

# Chapter 2

## Germany's long goodbye from coal

The role of coal in Germany's energy system and economy today; and the recommendations of Germany's Coal Commission<sup>1</sup> for the phasing-out of coal

Philipp Litz<sup>2</sup>

### Introduction

Around 21 per cent of Germany's primary energy consumption and around 34 per cent of its electricity generation in 2018 came from lignite or hard coal. Furthermore, coal-fired power plants still make an important contribution to the security of the supply of electricity and heating, and create economic value and employment in those regions where mining remains.

At the same time, it is obvious that Germany will not meet its climate targets for 2030 and 2050 without the gradual phasing-out of coal-fired power generation.

As a result, the political debate on the future of coal-fired power generation in Germany has intensified in recent years. In order to resolve the escalating conflicts between the political and social actors, the German federal government set up the Commission for Growth, Structural Change and Employment – or the 'Coal Commission', as it was called – in June 2018. The Commission's task was to develop a long-term exit strategy for Germany's coal industry and to identify the necessary accompanying energy, regional development and social policy measures. In January 2019, the Commission published its recommendations in the form of a final report.

This chapter first describes the objectives of the German energy transition and how this has changed and shaped the discussion on the future of coal-fired power generation in recent years. The paper then takes a detailed look at the current role of coal in the energy system and the economy (section 2). On this basis, the Commission's recommendations are then presented (in section 3); and, lastly, the recommendations are evaluated (in section 4).

### 1. Germany's energy transition and the discussion on coal

The transformation of the German energy system is based on a long-term energy strategy that aims to transform the existing energy system along four pillars:

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1. i.e. the Commission for Growth, Structural Change and Employment.  
2. Transparency note: From June 2018 to January 2019, the author supported the work of the Coal Commission as Personal Advisor to the Chairs of the Commission.

- nuclear phase-out: by the end of 2022, Germany will have phased out the use of nuclear energy. This is anchored in the nuclear phase-out law of 2011 (German Bundestag 2011);
- reduction of greenhouse gas emissions: in accordance with its Climate Action Plan 2050 (German Government 2016), adopted by the German federal government in 2016, Germany is aiming for near greenhouse gas neutrality by 2050. To achieve this, greenhouse gas emissions are to be reduced by forty per cent by 2020 and by 55 per cent by 2030 compared to 1990 levels. For 2030, there are also specific targets in place for the individual sectors of energy industry, buildings, industry, transport and agriculture;
- expansion of renewable energies: by 2050, at least sixty per cent of gross final energy consumption should come from renewable sources. In the electricity sector, the share of renewable energies is to be increased to 65 per cent by 2030 in accordance with the current coalition agreement (CDU *et al.* 2018). By 2050, it is to be raised to at least eighty per cent (German Government 2010);
- increasing energy efficiency: by 2050, primary energy consumption is to be reduced by fifty per cent compared with the 2008 level, with electricity consumption being reduced by 25 per cent compared with the 2008 level (German Government 2010).

In addition, the energy transformation is based on the guidelines of the energy policy triangle consisting of environmental compatibility, affordability and security of supply.

By 2018, Germany had already implemented a number of measures to transform its energy system. These included, for example, a law on the phasing-out of nuclear energy; the Renewable Energy Act; and a law to support combined heat and power generation and the participation of most German power and industrial plants in the European Emissions Trading System (EU-ETS). Also, certain measures have been put in place promoting electromobility, expenditure on energy research, more efficient heating systems and regulatory efficiency standards in the construction of new buildings (Federal Ministry for Economic Affairs and Energy 2018).

Germany's energy transition has therefore made some good progress in recent years. By the end of 2018, greenhouse gas (GHG) emissions had been reduced by around 30.5 per cent on 1990 levels. Figure 1 shows emissions reductions in the five main sectors of the economy.

- the energy industry has seen its greenhouse gas emissions fall by around 34 per cent since 1990. The main reasons for this are the age-related decommissioning of old coal-fired power plants, the transfer in 2016 of some lignite-fired power plants to a state of safety readiness, the expansion of renewable energies in the electricity sector and the increased use of combined heat and power generation;

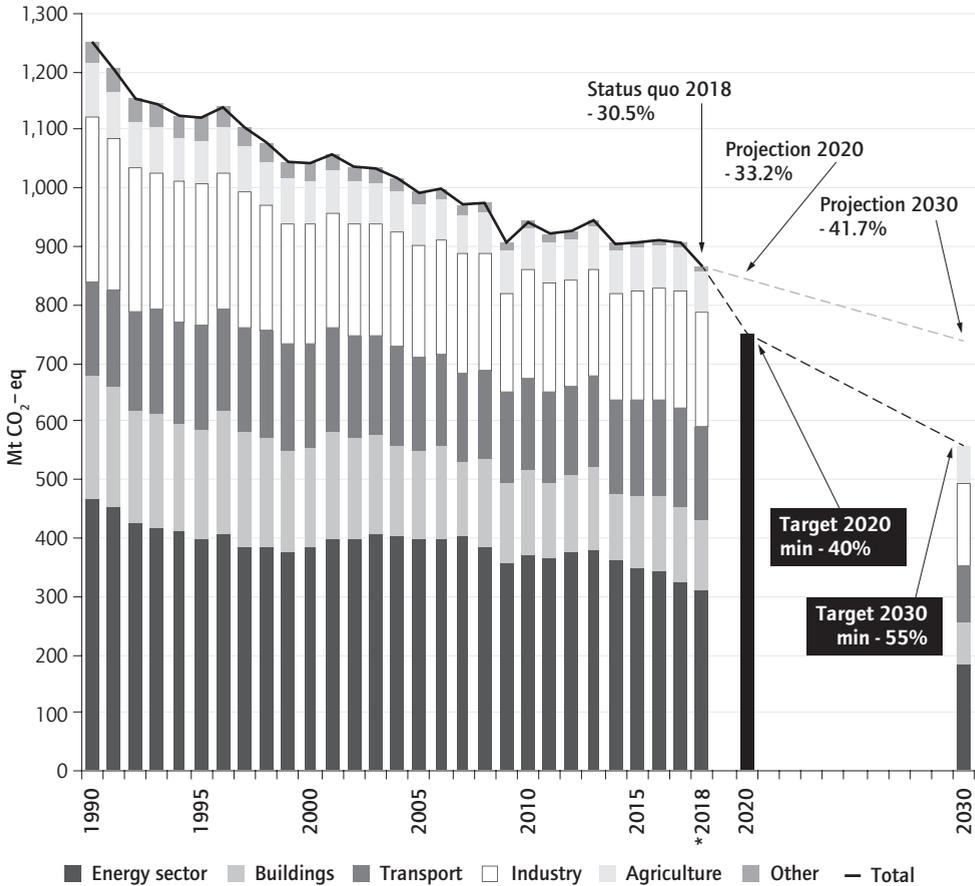
- industry has, so far, recorded a decline in GHG emissions of 31 per cent. This has been due to the closure of industrial plants in eastern Germany in the course of unification; the greater avoidance of process emissions through improved process technology and efficiency measures; and the greater use of natural gas and combined heat and power plants (CHP) to generate electricity and heating in place of coal;
- buildings sector emissions have so far fallen by 43 per cent. The main drivers here are, in particular, the conversion of old coal stoves and oil-fired heating systems to modern natural gas plants and the greater use of district heating schemes. Building efficiency standards for new buildings, as well as the energy-efficient refurbishment of part of the existing building stock, have also contributed to reducing emissions to date.
- the transport sector has, so far, reduced its greenhouse gas emissions by only one per cent compared with 1990 levels. This is due, on the one hand, to the significant increase in freight traffic being transported by road and, on the other, to the insufficient reduction in fleet consumption.
- for agriculture, greenhouse gas emissions have fallen by 23 per cent since 1990.

However, the federal government's current greenhouse gas projection report shows that Germany is likely to miss its 2020 target of a forty per cent reduction, with the projection suggesting that the already-implemented measures will ensure a reduction of only around 32 per cent by that date. A similar picture shows for the 2030 projection, where greenhouse gas emissions would be reduced by only 41.7 per cent (against the target of a drop of 55 per cent) (Ministry of the Environment, Nature Conservation and Nuclear Safety 2019).

One of the reasons for the failure to meet climate targets are Germany's high CO<sub>2</sub> emissions from coal combustion in the generation of electricity and heating in the energy and industrial sectors. In 2018, these accounted for around one-third of Germany's greenhouse gas emissions (Federal Ministry for Economic Affairs and Energy 2019). This clearly shows that German climate protection targets cannot be achieved without a substantial reduction in (and, in the long-term, without the end of) the use of coal.

The failure to meet the 2020 climate protection target is not surprising as it has been repeatedly announced in the German government's biennial greenhouse gas projection reports over the last couple of years. As a consequence, since the beginning of the 2010s, representatives of the civil society environmental movement, environmental associations and climate science have been calling for additional coal reduction measures in the short-term and the long-term phasing out of coal-fired power generation. The instruments proposed have included the regulatory decommissioning of power plants, additional national or regional CO<sub>2</sub> pricing, CO<sub>2</sub> limit values and annual emissions budgets for coal-fired power plants (DIW Berlin *et al.* 2019).

Figure 1 Historical greenhouse gas emissions, 1990-2018; climate targets and projections for 2020 and 2030



\* Preliminary data.

Sources: Federal Environmental Agency (2019); Ministry of the Environment, Nature Conservation and Nuclear Safety (2019).

However, at the same time, numerous arguments against additional measures for coal, or the long-term phasing out of the industry, have been put forward in the public debate. Firstly, this has included the fundamental rejection, or at least the feared redundancy, of national climate measures, especially for sectors already regulated within the European Emissions Trading System. Secondly, there has been concern about a secure and affordable energy supply, which some actors felt would be jeopardised by the phasing out of coal-fired power generation. And, thirdly, this has included the expected negative effects on those still employed in the coal industry today and the economic impact on coal-producing regions.

In response to the foreseeable failure to meet climate protection targets, the German government therefore adopted its 'Climate Action Programme 2020' in 2014, in which it defined additional contributions for all sectors in order to reduce the

expected 'climate gap' in 2020 (German Government 2014). In 2015, the proposed *Klimabeitrag* ('climate contribution'),<sup>3</sup> proposed by the Federal Ministry of Economics and Energy, led to major protests among utilities and trade unions, and the so-called *Sicherheitsbereitschaft* ('security reserve') was created as an alternative instrument. Formally, this is a capacity reserve for 2.7 gigawatts (GW) of old lignite-fired power plants outside the power market, for which operators are remunerated generously. This should result in additional CO<sub>2</sub> savings of 11 to 12.5 million tonnes of CO<sub>2</sub> in 2020 (German Bundestag 2016).

However, this has not been the end of the political and social debate on the future role of coal-fired power generation. On the one hand, the measures adopted have not been sufficient to ensure compliance with the climate targets for 2020. And secondly, in December 2015, the international community signed the Paris Climate Protection Agreement which represented an increase in the current level of global climate protection ambition (United Nations 2015).

With the adoption in 2016 of the 'Climate Action Plan 2050', its long-term climate protection strategy, the federal government therefore decided to convene a Commission for Growth, Structural Change and Regional Development (German Government 2016). This was intended to pacify the ever-increasing social conflict over the future role of coal in the German energy and economic system.

In March 2017, the new governing coalition of CDU, CSU and SPD confirmed the establishment of such a Commission in their coalition agreement which says: 'We will set up a Commission for Growth, Structural Change and Employment, involving actors from politics, business and environmental associations, trade unions and the federal states [*Länder*] and regions concerned, to draw up an action programme by the end of 2018 on the basis of the Climate Protection Action Programme 2020 and the Climate Protection Plan 2050.'

## 2. The role of coal in Germany's energy system and economy

### 2.1 Primary energy consumption

The importance of coal in the German energy system has gradually declined since 1990 (Figure 2). This can be explained by a variety of factors:

- falling energy demand: since 1990, overall primary energy demand has gradually declined. This is due both to direct efficiency and modernisation measures as well as to the increased use of energy sources and technologies with lower conversion losses;

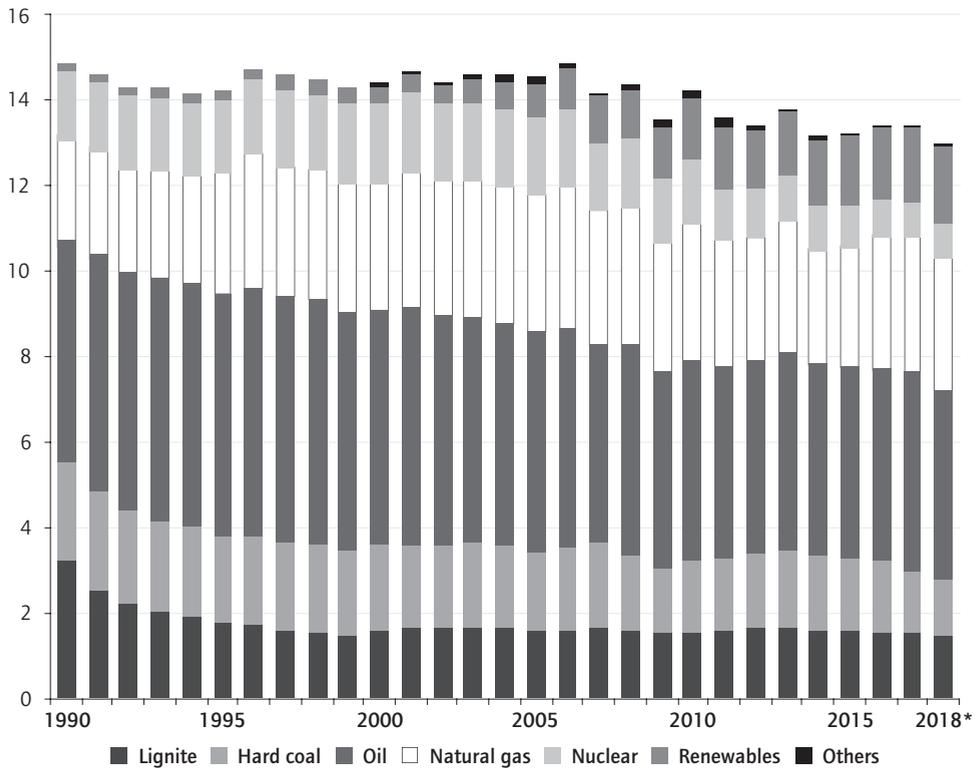
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3. The proposed *Klimabeitrag* was a price-volume hybrid measure designed to target especially old lignite plants.

- increased use of natural gas: over time, the use of natural gas has increased, particularly in buildings. In addition, natural gas has also been increasingly used in power plants, replacing coal-fired production;
- expansion of renewable energies: since 2000, the expansion of renewable energies, especially in the electricity sector, has been given impetus by the Erneuerbare-Energien-Gesetz (the ‘Renewable Energy Act’). In recent years, this has increasingly led to the displacement of coal-fired power plants in the electricity sector.

In 2018, primary energy consumption in Germany amounted to 12,963 petajoules (PJ). The dominant energy source was oil, with a share of 34.3 per cent. Gas followed in second place with 23.7 per cent. Coal contributed 21.3 per cent, with lignite and hard coal each accounting for about one-half of this (11.3 and 10.0 per cent of the total, respectively). The share of renewable energies was 14.0 per cent while nuclear energy contributed 6.4 per cent.

Figure 2 Primary energy consumption, 1990-2018 (in thousand PJ)



\* Preliminary data.  
Source: Federal Ministry for Economic Affairs and Energy (2019).

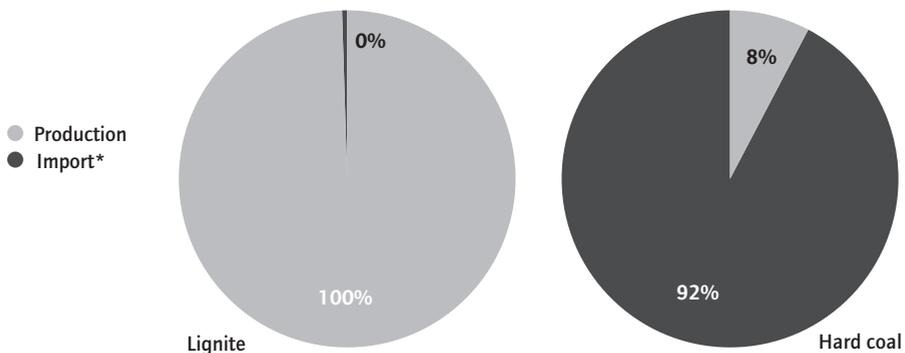
## 2.2 Occurrence and use of lignite and hard coal

Lignite is still mined almost entirely domestically in the three remaining lignite regions of Rhineland, Lusatia and central Germany whereas hard coal is now entirely imported (Figure 3). The share of domestic hard coal production in 2017 was still around 8 per cent but, following the closure of the last mines at the end of 2018, hard coal is no longer mined in Germany. The majority of imports in 2017 came from Russia (38 per cent), the USA (eighteen per cent), Colombia (thirteen per cent) and Australia (eleven per cent) (Federal Ministry of Economic Affairs and Energy (2019)).

Lignite is currently still mined in eight opencast mines in the three areas, with the opencast mines in each area being operated by one company: the opencast mines in the Rhineland (Hambach, Garzweiler and Inden) are operated by RWE; those in Lusatia (Welzow, Nochten and Reichwalde) by LEAG; and MIBRAG is responsible for the opencast mines in central Germany (Vereinigtes Schleenhain and Profen). RWE and LEAG also operate their own lignite-fired power plants, most of which are close to opencast mines; together, these account for the majority of the lignite-fired power plant capacity still installed (Öko-Institut 2017).

Total lignite resources would be sufficient to keep power generation from lignite-fired power plants at today's level for many decades to come. However, the quantities that have been approved for operation are considerably smaller and would last from ten to 25 years, depending on the mine (Öko-Institut 2017).

Figure 3 Occurrence of lignite and hard coal, 2017



\* Including inventory changes.

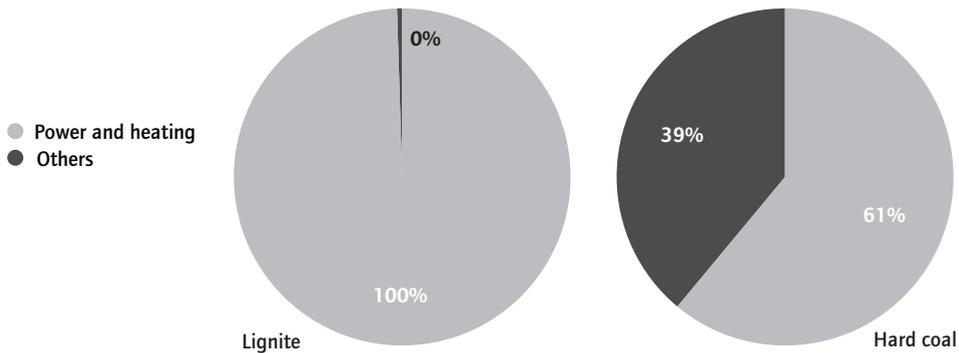
Source: Coal Industry Statistics (2019).

The current plans of the opencast mine operators still envisage the resettlement of eight villages, although in only one-half of cases has this already been approved. In almost all, resettlement has been rejected by parts of the local population while the other part has already signed bilateral resettlement agreements with the opencast mine operators. By 2018, a total of around 120,000 people had been resettled in today's lignite mining areas (Commission for Growth, Structural Change and Employment 2019).

Furthermore, the opencast mine operator RWE has been planning to clear the Hambach forest around the opencast mine there, which led to major protests by the environmental movement in 2018 (Bloomberg 2018).

The vast majority of lignite and hard coal is used to generate electricity and heat in power plants (Figure 4). Lignite in particular is burned almost entirely in power plants or as briquettes in heating stoves. Some two-thirds of hard coal production, on the other hand, is used in power plants to generate electricity and heat while the remaining one-third is used in particular in industry in steel and aluminium production.

Figure 4 Use of lignite and hard coal, 2017



Source: Own calculations based on Coal Industry Statistics (2019).

### 2.3 Installed generation capacity

At the end of 2018, Germany had a total installed energy generation capacity of around 222.3 GW (net). Around 110.7 GW were accounted for by variable, baseload plants and 111.6 GW by dispatchable plants,<sup>4</sup> corresponding in each case to about one-half of the installed generation capacity (Figure 5).

The installed generation capacity of coal-fired power plants at the end of 2018 was 44.7 GW. Of this total, 21.2 GW were accounted for by lignite power plants and 23.7 GW by coal-fired power plants. There is a total of 145 individual units with a minimum size of 10 megawatts (MW), of which 113 plants are technically capable also of generating heat in co-generation systems.

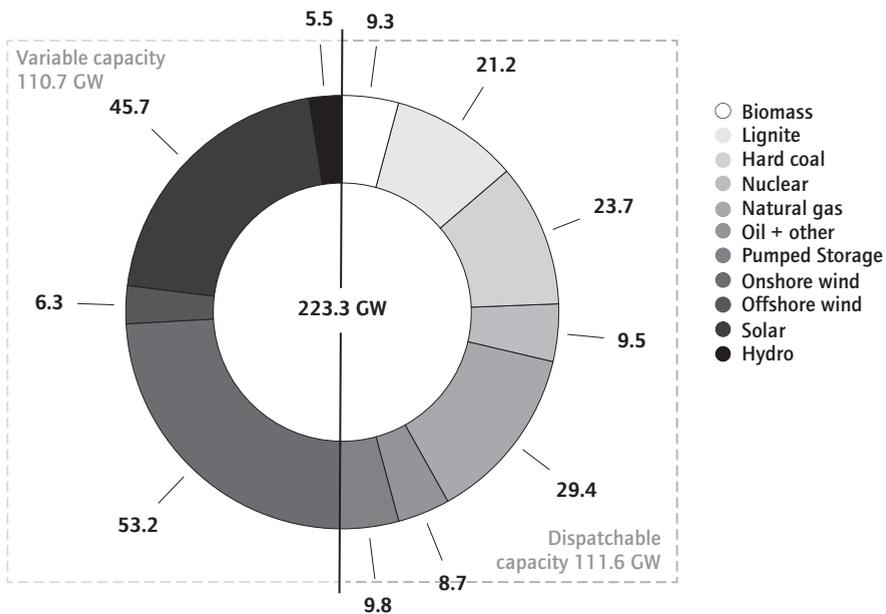
Lignite-fired power plants are mainly concentrated in lignite mining areas around opencast mines, whereas hard coal-fired power plants are more widely distributed throughout Germany. However, due to the lower transportation cost for hard coal when using waterways and the quantities of water required for cooling, these are more likely

4. 'Variable' plants are those power plants in which production is highly dependent on external weather conditions such as wind, solar or hydro. 'Dispatchable' plants are, in contrast, units in which production can be ramped up and down in a flexible way, i.e. biomass or fossil-based power plants.

to be found near larger watercourses or on the coast. However, the focus of hard coal-fired power plant sites is particularly in the federal states of North Rhine-Westphalia and Baden-Württemberg.

For reasons of dispatchability, coal-fired power plants continue to make an important contribution to the security of supply. This applies with regard to the available capacity, system stability during operation due to rotating masses and the provision of control energy or 'black start' capability (i.e. when the plant is recovering from total or partial shutdown).

Figure 5 Installed electricity generation capacity at the end of 2018



Source: own calculations based on Federal Networks Agency (2019).

## 2.4 Electricity and heat generation

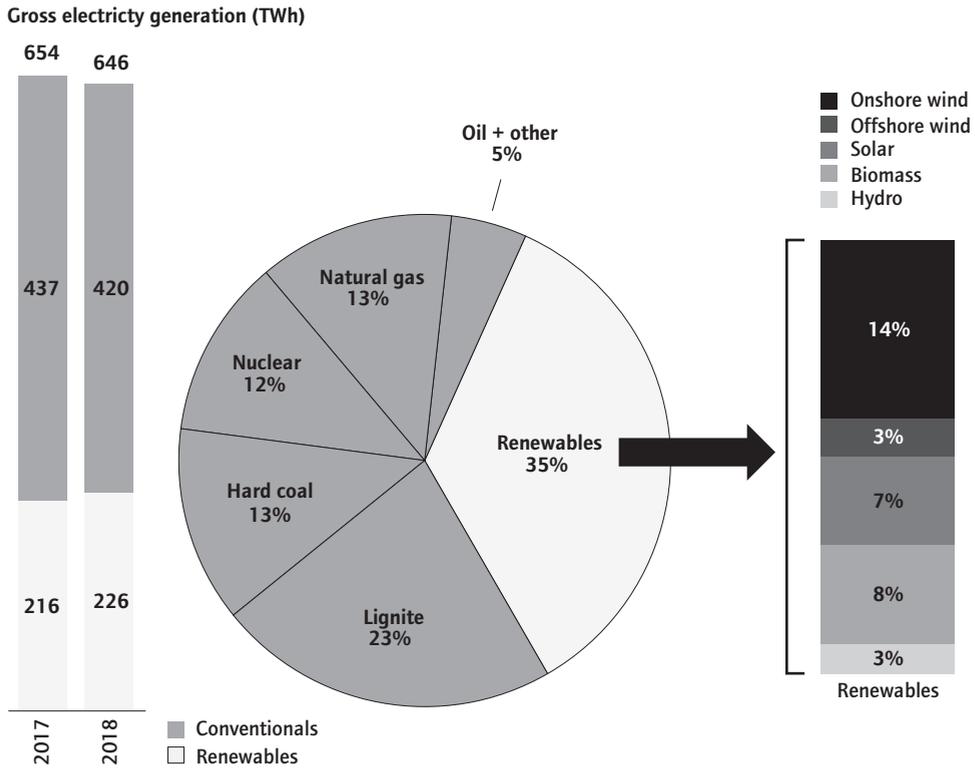
In 2018, total gross electricity generation in Germany accounted for 646.1 terawatt hours (TWh) (Figure 6), while gross electricity consumption was only 598.9 TWh. Thus, 51.2 TWh were physically exported to neighbouring countries.

Wind, solar and other renewable energy sources generated 225.7 TWh of electricity (34.9 per cent), while 420.4 TWh were generated on the basis of conventional energy sources (65.1 per cent). Of the latter, a total of 228.7 TWh still came from coal-fired power plants, corresponding to a share of 35.4 per cent. Lignite accounted for 145.5 TWh and hard coal for 83.2 TWh. It should be noted, however, that around eight per cent of the electricity generated by coal-fired power plants is not fed into the grid but is used to operate machinery within the plant (conveyor belts, coal mills). The

actual net electricity generation of coal-fired power plants is correspondingly lower (2018: 210.4 TWh).

Heat generation from coal-fired power plants capable of co-generation amounted to a total of 46.5 TWh in 2017.<sup>5</sup> Of these, 33.5 TWh were attributable to public district heating schemes and 12.9 TWh to processing the supply of steam and heat to industry. This corresponds to a total share of about 3.6 per cent of the final energy consumption of heating schemes.<sup>6</sup>

Figure 6 Electricity generation, 2018



Source: own calculations based on AG Energiebilanzen (2019).

## 2.5 CO<sub>2</sub> emissions and environmental impact

The combustion of coal generates considerable quantities of CO<sub>2</sub>. Depending on the efficiency of the plants and the quality of the coal burned, these vary from around 0.9 to 1.1 grams per kilowatt hour (electric) for lignite and 0.7 to 1.0 grams per kilowatt hour (electric) for hard coal. For coal-fired power plants with simultaneous heat generation

5. Heating statistics for 2018 are not yet published.

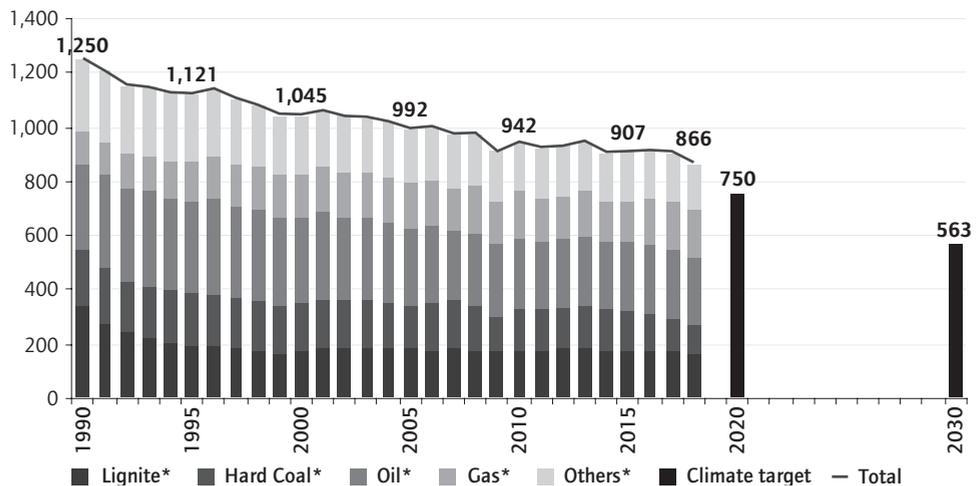
6. Own calculations based on Federal Ministry for Economic Affairs and Energy (2019).

capability, the specific emissions from electricity generation are correspondingly lower as the respective emissions are offset against both electricity and heat generation.

Although CO<sub>2</sub> emissions from lignite and hard coal have declined in recent years, about one-third of Germany's CO<sub>2</sub> emissions still originates from electricity and heat generation in coal-fired power plants (2018: 31.6 per cent). In 2018, this corresponded to 273 million tonnes of CO<sub>2</sub>. The combustion of oil accounts for 173 million tonnes (20.0 per cent) and gas for 174 million tonnes (20.1 per cent). The remaining greenhouse gas emissions are mainly caused by industrial processes and farming (Figure 7).

In addition, the combustion of coal is associated with further, considerable pollution such as mercury, sulphur dioxide, nitrogen oxides and fine dust. Air pollutants are usually produced locally and are particularly associated with increased respiratory and cardiovascular diseases. Further environmental impacts arise in the course of opencast mining operations due to the necessary lowering of the groundwater level and, in some cases, increased iron deposits into the surrounding waters (DIW Berlin *et al.* 2019).

Figure 7 Greenhouse gas emissions, 1990-2018 (Mio. tonnes)



\* CO<sub>2</sub> emissions from burning fossil fuels. 2018 preliminary data.  
Source: Federal Ministry for Economic Affairs and Energy (2019).

## 2.6 Employment and gross value added

At the end of 2018, a total of around 32,800 people were still directly employed in the German lignite and hard coal sector (Figure 8):

- lignite: the number of direct employees in the lignite industry totalled around 20,850. Of these, 15,600 were employed in opencast mining operations and around 5,200 in lignite-fired power plants

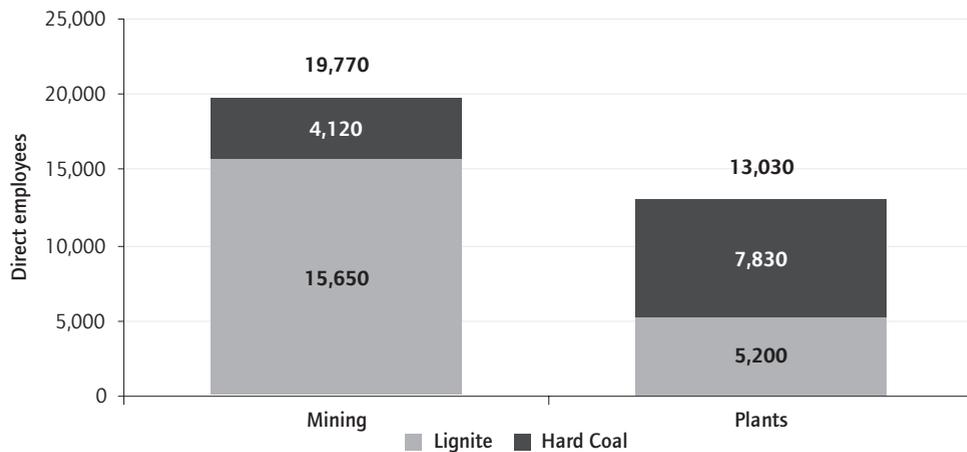
- hard coal: the number of employees in the hard coal sector totalled around 11,950, of which around 4,120 were still employed in mining. Due to the closure of the last coal mine at the end of 2018, employment in the hard coal mining sector has dwindled to only a few during 2019. The remaining 7,830 employees work in power plants.<sup>7</sup>

This corresponds to 0.1 per cent of the total number of employees that are subject to social insurance contributions in Germany (2018: 32.8 million) (Federal Statistical Office 2019).

At the end of 2018, up to 78,000 people were still employed directly or indirectly in the coal sector, or their employment was the result of coal sector activity.<sup>8</sup> In total, this corresponds to 0.26 per cent of the total number of employees subject to social insurance contributions.

In lignite mining areas, however, the share of employment is higher and reaches levels of 0.9 per cent (direct) and 1.4 per cent (direct, indirect and others) of the total number of employees subject to social insurance contributions. In addition, the average annual salaries in this sector are above average and are characterised by a comparatively high level of union organisation. The average age of direct employees is about 45 years (RWI 2018).

Figure 8 Direct employees in the lignite and hard coal sector, 2018



Source: Coal Industry Statistics (2019); own calculations based on enervis (2016) and Federal Networks Agency 2019.

7. There are no official statistics for employees in hard coal-fired power plants, so these have been estimated on the basis of the installed capacity (23.7 GW) and an employment factor of 0.3 employees/MW (enervis 2016).  
 8. There are various studies available, with different methodologies, for calculating the employment effects of the coal industry (see in detail DIW Berlin *et al.* 2019; Öko-Institut 2017; Commission on Growth, Structural Change and Employment 2019). For reasons of reducing the complexity, the Commission therefore recommended following the formula of one indirect and one further employee for each direct employee in the lignite sector. For the hard coal sector, these figures are adapted by the author to around 0.3 indirect/further employees for each direct employee due to the comparably smaller mining sector and its phase-out during 2018.

The gross value added of electricity generation in the lignite and hard coal industry is strongly dependent on developments in exchange electricity prices, commodity prices for fuels and on CO<sub>2</sub> certificate prices. For 2018, the direct gross value added of coal-fired power plants is estimated at a total of around €5.9bn, of which €4.2bn was created by lignite power plants and €1.7bn by hard coal power plants.<sup>9</sup>

The total direct gross value added of €5.9bn corresponds to about 0.19 per cent of total German gross value added (2018: €3,055bn) (Federal Statistical Office 2019). Within the mining regions, the lignite sectors might contribute up to 3 per cent of the regional gross value added. The eastern lignite mining areas of Lusatia and central Germany, in particular, are further challenged with weaker structural indicators than on average in Germany, such as lower employment and wages, lower innovation potential, lower private capital and lower infrastructure connections (RWI 2018).

### 3. The Commission on Growth, Structural Change and Employment

#### 3.1 Mandate and composition

In June 2018, the federal government established the Commission on Growth, Structural Change and Employment. The Commission consisted of a total of 31 members and was headed jointly by Ronald Pofalla, former head of the Federal Chancellery; Prof. Dr. Barbara Praetorius, energy and environmental economist; and Matthias Platzeck and Stanislav Tillich, former prime ministers of two *Länder*. The other members of the Commission were representatives from the energy sector, lignite regions, industry, environmental associations, trade unions, scientists and the coalition parties; the latter with speaking but not voting rights (Figure 9). All the members of the Commission worked on an honorary basis.

The plenary sessions were also attended by representatives of the *Länder* and federal ministries concerned as well as the Federal Chancellery (Commission on Growth, Structural Change and Employment 2019). The Commission's work was supported by a secretariat attached to the Federal Ministry of Economy and Energy. The chairs of the Commission also reported regularly to the State Secretaries Committee set up for this purpose, which included representatives of eight federal ministries (Figure 10).

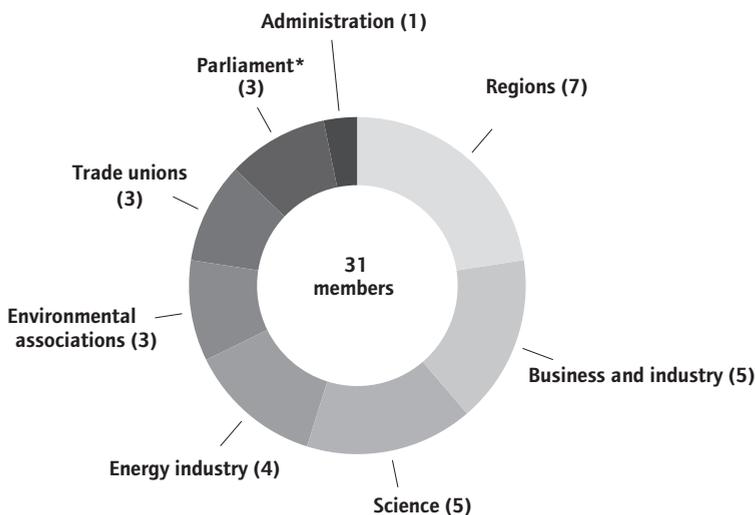
According to the federal government decision of 6 June 2018 to establish it, the Commission had the following mandate (German Government 2018):

- 'Development of a concrete perspective for new, future-proof jobs in the affected regions in cooperation between the federal government, the *Länder*, local authorities and economic actors (e.g. in the field of transport infrastructure, the development of skilled workers, entrepreneurial development, establishment of research facilities, long-term structural development);

9. Potential revenues from heat generation or the provision of system services are not taken into account as no data are publicly available for this purpose. However, these account for only a fraction of total power plant revenues and have therefore been ignored for this purpose. The advance payments of the mining industry are included.

- development of a mix of instruments that brings together economic development, structural change, social compatibility, social cohesion and climate mitigation and, at the same time, opens up perspectives for sustainable energy regions in the context of energy system transformation;
- this also includes necessary investments in the regions and economic sectors affected by structural change, for which existing federal and EU funding instruments are used effectively, purposefully and as a matter of priority in the affected regions and for which a fund for structural change, in particular from federal funds, is also used;
- measures that reliably meet the 2030 target for the energy sector, including a comprehensive impact assessment. The Climate Change Plan sets the target of reducing emissions from the energy sector by 61 to 62 per cent in 2030 compared to 1990 levels. For the contribution of coal to electricity generation, the Commission will propose appropriate measures to achieve the 2030 sectoral objective of the energy sector, to be included in the 2030 programme of measures to implement the Climate Change Plan;
- in addition, a plan for the gradual reduction and phasing out of coal-fired power generation, including a completion date and the necessary legal, economic, social, re-naturalisation and structural accompanying measures;
- also, measures on the contribution of the energy industry to reduce the gap as much as possible to reach the forty per cent reduction target. To this end, the federal government will publish a current estimate of the size of the gap to be expected in the context of the Climate Report 2017.’

Figure 9 Composition of the Commission on Growth, Structural Change and Employment

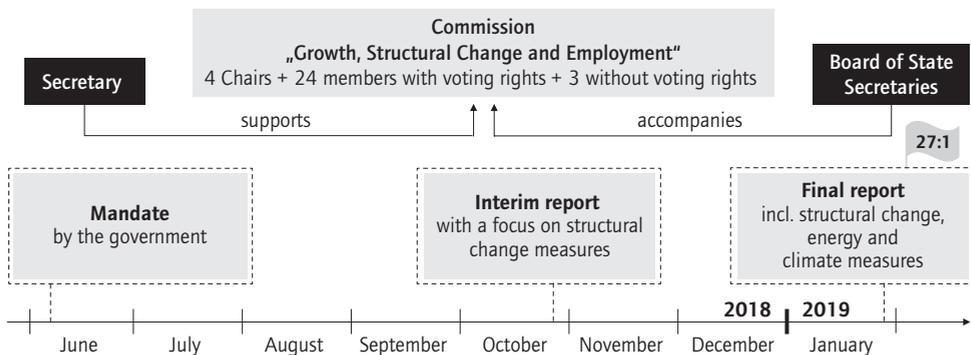


Source: own presentation based on Commission on Growth, Structural Change and Employment (2019).

The Commission held a total of ten plenary meetings. In the first part of the consultations up to autumn 2018, the Commission heard from a number of experts on regional development, climate mitigation and security of supply, as well as on cost and price effects, while the second part of the hearings focused on the negotiation of its final report recommendations. The plenary sessions were prepared by two working groups, one on 'regional development and employment' and the other on 'energy and climate'.

The final report was adopted almost unanimously by the members of the Commission in January 2019 (voting ratio: 27:1) and handed over to the federal government in February 2019 by the chairs of the Commission.

Figure 10 Commission's organisational structure and timetable



Source: own presentation based on Commission on Growth, Structural Change and Employment (2019).

### 3.2 Recommendations

In addition to a comprehensive review of the role of coal in Germany, the Commission's final report includes a strategy with five elements for the phasing-out of coal-fired power generation in Germany (Figure 11). The first element is reducing the capacity targets for coal-fired power stations in the market and phasing them out by 2038 at the latest (element A). Additionally, the Commission recommended the implementation of further measures. Current coal regions should be supported by active regional development policies to develop economic alternatives (element B); while, at the same time, the electricity and energy system must be comprehensively modernised (element C). Furthermore, there should be a cushioning against possible hardships for those directly affected by the exit from coal (element D). Finally, the phase-out and its effects are to be regularly monitored and, if necessary, readjusted (element E).

Figure 11 Overview of the Commission's recommendations

1	2	3	4	5
<b>Phase out coal to meet climate targets</b>	<b>Support transformation of traditional mining regions</b>	<b>Modernise the power system</b>	<b>Minimise negative effects on affected groups</b>	<b>Monitor and adjust measures</b>
<p>Avoid new commissioning of plants and mines</p> <p>Shut down existing fleet along specific target for 2023, 2025 and 2030 until 2035/2038</p>	<p>Help creating new jobs by modernising the energy regions and kickstart investments in infrastructure and innovation</p> <p>Secure polluter-pays-principle for reclamation</p>	<p>Ensure effective climate mitigation with more renewables, CHP and cancellation of CO<sub>2</sub>-certificates</p> <p>Ensure security of supply with reserves and new gas capacity</p> <p>Make the power system more flexible with more grids and storage</p>	<p>Secure competitiveness of industries and affordability for households with power price compensations</p> <p>Compensate utilities for early shut downs</p> <p>Ensure a 'Just Transition' for employees with active labour market policies</p>	<p>Monitor and report the progress in 2023, 2026, 2029 and 2032</p> <p>Take additional measures if needed</p>

Source: own presentation based on Commission on Growth, Structural Change and Employment (2019).

### Element A: Gradually reducing and terminating coal-fired power generation

The Commission's recommendations stipulated that, if possible, no new coal-fired power plants should go into operation and that new opencast lignite mines for energy use should be abandoned in the future. Furthermore, the Commission's recommendations provided for a gradual reduction of the capacities of existing coal-fired power plants in the market (Figure 12). Accordingly, the capacity available on the market from coal-fired power plants is to be reduced to a maximum of thirty GW by 2023 (of which fifteen GW lignite and fifteen GW hard coal) and to a maximum of seventeen GW by 2030 (of which nine GW lignite and eight GW hard coal) (Figure 12). In addition, a reduction contribution of ten million tonnes of CO<sub>2</sub> is to be made by lignite-fired power plants in 2025. All market exits are subject to approval by the Federal Network Agency in accordance with Section 13b of the Energy Industry Act. The latter may refuse a planned decommissioning if it considers that this would jeopardise security of supply in terms of system stability.

With regard to developments in the interim years, the Commission recommended that the path be designed in such a way that the overall reduction in greenhouse gas emissions is as steady as possible. The last coal-fired power plant should be phased out by 2038 at the latest. In 2032, it will be examined whether a complete phase-out of coal is possible by 2035. The specific design of the exit timetable should be such that the forest at the Hambach opencast mine, where major protests took place in 2018 (Bloomberg 2018), can be preserved at its present size.



The Commission's recommendations stipulated that coal regions should be developed into modern energy regions. This includes the increased expansion of renewable energies but also the continued use of today's power plant sites for alternative generation technologies and storage. At the same time, investments in transport and digital infrastructure, as well as in local research and innovation, should strengthen the regions' locational advantages and innovation potential. To achieve this, the regions are to be developed into regulatory model regions in which new industrial processes or procedures can be tested and further developed. In the short and medium term, several federal authorities, with a total volume of 5,000 employees, are to be located in coal regions by 2028 at the latest.

All these measures are to be implemented with financing for the coal regions of €40bn over the next twenty years. To this end, the Commission recommended that the government draft a regional development law by the end of April 2019.

A further building block is the increased use of securing services for the operation of opencast lignite mines. This is intended to reduce the risk to lignite regions of the possible bankruptcy of an opencast mine operator and the associated financial costs of re-naturalisation falling on public funds.

### **Element C: Modernise the electricity and energy system**

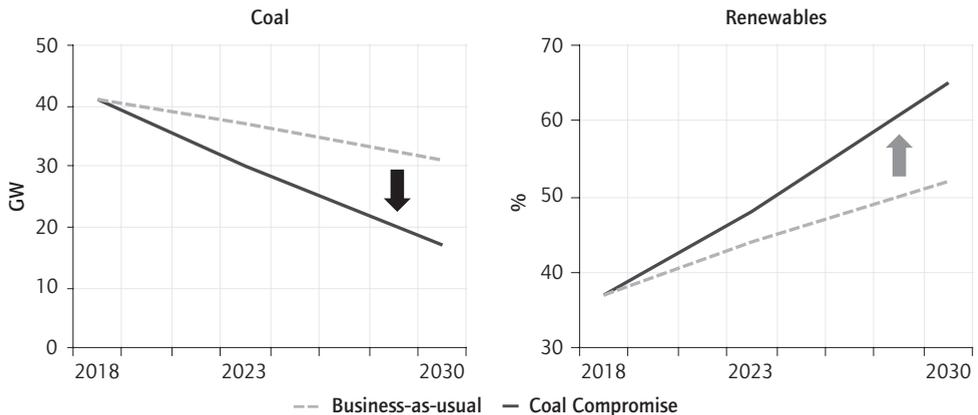
Another element of the Commission's final report is the comprehensive modernisation of the electricity and energy system. Firstly, the climate mitigation effect of the phasing-out of coal must be safeguarded. For this reason, renewable energies are to be expanded to a 65 per cent share of gross electricity consumption by 2030 and the necessary expansion quantities are to be anchored in the Renewable Energy Act accordingly (Figure 13). The continuation of the promotion of combined heat and power is also part of this (see below). To ensure that the phasing out of coal-fired power generation also has an impact within the framework of the European Emissions Trading System, and does not lead to the long-term shifting of emissions abroad, the federal government should also cancel the necessary quantity of CO<sub>2</sub> certificates.

Secondly, with a view to security of supply, the existing monitoring mechanisms are to be further developed. If there are short-term supply bottlenecks, the existing system of reserves is to be used. However, if the market does not show signs of sufficient investment in new plants in the medium term, the introduction of a capacity market should be examined. Furthermore, in order to secure the supply of heat at today's coal-fired power plant sites in the future, the replacement of such power plants with heat extraction needs to be promoted via an extension of the Combined Heat and Power Act until 2030. At the same time, however, the support system is to be further developed in the direction of flexible CHP systems, including heat from renewable energy.

Thirdly, the electricity and energy system should become more flexible in the course of the further expansion of wind and solar power. This includes the modernisation and better use of electricity grids through the optimisation of existing capacity, expansion and market measures. This also encompasses the promotion of storage facilities –

especially in coal regions in the form of pilot power-to-gas projects. Moreover, the existing levy system in the energy sector needs to be reviewed, as this is increasingly proving to be an obstacle to the necessary integration of energy sectors. Appropriate CO<sub>2</sub> pricing in sectors outside the Emissions Trading System, such as transport and residential heating, also needs to be considered.

Figure 13 Changes in coal capacity and renewable energy shares between business as usual development and the recommendations of the Commission



Source: own presentation based on Commission on Growth, Structural Change and Employment (2019).

#### Element D: Soften potential negative impacts on affected groups

In implementing the phase-out of coal-fired power generation, the Commission considered that the proposed measures could have potential negative impacts. In order to mitigate – or, if possible, even avoid – these effects, the Commission proposed a package of support and compensation measures.

This included, firstly, ensuring that the phasing-out of coal-fired power generation is as socially acceptable as possible. Therefore, extensive labour market policy measures were recommended for those still employed in the coal industry today, including the exclusion of redundancies in the course of the phasing-out of coal-fired power generation. Furthermore, it was recognised that there would be a need for further training measures for employees as well as the targeted re-employment in suitable positions, within and outside lignite companies, of those affected. For employees older than 58 years, a compensation fund is to be used to enable them to retire early without financial loss.

State governments should seek talks with residents in opencast mining regions and adjust opencast mining plans in the respective districts as promptly as possible in accordance with the Commission's recommendations. The aim is to ensure that those affected by possible resettlement receive sufficient planning security.

The competitiveness of energy-intensive industry is to be maintained by the federal government advocating the continuation and further development of CO<sub>2</sub> electricity price compensation at European level. In addition, commercial and industrial electricity consumers, as well as private consumers, are to be protected against a possible increase in retail prices by a lowering of transmission grid charges. The Commission anticipated that a total of €2bn a year in relief would be needed from 2023. In addition, the costs of phasing out coal-fired power generation will not be passed on to electricity consumers.

Lastly, the phasing-out of coal-fired power generation should take place in agreement with the power plant operators. This also means that power plant operators will be compensated for the early closure of capacities. The extent of the compensation is part of the federal government's negotiations with the operators or will be determined by means of a call for tenders for closures.

### **Element E: Monitoring**

In order to ensure successful implementation in all areas, the implementation of the measures is to be regularly reviewed by close monitoring in accordance with specific criteria and recorded in progress reports in 2023, 2026 and 2029. In addition, the progress reports should be discussed in the German parliament.

Furthermore, an independent panel of experts should be entrusted with the evaluation of the implementation. If the implementation of the measures reveals any shortcomings, the federal government should make consistent adjustments.

## **4. Assessment and outlook**

### 4.1 Assessment

In recent years, the phasing-out of coal-fired power generation in Germany has been intensively and controversially discussed. The recommendations drawn up by the Commission represent a pragmatic compromise between the main interest groups from industry, the energy sector, trade unions and environmental associations. Germany is thus continuing its tradition of finding joint solutions to major political conflicts, extending the analogy with the end of coal subsidies and the phasing-out of nuclear power. The almost unanimous adoption of the recommendations should give the federal government a reason to stick to the negotiated compromise. At the same time, the compromise ends the social debate surrounding the phasing-out of coal: whether Germany will phase out lignite and hard coal-fired power generation is no longer in question.

Without the implementation of the measures recommended by the Commission, electricity generation from coal-fired power stations, and thus also CO<sub>2</sub> emissions, especially lignite, would fall only slowly. The proposed measures will enable the energy sector to meet its sectoral targets by 2030 (Agora Energiewende 2019). Since the phase-out of coal-fired power generation is to be replaced primarily by domestic renewable

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energies with, additionally, the necessary amount of CO<sub>2</sub> certificates being cancelled, the relocation of CO<sub>2</sub> emissions abroad can be almost completely avoided.

The credibility of Germany's energy system transformation has suffered considerably in recent years due to the sluggish reduction of greenhouse gas emissions. In particular, the foreseeable failure to meet climate protection targets for 2020, and the persistently high level of coal-fired power generation, have contributed to this. If the Commission's recommendations are implemented, it will be possible to restore some of the credibility of the energy system transformation. However, for this to succeed completely, and for the climate target of 2030 to be safely achieved, as agreed in the current coalition agreement, considerable efforts are still needed in the building, industry, transport and agriculture sectors.

The combination of the gradual reduction of coal-fired power generation and the expansion of renewable energies to 65 per cent by 2030 will mean that wholesale electricity prices will be significantly lower than would be expected on the basis of previous energy and climate policy decisions (Agora Energiewende 2019). Energy-intensive industry, in particular, will benefit from this. For the energy industry, the further expansion of renewable energies, the modernisation of the electricity grid, the conversion from coal-fired to gas-fired power plants, some of which are associated with the further development of CHP support, and incentives for storage facilities offer new investment and growth opportunities.

The scale and long-term nature of the recommended regional development financing for coal regions and the related investments in energy, infrastructure and research may enable the regions to develop sustainably. In addition, they offer the eastern German *Länder* the possibility of compensation for some of the structural policy failures that have occurred since unification. Extending the phase-out of coal to 2038 at the latest, and actually phasing it out, will also enable coal regions to create new jobs in a reasonable amount of time. A comprehensive package of labour policy measures will create fair transition options for affected employees.

In the light of the Federal Network Agency's reservation power on decommissioning, a consensual decommissioning approach with the operators, as well as the continuation of the Combined Heat and Power Act, the further development of supply security monitoring and the existing reserve instruments shows that sufficient national instruments and measures are available to guarantee supply security even in the course of the withdrawal from coal. Even so, the model calculations show that this will require the construction of several gigawatts of new gas-fired power plant capacity by 2030 (Agora Energiewende 2019). Whether this can actually be financed via the energy-only market will have to be closely monitored by the German government in the coming years and, in case of doubt, adjusted in good time.

In total, the additional costs of the proposed measures for the federal budget until 2038 amount to between €69bn and €93bn (Agora Energiewende 2019). This corresponds to about €3.6bn to €4.9bn per year over the same period. These costs could have been significantly lower if, in recent years, the federal government had taken a more

proactive approach to climate, energy and structural policy. In the interests of long-term planning security for companies, regions and employees, as well as socially-acceptable arrangements for the phasing-out of coal, the Commission's recommendations should be followed.

In summary, under its recommendations the Coal Commission has followed the concept of a just transition in various dimensions. Firstly, a high number of directly-affected interest groups were included in the political process of solution finding, ranging from coal workers to regional representatives of civil society and to environmental associations. Secondly, with a phase-out stretched over sixteen to nineteen years, both the regions and the energy and industry companies have been given a reasonable amount of time to transform. And, thirdly, the proposal foresees the provision of comprehensive financial support to the stakeholder groups affected.

## 4.2 Outlook

In February 2019, the federal government accepted the Commission's report and announced that it would examine its recommendations. Due to the Commission's recommendations being adopted almost unanimously by the various players from industry, the energy sector, environmental associations, trade unions and academia, the federal government is under pressure to implement them faithfully and in full.

Two central legislative projects are at the centre of implementation: firstly, there will be a regional development law whose aim is to safeguard economic development in the regions; and, secondly, there is the legal anchoring of the phase-out of coal.

In September 2019, the government has presented the respective proposals for both laws, which should enter the parliamentary procedure before the end of 2019.

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