negative effects on security of supply. Even in 2023, after nuclear power will have been phased out, 4GW of the reserve would only be drawn upon during six hours of the entire year. It would also put an end to Germany exporting coal power to the rest of Europe. Instead, electricity imports would cover 20% of consumption in 2023.
  - > Such a move would also lead to a slight increase in consumer electricity prices of 0.6ct/kWh in 2015, which would be enough to significantly increase the load factor of gas power stations. This would lead 3% higher electricity bills for consumers at most.
- > German NGO **BUND** has, in a policy paper, proposed regulation to mandate that coal power stations would have to shut down after 35 years of operations.<sup>71</sup> They argue that such a measure is necessary to reach Germany's climate commitments and spur the energy transition. Due to the existing overcapacities, the resulting gradual reduction in coal power use would not endanger security of supply. It would also lead to positive economy-wide effects by reducing externalities which cost the German economy €40.7bn in 2010, according to Germany's Federal Environment Agency.

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<sup>70</sup> Greenpeace/Brainpool (2015) **Auswirkungen eines partiellen Kohleausstiegs**

<sup>71</sup> BUND (2015): **Abschaltplan: Laufzeitbegrenzung für die ältesten Braunkohleblöcke bis 2020**

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