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THE NEXT STAGE OF THE ENERGIEWENDE

Michał Kędzierski

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WARSAW
JANUARY 2022

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ISBN 978-83-67159-20-3

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INTRODUCTION

Lignite and hard coal still play an important role in the German energy sector.[1] In 2019, a total of 28.4% of the electricity generated in Germany was by coal-fired power plants. Due to their high emission levels, these power plants are a significant source of carbon dioxide – accounting for three quarters of such emissions in the national energy sector and a quarter in the entire economy. It will not be possible to meet the country's climate policy targets in the medium term without accelerating the transition away from coal use for energy purposes. The process of phasing out coal (*Kohleausstieg*) presents a major challenge in terms of restructuring energy policy on the one hand, while also encompassing various opposing political, economic and social interests on the other.

The first chapter of the report sets out the role of coal in the German energy sector and the impact of its use on greenhouse gas emissions. The second chapter illustrates the context of the *Kohleausstieg* debate in Germany and the importance of the coal commission and the community-wide compromise it produced in achieving a successful political regulation of the coal phase-out. The next section presents the statutory mechanism for phasing out coal-based energy production in Germany. The study also addresses the issue of restructuring lignite mining regions and the role of the transformation of mining basins in ensuring the acceptance of citizens for the entire process of phasing out coal. The last chapter is an attempt to show the consequences of the *Kohleausstieg* as the next stage of the German energy transition after the abandonment of nuclear energy, and how this transition may be affected by new emission reduction targets in the EU and changes in the assumptions underlying Germany's climate policy.

[1] In 2020, as a result of the economic effects of the COVID-19 pandemic, the importance of coal temporarily declined, making it an unsuitable benchmark for comparison. In the first half of 2021, a resurgence of its consumption for energy purposes was observed – close to the level recorded in 2019.

MAIN POINTS

- The problem of abandoning coal-fired power generation is a very uncomfortable one from the political standpoint. It touches upon the opposing interests of many influential social and economic groups which make up the electorate of the Christian Democrats and Social Democrats. In order to find a way out of this complicated situation, a so-called coal committee was set up, in which an acceptable compromise, taking into account economic, social, regional and climate protection interests, was reached with the participation of stakeholders. The agreement reached in January 2019 within this body became the benchmark and foundation for Germany's coal phase-out process. The committee's main recommendations have served the government on the one hand as signposts when drafting the relevant legislation, and on the other hand as a convenient and effective way of legitimising the implemented decisions.

- The Act on the Phase-out of Coal of 3 July 2020 stipulates that the last coal-fired units will have to be closed by the end of 2038 at the latest. The mechanism adopted regulates the rate and rules for the withdrawal of these power plants from the market. This course of action is a safe solution from the perspective of ensuring energy supply, but it does not guarantee a permanent reduction in emissions in line with Germany's climate policy. Reducing the capacity of power plants participating in the market does not have to automatically translate into a reduction in their electricity production. The use of the remaining coal-fired units will increase in the coming years, due among other things to the decommissioning of the last nuclear power plants by the end of 2022. In turn, the competitiveness of coal-fired power generation will be undermined by the expected further increase in the price of CO_2 emission allowances under the EU ETS (EU Emissions Trading Scheme) and the continued increase in the share of renewable energy sources (RES) in the mix.

- Among the elements of the plans to abandon coal-fired power generation, the most controversial in Germany are the compensation payments for the operators of lignite-fired power plants. The non-transparent way in which the compensation was agreed is questionable, as was the amount itself (RWE and LEAG are to receive a total of €4.35 billion), which is widely seen as disproportionately high. According to most representatives of the expert community, it results from the use of erroneous, unrealistic assumptions, and the stated benefits may have been deliberately inflated for political

reasons. Most of these concerns about the level of compensation for RWE and LEAG were shared by the European Commission, which initiated a formal investigation to examine their compliance with EU state aid rules. The likely scenario is that the EC will force a renegotiation of the benefits.

- A key determinant of public acceptance for the move away from coal in mining regions is the provision of time and funding for restructuring. The phasing out of the industry is of great concern to citizens and poses a major economic challenge, especially in the eastern German mining districts. The prime ministers of Saxony, Brandenburg and Saxony-Anhalt had a significant influence on the course of the negotiations and obtained far-reaching concessions with regard to both the shape of the timetable for power plant closures and the amount of financial support for the transformation of the mining regions. The pool of funds, totalling €40 billion, will also be used to finance investments in road and rail cross-border connections with Poland.

- Germany's coal phase-out involves a major overhaul of its electricity system and represents a further stage in the Energiewende, following the abandonment of nuclear power. The phasing out of coal-fired power plants will inevitably lead, in the short to medium term, to an increase in the significance of natural gas as a transition fuel for the energy transformation. The phasing out of a significant number of conventional power plants will bring an increase in electricity imports. Many scenarios indicate that Germany will transform itself from a net exporter to an importer in the mid-2020s. In addition, the capacity of back-up power plants will have to be increased (up to five times) in order to ensure the security of electricity supplies. The extent to which these consequences occur will depend on the rate of growth in RES capacity, the expansion of electricity grids and the scale of growth in electricity consumption as part of the energy transition.

- The new EU emissions reduction target for 2030 (by 55% compared to 1990) and the related new assumptions of Germany's climate policy (cutting emissions by 65% by 2030, by 88% by 2040 and achieving carbon neutrality in 2045) increase the pressure to significantly accelerate the Energiewende. The decarbonisation rate in the power sector is to halve between 2020 and 2030, which means that the coal phase-out process will have to progress much more quickly than is envisaged by current statutory regulations. The expected significant increase in the price of emission allowances in the EU ETS will increasingly aggravate the profitability of power generation

in coal-fired power plants (relative to gas-fired plants), which will encourage operators to withdraw them on their own for business reasons, which is a possibility allowed by the law. From the federal government's perspective, there is no need to amend the law by setting a new date for the coal phase-out, as this would mean the need to renegotiate the amount of compensation for energy companies.

- The implementation of the green transformation of the economy in line with the long-term goal of achieving carbon neutrality by 2045 is one of the greatest challenges faced by the new coalition holding the reins after the elections to the Bundestag. In order to meet its obligations in the electricity sector, Germany will first of all have to multiply the rate of growth of the installed RES capacity and create incentives to invest in new gas units or to switch from coal to natural gas in existing power plants. Due to the bridging nature of natural gas in the transition, new gas investments are likely to already take into account the possibility of future hydrogen use. Germany's electricity system is to become RES-based in its entirety by the early 2040s.

I. COAL PHASE-OUT AND CLIMATE POLICY

1. The importance of coal in the German energy industry

In 2018 Germany was ranked first, ahead of China, Turkey and Russia, in the world in terms of both lignite extraction and consumption. A total of 166.3 million tonnes of lignite were extracted in the three domestic coalfields (Lusatian, Central German and Rhineland), accounting for 16.3% of global mining.[2] The coal extracted is almost entirely consumed for its own needs – only 430,000 tonnes were exported in 2018 – and is used for 90% by domestic power plants.

In December 2018, the last two hard coal mines – Prospel Haniel and Ibbenbüren in North Rhine-Westphalia – ceased operations. From 2019, Germany's demand for this resource (44 million tonnes in 2018) will be covered entirely by imports. Its largest suppliers include: Russia (41%), USA (21%), Australia (11%), Colombia (8%) and Poland (4%).[3] In 2018, nearly 59% of hard coal consumption was for the production of electricity and heat, and 39% for the needs of the metallurgical industry.[4]

The end of hard coal mining in Germany

Hard coal was closely associated with the period of the post-war economic miracle (*Wirtschaftswunder*) in West Germany – its mining was a key economic sector and drove industrial development. By the end of the 1950s it employed more than 600,000 people and annual output reached 150 million tonnes. As a result of the increasingly difficult access to the geological formations in which the deposits were located, the indigenous resource began, from the 1960s onwards, to decline significantly in terms of competitiveness against imports. Due to the deficient nature of hard coal mining, subsidies from public funds (federal and state) were introduced for the first time for this sector in 1974. Between 1998 and 2018 alone, subsidies from the central budget totalled around €40 billion. After peaking in 1957, both the mining rate and employment in German mines declined steadily to 70 million tonnes and 130,000 employees in 1990. In 1997, 2003 and 2007, the government reached agreements with mining organisations to reduce production and gradually close down the mining sites.

[2] *BGR Energiestudie 2019 – Daten und Entwicklungen der deutschen und globalen Energieversorgung*, Federal Institute for Geosciences and Natural Resources, April 2020, bgr.bund.de.

[3] *Ibidem*.

[4] *Energieverbrauch in Deutschland im Jahr 2018*, AG Energiebilanzen e.V., February 2019, after: zsw-bw.de.

The last of the agreements, signed with the governments of North Rhine-Westphalia and Saarland, RAG Deutsche Steinkohle AG and the Industrial Union of Mining and Energy, Chemistry, Energy (IG Bergbau Chemie Energie), stipulated the expiry of coal mine subsidies at the end of 2018. In that year, Germany's 4,900 miners had extracted only 2.7 million tonnes of raw material.

Even at the beginning of the second decade of the 21st century, coal accounted for almost half of Germany's electricity production (see Chart 1). In view of the planned phasing out of nuclear energy in 2000 (at that time the coalition of SPD and the Greens, together with energy corporations, decided to phase out nuclear for the first time)[5], coal-fired power plants were seen as playing a key role in ensuring the security of energy supplies in the coming decades. Together with gas-fired power stations, they were to form a bridge to a system based increasingly on renewable energy sources. In the middle of the first decade of the 21st century, the favourable operating prospects and sometimes even pressure from representatives of federal and state government groups encouraged the national energy companies to construct new coal-fired units.[6] Between 2006 and 2008, the construction of nine modern hard-coal-fired power stations with a total capacity of 7.3 GW began. The cornerstone-laying ceremony in Hamm, organised by RWE, was attended by Chancellor Angela Merkel, who emphasised in her speech the importance of this resource for Germany's energy security and low energy prices for the competitiveness of its industry.[7] The power plants under construction at the time began operating between 2013 and 2015 – with the exception of the power plant at Datteln, which was not commissioned until 2020.

In 2011, after the Fukushima disaster, the decision to accelerate the exit from nuclear power was influenced by public opinion.[8] As a result of the immediate closure of eight out of seventeen reactors, coal-fired power generation

5 Under an agreement reached on 14 June 2000 between the federal government and energy companies, German nuclear power plants were assigned specific quotas of energy after which they were to be shut down. It was estimated that the last of them would exhaust its budget in the early 2020s. The deal was approved by law in December 2001 by a vote of the SPD-Green coalition, with opposition from the CDU/CSU and FDP. Following the formation of the Christian Democrat-Liberal coalition in 2009, the new cabinet decided in autumn 2010 to extend the operation of nuclear power plants into the 2030s.

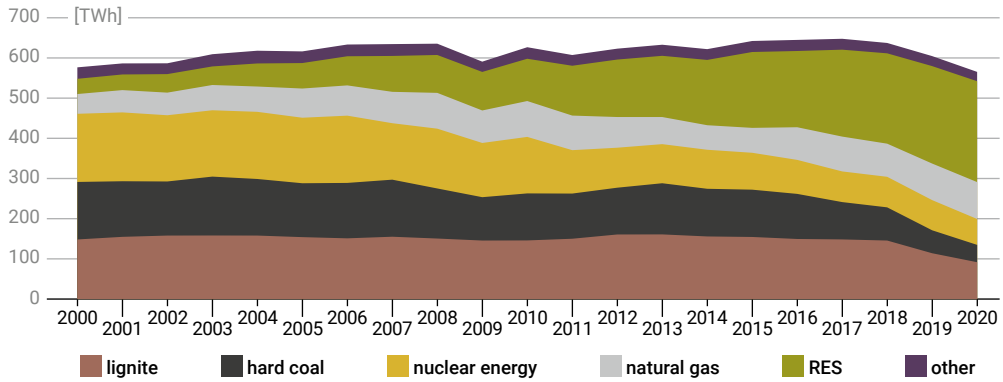
6 F. Illing, *Energiepolitik in Deutschland: die energiepolitischen Maßnahmen der Bundesregierung 1949–2013*, Nomos, Baden-Baden 2012.

7 'Merkel wirbt für Neubau von Kohlekraftwerken', Welt, 30 August 2008, welt.de.

8 A. Kwiatkowska (ed.), *Germany's energy transformation: difficult beginnings*, OSW, Warsaw 2013, osw.waw.pl.

increased by 10% between 2011 and 2013, partially filling the gap in the system (mostly covered by rising generation from renewable energy sources). During this period, generating electricity through this route was cheaper than from natural gas. It was not until the end of the second half of the decade that energy obtained from hard coal clearly lost its competitiveness, which resulted in the gradual elimination of this fuel from the mix. This trend was mainly supported by growing generation from RES (which has priority access to the grid), lower natural gas prices and strongly increasing CO_2 emission allowances under the EU Emissions Trading System (EU ETS) from 2018.

Chart 1. Structure of electricity production in Germany in 2000–2020



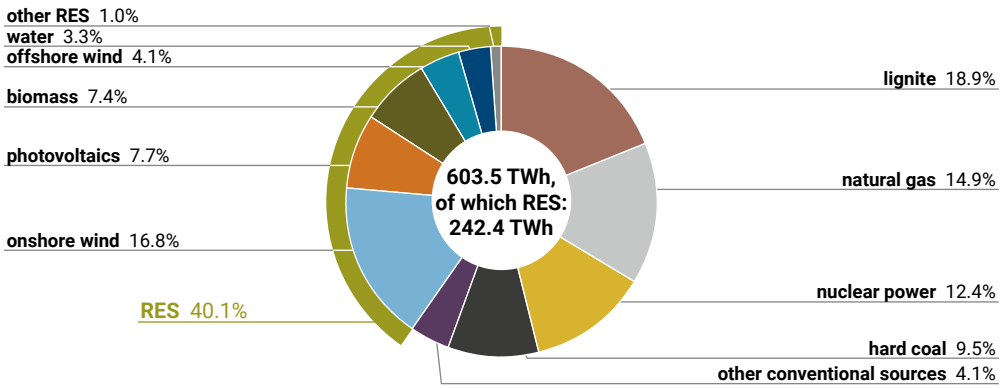
Source: AG Energiebilanzen e.V.

Despite the decline in the share of coal in the energy mix outlined at the end of the last decade, this resource still plays a very important role in the mix. In 2019, it accounted for a total of 28.4% of electricity generated in Germany – falling behind RES for the first time, which together accounted for 40.1% of electricity (the share of RES in its consumption, i.e. after taking into account the balance of trade, was 42% – an important indicator from the perspective of Germany's climate and energy policy). With a share of 18.9%, lignite was then the largest source of electricity generation – ahead of onshore wind (16.8%), natural gas (14.9%) and nuclear energy (12.4%). Hard coal was fifth in this ranking with a share of 9.5% (see Chart 2). Moreover, coal still counts in district heating. In 2019, hard coal accounted for 17.5% and lignite for 5.6% of district heating generated in CHPs (Combined heat and power plants). Its main source, with a share of 43.9%, is natural gas.

The importance of coal in power generation clearly increases in the autumn and winter months, when on the one hand energy consumption increases,

and on the other hand (especially in periods of the so-called dark wind lull, i.e. low wind and lack of sunshine) the share of photovoltaic and wind sources decreases. Coal-fired power stations, on the other hand, are used less frequently in spring and summer – during that time, taking into consideration the reduced demand, photovoltaics in particular take a significant place in the mix. In November 2019, for example, coal accounted for a total of 36% of the power generated in Germany, and in May 2019 it was 26%. In winter, however, there are days when the share of RES drops to several percent and coal is used to generate nearly half of electricity.[9]

Chart 2. Structure of electricity production in Germany in 2019, by source

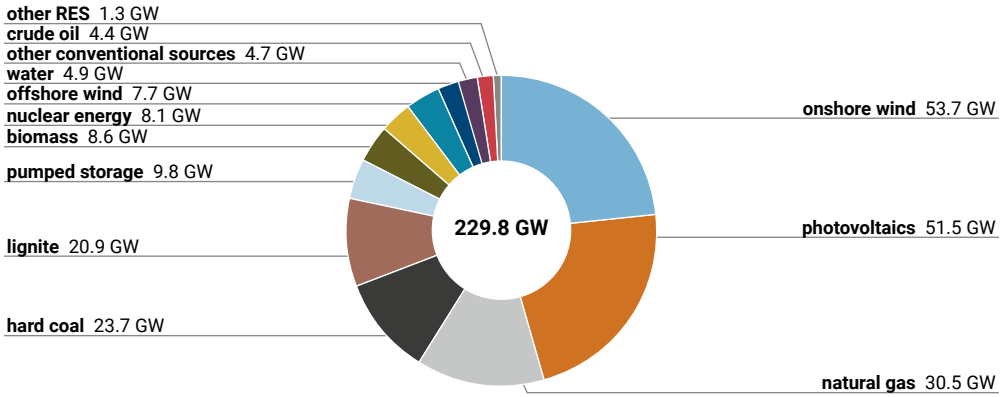


Source: AG Energiebilanzen e.V.

At the end of 2020 (before the start of the phase-out of power units under the act), the installed capacity of lignite-fired power plants in Germany was 20.9 GW and that of hard coal-fired power plants was 23.7 GW. However, some of these were in reserve or temporarily shut down (at the time, this was the case for power plants with capacities of 2.7 GW and 3 GW respectively). The installed capacity of all generation sources in the country's electricity system was 229 GW, with RES accounting for a total of 128 GW and conventional units for 101 GW. Coal-fired power plants thus provided Germany with a total of nearly one fifth of the capacity (see Chart 3).

[9] Data according to the Energy Charts website run by the Fraunhofer Society, energy-charts.info.

Chart 3. Installed capacity in the German electricity system in 2020, by source

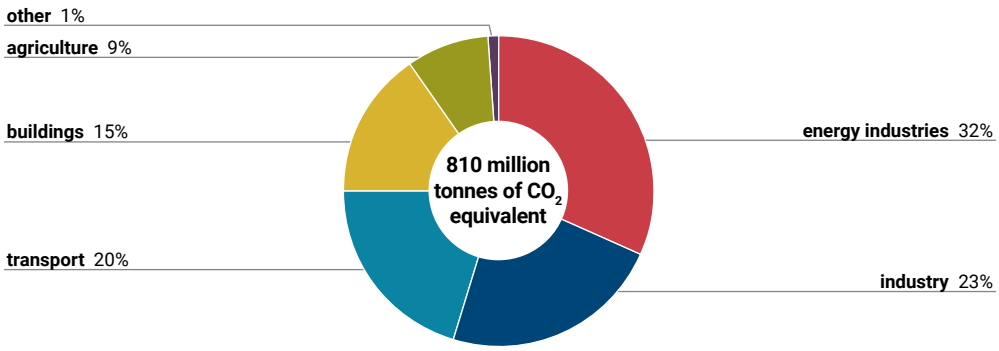


Source: Federal Network Agency.

2. Germany's emissions profile

In 2019, Germany's total greenhouse gas emissions amounted to 810 million tonnes of CO_2 equivalent. Sector-wise, energy was the largest source, accounting for 32% of emissions, with industry contributing 23%, transport 20%, building use 15% and agriculture 9% (see Chart 4). In power generation, nearly three quarters of emissions came from coal combustion, with lignite-fired power plants and CHPs responsible for about half and hard coal-fired units for nearly a quarter. Units using natural gas as fuel in turn generated just over 12% of the sector's emissions. Thus, the use of coal for electricity and heat generation accounted for about a quarter of all greenhouse gas emissions in Germany.

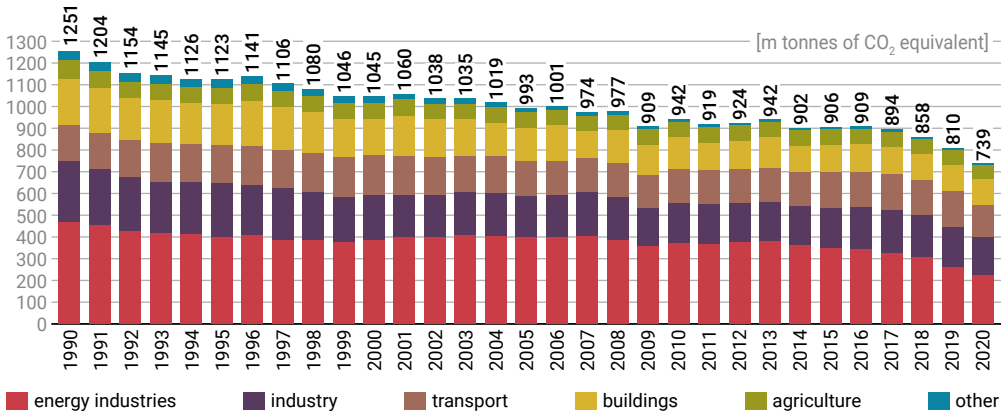
Chart 4. Greenhouse gas emissions in Germany in 2019, by sector



Source: Federal Environment Agency.

In the first decade following reunification, Germany experienced a significant decrease in greenhouse gas emissions, which was mainly due to the decommissioning or modernisation of industry (including energy) in the former GDR.[10] Since the late 1990s, reductions have been slower and there have also been several years of stagnation (see Chart 5). This was due, among other things, to the persistence of a high share of coal – the most emission-heavy fuel used to produce electricity – in the energy mix.[11] This resulted from, among other factors, the shutdown of eight nuclear power plants in 2011 and the partial replacement of the resulting shortfall by coal-fired units. The increase in greenhouse gas emissions observed between 2011 and 2013 (by 10%) and the simultaneous rapid development of RES generation has been dubbed the Energiewende paradox. In 2013, the amount of greenhouse gas emissions generated in the power industry increased to the level of 1997.

Chart 5. Greenhouse gas emissions in Germany in 1990–2020



Source: Federal Environment Agency.

An acceleration in the pace of reduction came in the second half of the last decade, with a progressive decline of the share of coal in the energy mix. The clear reduction of emissions in the economy after 2016 almost exclusively occurred in the energy sector – other sectors saw only small changes. According to preliminary estimates from the Ministry of the Environment, in 2020 the level of emissions fell by 41% compared to the 1990 base year for climate policy. It also recorded a significant reduction compared to 2019. However, this was not the result of a technological change in the economy, but a short-term

[10] R. Bajczuk, M. Kędzierski, *The leader is gasping for breath. Germany's climate policy*, OSW, Warsaw 2020, osw.waw.pl.

[11] According to the German Emissions Trading Authority (DEHSt), the CO_2 emission indicator for lignite is 104–114 kg/GJ, for hard coal – 95 kg/GJ, for fuel oil – 74–78 kg/GJ and for natural gas – 56 kg/GJ.

effect of the COVID-19 pandemic, including reduced energy demand or reduced mobility, among others.[12] As the economy recovers from the pandemic crisis, emissions are expected to increase once again.

The government's energy strategy (*Energiekonzept*), adopted in 2010, stipulates that Germany's climate policy goals are to reduce greenhouse gas emissions by 55% by 2030, by 70% by 2040 and by 80–95% by 2050.[13] With the adoption of the Climate Protection Act (*Klimaschutzgesetz*) in December 2019, the latter objective was raised to the achievement of carbon neutrality, which means reduction of emissions of around 95% (the remaining greenhouse gases that are difficult to eliminate will have to be offset, e.g. through natural absorption or carbon capture and storage).[14]

It will not be possible to achieve the climate policy goals formulated in this way without significantly reducing emissions from the burning of coal in the power industry, both in the long and medium term. According to the position prevailing in the German debate, phasing out coal is not only indispensable, but also the fastest and most effective way of reducing greenhouse gas production. Expert reports prepared for the coal commission by think tanks (described extensively in chapter two) have indicated that reducing emissions by 55% by 2030 would require a reduction in the amount of coal-fired power capacity available in the system to a total of 16–20 GW, and the complete abandonment of coal-fired generation by 2040 at the latest.[15] Meanwhile, forecasts indicated that due to worsening market conditions (mainly because of the increase in generation from RES and prices of emission allowances), the installed capacity of power plants burning hard coal would fall to 11–17 GW by 2030, and units using lignite – to 16 GW. A fully market-driven phase-out of coal would therefore be too slow to ensure that the climate strategy targets would be met. From the federal government's perspective, this meant that political measures had to be taken to speed up the process.

[12] M. Kędzierski, 'COVID-19 i Energiewende: wpływ pandemii na niemiecką transformację energetyczną', *Komentarze OSW*, no. 340, 17 June 2020, osw.waw.pl.

[13] *Energiekonzept für eine umweltschonende, zuverlässige und bezahlbare Energieversorgung*, Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection, 28 September 2010, bmwi.de.

[14] M. Kędzierski, 'Niemiecka ustawa o ochronie klimatu: mechanizm pozbawiony sankcji', OSW, 16 October 2019, osw.waw.pl.

[15] According to estimates by Aurora Energy Research, the installed capacity of coal-fired power plants should fall to 16 GW (9 GW – hard coal, 7 GW – lignite) by 2030, according to r2b – to 17 GW (8 GW – hard coal, 9 GW – lignite), according to ENavi – to 18 GW (11 GW – hard coal, 7 GW – lignite) and according to BCG/Prognos – to 20 GW (11 GW – hard coal, 9 GW – lignite). The results of the projections differ due to differently chosen variables such as commodity prices, EU ETS allowance prices, the regulatory environment and available installed capacity from renewable sources.

II. THE CARBON COMMISSION – A KEY COMPROMISE

1. Origins and context of the debate on the coal phase-out

Back in 2013, the issue of abandoning coal-fired power generation was not a significant topic of political discourse in Germany. The coalition agreement concluded by the CDU, CSU and SPD parties at the time stated that "conventional power plants (lignite, hard coal and natural gas) will remain an indispensable part of the national energy mix for the foreseeable future".[16] However, the increased importance of coal in power generation following the shutdown of eight nuclear power plants in 2011 resulted in increased greenhouse gas emissions, as already mentioned. Climate experts, in addition to environmental organisations, increasingly called for political regulation of the problem and for commencing the process of phasing out the most highly emitting coal units,[17] but the government was not yet ready for such far-reaching measures. The solution proposed in March 2015 by the Ministry of Economic Affairs and Energy, which envisaged the introduction of a so-called climate fee for the oldest power plants (those more than 20 years old), was vehemently opposed by trade unions and the energy industry. The Christian Democrats also came out against the proposal. The breakthrough came in April with a demonstration by 15,000 trade unionists in Berlin, after which the idea was finally abandoned. In July of the same year, the coalition partners presented a compromise solution, which provided for the gradual transfer of lignite-fired power plants with a total capacity of 2.7 GW to a so-called safety reserve. The operators of these units were to be compensated for keeping them in operation for four years, and they were to be switched on only by order of the Federal Network Agency (Bundesnetzagentur, BNetzA) in exceptional situations. After this period, they were to be finally shut down. However, this solution remained only a short-term way of reducing emissions – only 13% of the capacity of German lignite power plants was affected.[18]

The issue regarding the eventual cessation of coal use for generating electricity permanently entered the national public debate at the end of 2015 during the negotiations on an international agreement at the Paris climate conference (COP21), which were conducted with Berlin's vigorous involvement. At the time,

[16] *Deutschlands Zukunft gestalten. Koalitionsvertrag zwischen CDU, CSU und SPD*, 27 November 2013, cdu.de.
[17] G. Rueter, 'Klimaexperten drängen auf Kohleausstieg', Deutsche Welle, 12 September 2014, dw.com.
[18] R. Bajczuk, 'The uncertain future of the coal energy industry in Germany', *OSW Commentary*, no. 188, 20 October 2015, osw.waw.pl.

Federal Environment Minister Barbara Hendricks (SPD) announced the need to initiate talks on the coal phase-out within 20–25 years in order to meet climate policy commitments. In the Bundestag, she argued that "the time of fossil fuels is coming to an end, and we must speak openly about this to the public".[19] Although her speech drew criticism from both the Christian Democrats and members of her own party, polls showed that citizens clearly supported her initiative, with 68% of respondents in favour of closing the last coal-fired power stations between 2035 and 2040 and 25% against.[20]

The issue of abandoning coal power remained politically very uncomfortable for the ruling Christian Democrats and Social Democrats, as it touched the interests of many influential social and economic groups belonging to the electorate of both parties. The group of interested actors ranged from environmental organisations, trade unions and representatives of various sectors of the economy (energy, industry or the SME sector) to residents of mining districts, for whom coal mining companies are an attractive employer. The interests and expectations of these parties were so conflicting that initially the vast majority of politicians from the CDU/CSU-SPD coalition were deeply reluctant to discuss the political regulation of the coal phase-out.

The way out of this complicated situation was the establishment of a round table, at which a socially acceptable compromise could be worked out with the participation of the parties concerned, taking into account economic, social, regional and climate protection interests. From a political perspective, the establishment of such a body was to serve the purpose of shifting the dispute to a new level, as a result of which responsibility for the solutions thus worked out would be spread over a broad spectrum of actors representing all those concerned. This was to increase the legitimacy of the outcome of the deliberations, as they could be presented as a nationwide compromise, while the authorities would only be responsible for its implementation.

The establishment of such a body was first announced in the *Climate Protection Plan 2050*,[21] adopted by the federal government in 2016 and confirmed in March 2018 in the new coalition agreement between the CDU/CSU and SPD. At that time, the ruling parties agreed to establish a Commission for Growth, Structural Change and Employment, whose task was to present "a plan for

[19] 'Hendricks: Zeit der Kohle geht zu Ende', Deutsche Welle, 4 December 2015, dw.com.
[20] G. Rueter, 'Mehrheit in Deutschland will Kohleausstieg', Deutsche Welle, 10 December 2015, dw.com.
[21] *Klimaschutzplan 2050*, Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection, November 2016, bmuv.de.

the gradual reduction of and ending the use of coal for electricity generation, including a date for this ending and the necessary legal, economic, social and structural accompanying instruments". Although it was the intention of the originators to give this body a name that would escape the negative connotations of the phasing out of the coal industry in Germany, and focus attention on the positive aspects of the structural transformation, it was commonly referred to as the coal commission.

2. Composition and priorities of the coal commission

The body was finally established by the government in June 2018. It consisted of 28 voting members, representatives of, among others, environmental organisations, regional organisations, employers' associations, trade unions, industry, the small and medium-sized enterprise sector, academia, as well as politicians from the federal and state level. The committee was headed by four chairpersons: three politicians – the former prime ministers of Brandenburg and Saxony, Matthias Platzeck (SPD) and Stanislaw Tillich (CDU), as well as the former head of the Chancellery and Merkel's confidante, Ronald Pofalla (CDU) – and an academic, Prof. Barbara Praetorius. Three non-voting members of the governing parties (CDU, CSU and SPD) and four representatives of the Landtags (federal state parliaments) of the federal states where lignite mining still takes place (Brandenburg, Saxony, Saxony-Anhalt and North Rhine-Westphalia) also took part in the proceedings. The work was also supported by secretaries of state from the ministries of economy and energy, environment, internal affairs and construction, and labour and social policy.

Both the name of the committee and the six priorities formulated by the government which it was to deal with made it clear to the public that the phasing out of coal-fired power generation would not only serve to achieve the goals of climate policy, but would above all represent a new development opportunity for the coal regions and Germany as a whole.[22] Four of the six priorities concerned outlining the prospects for the transformation of the areas affected by the closure of mines and power stations, together with the necessary set of instruments for its successful implementation, taking into account economic, labour, social, climate and energy policies. Among other things, the committee was to determine which investments from federal and EU funds should be made on a priority basis to ensure the success of the restructuring process, to determine the scale of budget support needed under a special structural

[22] R. Bajczuk, 'Phasing out coal the German way', OSW, 13 June 2018, osw.waw.pl.

transformation fund, and only then to work out a timetable and a method for implementing the coal phase-out (point 5) and to prepare proposals of tools to help Germany achieve its emission reduction targets for 2020 and 2030 (points 4 and 6).[23]

A two-thirds majority of the committee members was theoretically required to make decisions, but in practice a compromise acceptable to all parties was sought. The sessions were accompanied by protests from both supporters and opponents of coal power phase-out. Due to diverging interests, the discussions were often very heated and on several occasions the talks almost broke down. Contrary to the government's initial plans, the body was unable to complete its work before the COP24 climate summit in Katowice in December 2018, where it was intended to present Germany's plan to phase out coal power to the world public and show Germany as a leader in global climate policy. A compromise was finally reached after seven months of the sessions, in January 2019. 27 of the 28 members voted in favour of the final report (only Hannelore Wodtke, a CDU councillor from the town of Welzow in Lusatia, voted against).

3. Final report and evaluation of the recommendations

According to the committee's report, Germany should phase out coal-fired power generation by 2038 at the latest, and power plants should be phased out so that by the end of 2022 a total of 30 GW of coal-fired units will be left in the grid, and in 2030 – a maximum of 17 GW. While discussing the issue, it was suggested that in 2032 the possibility of accelerating the closure of all mines and power plants by 2035 should be explored. The body recommended that operators of units shut down by 2030 should receive compensation, the amount of which was to be determined by agreement between the government and the owners or by using an auction system. In order to ensure the security of electricity supply, it was recommended to introduce mechanisms to financially support the conversion of coal-fired CHPs to natural gas and additional instruments to accelerate the expansion of capacity installed in RES (by 2030 their share in electricity consumption should reach 65%). In addition, the committee recommended that authorities introduce mechanisms to stabilise electricity prices for both industry and private consumers, in view of their expected increases due to the coal phase-out. The government should also protect employees of the coal industry from the detrimental effects of

[23] *Kommission „Wachstum, Strukturwandel und Beschäftigung" – Abschlussbericht*, Federal Ministry for Economic Affairs and Climate Action, January 2019, bmwi.de.

this process – e.g. by prohibiting collective redundancies, compensating workers of pre-retirement age and providing appropriate opportunities for raising qualifications and changing career paths. It was also recommended that over a 20-year period €14 billion be allocated to those federal states with coal basins for their own projects to support restructuring. Another €26 billion would be allocated by the government for investments in the mining regions directly from the federal budget.[24]

Reactions to the results of the coal commission were mostly positive. Representatives of individual interest groups emphasised that the adopted recommendations were the result of a balance of arguments and pointed to the fact that the key demands from their perspective had been pushed through. Trade unions, representatives of the energy industry and politicians from the coal-mining regions were particularly satisfied. Environmental organisations were less enthusiastic, describing the closure of the last power plants in 2038 as insufficient, but at the same time stressing the ground-breaking nature of the very beginning of the process of moving away from coal and its irreversibility. Among the members of the committee, the most sceptical were representatives of industry, who expressed concerns about rising energy prices.[25]

Politicians from the governing coalition and the majority of experts were positive about the committee's recommendations. They stressed the importance of the compromise for the success of the project, pointed to its "historic" nature, and described it, among other things, as "a moment of glory for the German political system".[26] The Minister of Economic Affairs and Energy, Peter Altmaier (CDU), announced that the recommendations would be implemented quickly as part of the legislative process.[27] Representatives of the opposition Left party and the Greens reacted in a similar fashion. The result of the work was criticised by FDP and AfD politicians. The Liberals accused the government of intending to manually steer the activities of companies in order to achieve energy and climate policy goals. The AfD, on the other hand, spoke unfavourably about the winding down of the coal industry as a prosperous branch of the economy and warned of the adverse impact of phasing out coal for citizens.[28]

[24] *Ibidem*.
[25] 'Regierungskommission verständigt sich auf Kohleausstieg bis 2038', Handelsblatt, 25 January 2019, handelsblatt.de.
[26] B. Schmidt-Mattern, B. Brandau, 'Wie Bund und Länder den Kohleausstieg finanzieren wollen', Deutschlandfunk, 31 January 2019, deutschlandfunk.de.
[27] 'Altmaier kündigt schnelle Ausstiegsgesetze an', ntv Nachrichten, 28 January 2019, n-tv.de.
[28] R. Bajczuk, 'Germany: compromise on the departure from coal', OSW, 30 January 2019, osw.waw.pl.

The compromise reached as part of the committee's activities became a reference point and a foundation for the process of abandoning coal-fired power generation. The committee's key recommendations served the government on the one hand as guideposts when drafting acts and on the other hand as a convenient and effective way to legitimise the implemented decisions. At the same time, the findings of the committee were utilised by the Greens and Left parties, which used them to urge the government to act and to hold it accountable for the compliance of proposed acts with the recommendations.

III. THE MECHANISM FOR PHASING OUT COAL

Germany's coal phase-out mechanism was regulated by the Coal Phase-out Act (*Kohleausstiegsgesetz*) adopted by the Bundestag and Bundesrat on 3 July 2020. As stated in paragraph 2, its declared aim is to "reduce and end the use of coal for electricity generation in Germany in a socially responsible, gradual and possibly stable manner, thereby reducing greenhouse gas emissions and at the same time guaranteeing a secure, cheap, efficient and climate-friendly electricity supply".[29]

1. Schedule

According to the recommendations of the coal committee, the phase-out of coal-fired power generation will take place by way of a top-down limitation by the legislator of the maximum available installed capacity of power stations using hard coal and lignite as fuel in the coming years. The regulations apply to power plants which sell the energy they generate on the market (the adopted schedule does not include facilities remaining in reserve). According to the act, their installed capacity is to be no more than:

- 15 GW for hard coal and 15 GW for lignite in 2022,
- 8 GW for hard coal and 9 GW for lignite in 2030,
- 0 GW for both fuels by 2038 at the latest.

The total capacity of coal-fired power plants selling electricity on the energy market should thus amount to no more than 30 GW in 2022, 17 GW in 2030 and be reduced to zero by the end of 2038. Between these milestones, on the other hand, it is supposed to fall each year by the same amount – by about 1.63 GW in 2023–2030 and by about 2.13 GW in 2031–2038 (see Chart 6). However, the rate at which coal-fired power plants are phased out will differ in the following years, owing to the different rules adopted for the two technologies. With regard to lignite-fired power plants, the schedule for the phasing out of individual units has already been predetermined and attached to the act as an appendix. The phasing out of hard coal units, on the other hand, will be more flexible and should be treated as a kind of supplement to the reduction of capacity available from lignite. In this case, the legislator decided to introduce the instrument of auctions, allowing the rate of capacity reduction in accordance with the adopted plan to be adjusted to the current situation in subsequent years.

[29] Gesetz zur Reduzierung und zur Beendigung der Kohleverstromung und zur Änderung weiterer Gesetze (*Kohleausstiegsgesetz*), 3 July 2020, bundesrat.de.

2. Lignite

In the case of lignite-fired power plants, the government decided to negotiate directly with the operators in order to work out a timetable for phasing out individual units and the amount of compensation for termination of operations earlier than planned. Finding an amicable solution was one of the recommendations of the coal committee. It was taken into account that there are only a few operators on the German market (which ruled out the implementation of a competitive solution) and, probably more importantly, that the power plants are supplied with raw material by opencast mines operating in their vicinity and usually belonging to the same concern, employing a total of approximately 20,000 people. The latter aspect made it necessary to take into account the decommissioning of the associated opencast mines when planning the closure of the power plants.

In mid-2019, the Federal Ministry of Economic Affairs and Energy began negotiations with the power plant operators and the prime ministers of the states where the lignite mines operate (North Rhine-Westphalia, Brandenburg, Saxony and Saxony-Anhalt). The talks were conducted reluctantly and in a tense atmosphere, as the issue of moving away from coal was not only connected with the opposing interests of the parties, but also posed a political problem, especially for the ruling coalitions in the individual states. The government was keen to agree an amicable solution that would involve a timetable for the closure of coal units that would be in line with the coal commission's recommendations and climate policy objectives, with as little compensation as possible. On the other hand, the prime ministers of the federal states (especially those in the eastern part of the country) were in favour of delaying the closure of power plants and open pits as long as possible in order to gain time to start restructuring the regions dependent on the mining industry (for more details, see Chapter IV). Power plant operators, on the other hand, were willing to agree to a faster closure with sufficiently high compensation.

The talks finally ended on 15 January 2020 at a meeting between representatives of the federal government and the federal states concerned, at which the prime ministers of the federal states endorsed the plan negotiated with the power plant operators for moving away from lignite.[30] The agreements

[30] The meeting was held at the highest level – it was attended by Chancellor Angela Merkel (CDU), Deputy Chancellor and Finance Minister Olaf Scholz (SPD), Economy and Energy Minister Peter Altmaier (CDU), Environment Minister Svenja Schulze (SPD), Head of the Chancellery Helge Braun (CDU) and the prime ministers: North Rhine-Westphalia – Armin Laschet (CDU),

reached were later incorporated into the content of the *Kohleausstiegsgesetz*, and also became part of the public-private agreement between the authorities and the power plant operators, signed by representatives of both parties on 10 February 2021.[31] It covers both the timetable for shutting down individual units and the amount and rules for paying the associated compensation, as well as an undertaking by the corporations not to pursue any potential legal claims. This last issue – after the bitter lesson learnt from the nuclear power shutdown – is particularly important for the federal government.[32]

Lignite phase-out schedule

The established power plant shutdown schedule, shown in the table below, includes large power plants with an installed capacity of at least 100 MW that were still operating in the energy market in 2020. They account for nearly 96% of the capacity of lignite-fired power plants in the electricity system. The remaining, smaller units, which belong to small entities, will be subject to the same regulations as those for hard coal. According to the adopted schedule, the oldest power plants in North Rhine-Westphalia belonging to the RWE concern will be phased out in the first period – eight units with a total capacity of 2.8 GW will be shut down by the end of 2022. The first power stations in eastern Germany, operated by the Czech-owned company LEAG,[33] will not be shut down until the end of 2028 (two units of the Jänschwalde power station in Lusatia near the Polish border will be transferred to reserve in 2025 and 2027 respectively). In total, between 2023 and 2029, power stations owned by RWE and LEAG with a total capacity of 5.7 GW will disappear from the market. Of the remaining plants that will remain in operation after 2030, as many as two-thirds (6.1 GW out of 8.7 GW) will be able to operate until the end of 2038, i.e. until the end of the use of coal for generating electricity in Germany.

Brandenburg – Dietmar Woidke (SPD), Saxony – Michael Kretschmer (CDU), and Saxony-Anhalt – Reiner Haseloff (CDU). For more information, see M. Kędzierski, 'Germany: The central government strikes a deal with the federal states on phasing out coal', OSW, 17 January 2020, osw.waw.pl.

31 'Rechtssicherheit für alle Beteiligten: Öffentlich-rechtlicher Vertrag zum Kohleausstieg in Deutschland unterzeichnet', Federal Ministry for Economic Affairs and Climate Action, 10 February 2021, bmwi.de.

32 M. Kędzierski, 'Niemcy: rekompensaty za odejście od energetyki jądrowej', OSW, 21 June 2021, osw.waw.pl.

33 LEAG (Lausitz Energie AG) was formed in 2016 from Lusatian coal assets (lignite mines and nearby power plants) acquired from Sweden's Vattenfall. The company is owned equally by the Czech energy company EPH and the fund PPF Investments, controlled until March 2021 by the then richest Czech – the late Petr Kellner. Since 2009, MIBRAG (Mitteldeutsche Braunkohlengesellschaft mbH), which mines lignite in the Central German Basin, has also been part of EPH.

Table 1. Extinction dates for individual lignite-fired power plants

Operator	Unit name	Federation Country	Net capacity (MW)	Date of transfer to reserve	Date of shutdown
RWE	Niederaußem D	North Rhine-Westphalia	297	-	2020-12-31
RWE	Niederaußem C	North Rhine-Westphalia	295	-	2021-12-31
RWE	Neurath B	North Rhine-Westphalia	294	-	2021-12-31
RWE	Weisweiler E or F	North Rhine-Westphalia	321	-	2021-12-31
RWE	Neurath A	North Rhine-Westphalia	294	-	2022-04-01
RWE	Frechen/Wachtberg	North Rhine-Westphalia	120	-	2022-12-31
RWE	Neurath D	North Rhine-Westphalia	607	-	2022-12-31
RWE	Neurath E	North Rhine-Westphalia	604	-	2022-12-31
RWE	Weisweiler E or F	North Rhine-Westphalia	321	-	2025-01-01
LEAG	Jänschwalde A	Brandenburg	465	2025-12-31	2028-12-31
LEAG	Jänschwalde B	Brandenburg	465	2027-12-31	2028-12-31
RWE	Weisweiler G or H	North Rhine-Westphalia	663/656	-	2028-04-01
LEAG	Jänschwalde C	Brandenburg	465	-	2028-12-31
LEAG	Jänschwalde D	Brandenburg	465	-	2028-12-31
RWE	Weisweiler G or H	North Rhine-Westphalia	663/656	-	2029-04-01
LEAG	Boxberg N	Saxony	465	-	2029-12-31
LEAG	Boxberg P	Saxony	465	-	2029-12-31
RWE	Niederaußem G or H	North Rhine-Westphalia	628/648	-	2029-12-31
RWE	Niederaußem G or H	North Rhine-Westphalia	628/648	2029-12-31	2033-12-31
Saale Energie	Schkopau A	Saxony-Anhalt	450	-	2034-12-31
Saale Energie	Schkopau B	Saxony-Anhalt	450	-	2034-12-31
LEAG	Lippendorf R	Saxony	875	-	2035-12-31
EnBW	Lippendorf S	Saxony	875	-	2035-12-31
RWE	Niederaußem K	North Rhine-Westphalia	944	-	2038-12-31
RWE	Neurath F	North Rhine-Westphalia	1060	-	2038-12-31
RWE	Neurath G	North Rhine-Westphalia	1060	-	2038-12-31
LEAG	Schwarze Pumpe A	Brandenburg	750	-	2038-12-31
LEAG	Schwarze Pumpe B	Brandenburg	750	-	2038-12-31
LEAG	Boxberg R	Saxony	640	-	2038-12-31
LEAG	Boxberg Q	Saxony	857	-	2038-12-31

The regulations adopted in the law and the public-law agreement also provide for the possibility of individual units being phased out more quickly than shown in the table. The federal authorities will be able to decide to accelerate the phasing out of the last coal units by three years (until 2035), as recommended by the commission. Such a change will not entail additional compensation if operators are informed of the earlier termination date at least five years prior to the new shutdown date (i.e. for power plants scheduled to be phased out in 2038, the decision to decommission in 2035 will have to be announced in 2030 at the latest).[34] They have also been given permission to close power stations or their individual units earlier on their own if the deteriorating market situation prompts them to do so.

Compensation

According to the recommendations of the coal committee, compensation for the accelerated phasing out of lignite power plants will be paid to those companies whose facilities will be withdrawn from the market by 2030. This applies to two operators – the western German company RWE, which will shut down units with a total capacity of 5.7 GW between 2020 and 2029, and the eastern German company LEAG, which will close power stations with a capacity of 2.8 GW between 2025 and 2029. The total compensation was set at €4.35 billion, with RWE receiving €2.6 billion and LEAG €1.75 billion. In contrast, no compensation will be granted to operators of units phased out after 2030.

The benefits for RWE and LEAG are the most controversial element of the German coal phase-out plan. Both the lack of transparency in the process of their determination and the sums involved have been criticised. Negotiations on the issue took place behind closed doors, and the government did not disclose the method used to determine the extent of the damage resulting for the mine owners from a faster end to mining. Representatives of the authorities limited themselves to enigmatic statements that typical, standardised empirical data on lost profits or additional costs for reclamation of post-mining areas resulting from a change in plans for mine development and early closure were adopted. This took into account the long-term plans given by the operators themselves with regard to the exploitation of the deposits, together with the dates of termination at individual sites.

[34] Public Law Agreement on the Reduction and Termination of Lignite Generation in Germany – Öffentlich-rechtlicher Vertrag zur Reduzierung und Beendigung der Braunkohleverstromung in Deutschland, Federal Ministry for Economic Affairs and Climate Action, 10 February 2021, bmwi.de.

The vast majority of national experts considered the negotiated compensation to be disproportionately high. The lack of transparency in their determination and the failure to disclose the methodology adopted, on the other hand, are seen as an attempt to hide the fact that incorrect, unrealistic assumptions were used to justify higher compensation amounts. According to critics, their determination did not take due account of, inter alia, the progressive decline in the competitiveness of coal-fired generation and the unfavourable market prospects – above all, the rising price of emission allowances in the EU ETS as a result of the EU's more ambitious climate policy, the continued growth of production from RES, which leaves less room for energy from conventional sources, and the relatively lower prices of natural gas, which, combined with the lower carbon intensity of plants using this resource, put them in an increasingly favourable position compared to coal-fired units. The latter argument is undermined by the situation in the European market in mid-2021 related to the radical increase in gas prices (electricity generation in coal-fired power plants has become competitive again against gas-fired units despite the high price of emission allowances in the EU ETS).[35] In addition, the calculation of lost profits may have insufficiently taken into account the fixed costs of mine operations.[36] Experts also point out that both RWE and LEAG will first extinguish the oldest, least efficient and most emission-intensive power plants, which may already be unprofitable and would soon be phased out anyway. Relatively new and more efficient plants, on the other hand, are not expected to close until the second half of the 2030s. Meanwhile, according to some studies, a significant proportion of German coal-fired units were already making losses in 2019.[37]

Data from the Öko-Institut, a centre advising the government, shows that, depending on the assumptions used, the negotiated compensation could be inflated even twice over.[38] At the same time, while the amount for RWE can be justified on the basis of the very high additional costs of reclamation, the amount of compensation for LEAG cannot be defended on the basis of any of the assumed scenarios. It was also noted that the Lusatian units of the Jänschwalde power plant will only be phased out at the end of the decade, which

35 For more details, see A. Łoskot-Strachota, 'Rising gas prices are a pressing problem for the EU', OSW, 24 September 2021, osw.waw.pl.

36 H. Koenig, *Stellungnahme zum Thema „Öffentlich-rechtliche Verträge der Bundesregierung mit den Braunkohle-Betreibern"*, Aurora Energy Research, 7 September 2020, bundestag.de.

37 *The cash cow has stopped giving: Are Germany's lignite plants now worthless?*, Sandbag, July 2019, thecoalhub.com.

38 F. Matthes et al., *Einordnung der geplanten Entschädigungszahlungen für die Stilllegungen deutscher Braunkohlekraftwerke im Kontext aktueller Entwicklungen*, Öko-Institut, 29 June 2020, oeko.de.

is what their previous owner, Vattenfall, had already planned in 2016. However, the current operator, LEAG, points to the 2017 plan already adopted after the acquisition, which envisaged a much longer operating period and even the commissioning of new open pits. Media reports further indicate that, in negotiations with the government, the company was prepared to shut down its power stations early, but that this action was blocked by the prime ministers of the eastern federal states. This lends credence to accusations that the compensation agreed in the case of the Lusatian company was deliberately inflated for political motives.

Compensation to RWE and LEAG is subject to European Commission review for compliance with EU state aid rules. The formal investigation was officially launched on 2 March 2021. In a statement, the EC said it had doubts about the adequacy of the compensation in relation to the operators' expected lost profits and the additional costs of rehabilitating post-mining sites. Thus, it largely shared the experts' doubts. The unambiguously critical tone of the communication drew attention, which was interpreted as a prelude to difficult negotiations between the federal government and the Commission. However, the Federal Ministry for Economic Affairs and Energy emphasises that the formal investigation, which may take many months, does not stop the implementation of the part of the agreement concerning the shutdown of power plants – at the end of 2020, RWE closed unit D of the Niederaußem power plant as scheduled.

3. Hard coal

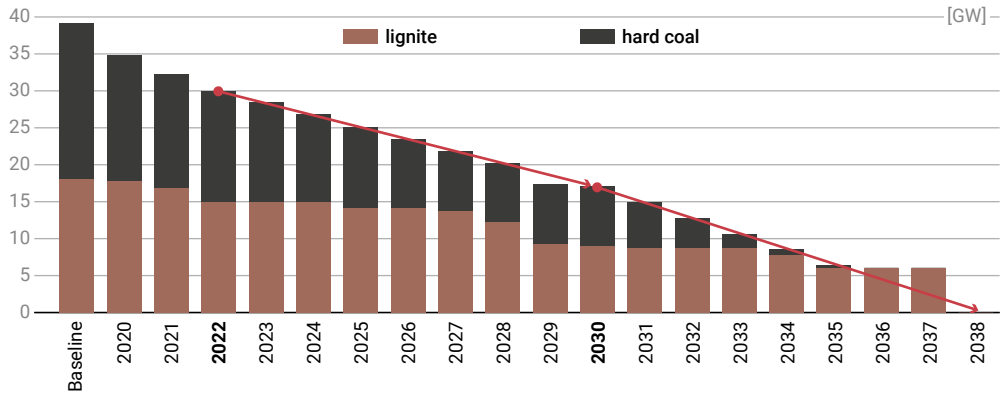
The phasing out of coal-fired power generation is divided into two stages, which will use different mechanisms.[39] In the first, covering the period 2020–2027, the phasing out of power plants is carried out through auctions conducted by the Federal Network Agency. In a competitive process, coal unit operators may voluntarily declare their willingness to cease production in exchange for an amount of financial compensation indicated by them. Its maximum amount will diminish over time – from €165,000 per 1 MW in 2020 to €89,000 in 2027. Two factors will be decisive in selecting an offer in the auction procedure – the proposed compensation amount and the average annual carbon dioxide emissions of a given unit per 1 MW, which will result in the highest emission savings for the lowest amount. Such a mechanism, in which

[39] As already mentioned, the solutions directed to coal-fired power plants are also intended for small lignite-fired power plants whose installed capacity does not exceed 100 MW and which are not covered by the agreement between the federal government and the operators.

the owners of the facilities apply for the amount of compensation, is to ensure that the budget costs of the entire procedure are reduced. The results of each procedure will be checked by transmission grid operators for security of energy supply. If they consider that the unit selected for extinguishing is indispensable for the proper functioning of the system, they may request the agency to transfer it to the reserve for a specified period of time.

The act provides for a total of eight auctions to be held to select the power plants to be shut down in subsequent years, starting in 2020 and ending in 2027. In the first two auctions, the amount of capacity to be shut down has been predetermined (4 GW for 2020 and 1.5 GW for 2021). Before the start of the subsequent rounds, the BNetzA is to examine the **baseline**, i.e. the total capacity of the coal-fired power plants that are still operating in the energy market in a given year, and the **auction volume** – the capacity subject to phase-out in each round. How many power stations will be allowed to remain operational in subsequent years will be calculated by subtracting the total capacity of operating lignite power stations from the maximum allowable capacity of coal--fired power stations (according to the coal phase-out schedule). The difference between the baseline and the allowed maximum capacity in hard coal will determine the auction volume. In this way, the rate of exit from hard coal depends on the speed of shutting down lignite power plants – if the operators of the latter want to close their facilities faster than envisaged in the agreement with the government, more hard coal units will be able to remain active.

Chart 6. Maximum installed capacity of coal-fired power plants remaining on the energy market in accordance with the Coal Phase-out Act (each value as of 31 December)



Source: own calculations based on the Coal Phase-out Act.

The Act also provides for a situation in which the number of bids submitted by operators in individual auctions does not fill the volume to be phased out. In such a situation, BNetzA will fill the gap in the auctions for the period 2024–2027 by indicating the units to be closed in a top-down manner. In doing so, it is to be guided by the duration of operation of the active coal units – the oldest ones will be designated first. Power stations withdrawn in this way will not receive financial compensation.

Given that market conditions will worsen over time, it is possible that power plant owners who were unsuccessful in the auctions will, in order to limit losses resulting from maintaining unprofitable units, decide to voluntarily decommission them without compensation outside the statutory mechanism or to change the type of fuel (see below). If, in a given year, the total capacity of active hard coal-fired power stations turns out to be less than the permitted capacity, the BNetzA will not hold an auction.

Fuel switching subsidy for coal-fired CHPs

Kohleausstiegsgesetz introduced investment subsidies for fuel switching in existing coal-fired CHPs (mainly to natural gas, to a lesser extent to biomass). A special bonus (*Kohleersatzbonus*), aimed exclusively at operators of power plants that also generate heat, is intended to encourage them to continue operations at their current locations and thus also secure the substitution of district heating supplies as part of the process of coal phase-out. The highest subsidies (€240,000–390,000 per 1 MW) are available for the newest CHPs, commissioned after 1994. The lowest amount of support (€5,000–20,000 per 1 MW) is provided for those built between 1975 and 1984. The bonus amount depends on the speed of the investment – the highest amounts will be granted to projects completed by 2023, and the lowest – to those put into operation by the end of 2029. Due to the greater importance for the supply of district heating in Germany of units burning hard coal, this mechanism was designed mainly for facilities using this fuel. However, the law excludes the possibility of applying the bonus to power plants that have received compensation for shutdowns under the auction mechanism.

In the second phase, covering the period 2031–2038, hard coal-fired power stations will only be closed by a top-down decision of the BNetzA, without financial compensation. The order of closure will depend on the age of the plants, with the oldest units going out first. The volume of capacity to be decommissioned

will be calculated in the same way as in the first stage auction. The schedule for closing lignite-fired power plants envisages nearly 8 GW capacity drop by 2035 and 6 GW by 2038, so if their operators do not decide to shut down production earlier, the last hard-coal unit – Datteln IV – will have to be closed in 2034 at the latest (see Chart 6). The decision to decommission a particular power plant is to be announced by the BNetzA no later than 30 months before the date of decommissioning. However, the owner of a power plant identified for decommissioning will be able to apply for its transfer to the capacity reserve (such plants cannot sell energy, but are activated in certain situations at the request of network operators to maintain stability of supply; they receive a certain degree of financial compensation for the period they remain in the reserve).

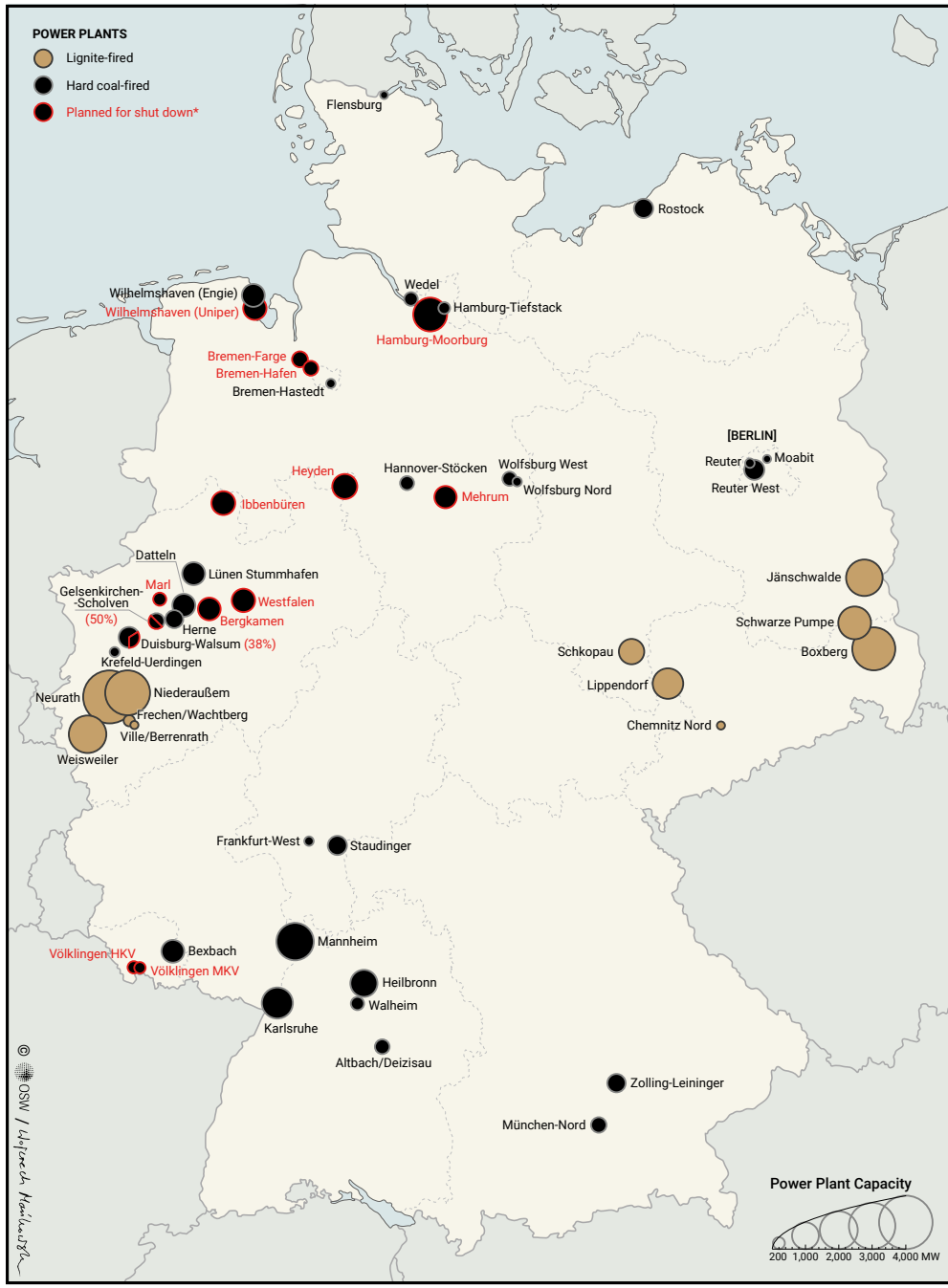
Results of the first auctions

In the auction for 2020 (distributed power plant capacity to be phased out: 4,000 MW) 11 bids were accepted for a total capacity of 4,788 MW. The average compensation awarded was €66,300 per MW (the maximum allowed was set at €165,000 per MW). The plants selected for withdrawal from the market at the end of the year included Hamburg-Moorburg (Vattenfall), Ibbenbüren and Westfalen (RWE), Heyden (Uniper) and Walsum (STEAG). After a period of remaining in reserve, they were finally phased out on 7 July 2021 (with the exception of the Heyden power plant, which by decision of the BNetzA is to remain in reserve until 2022).

In the auction for 2021 (distributed capacity: 1,500 MW), three bids were selected to shut down the power plants with a total capacity of 1,514 MW. These concerned the hard coal plants at Wilhelmshaven (Uniper) and Mehrum (EPH) and a small (67 MW) lignite-fired unit at Deuben (MIBRAG). The BNetzA did not disclose the average amount of compensation awarded, but the highest was €59,000 per MW (the maximum value was set at €155,000). The selected power plants must be finally shut down by 8 December 2021 at the latest.

In the auction for 2022 (distributed capacity: 2,481 MW) 11 bids were received for the shutting down of power plants with a total capacity of 2,133 MW, all of which were accepted. The average compensation was €103,000 per MW (the maximum value was set at €155,000). Among the power plants that will have to be shut down by the end of 2022 are the facilities at Bergkamen and Völklingen (STEAG), Bremen-Farge (Onyx) and Gelsenkirchen-Scholven (Uniper).

Map 1. Coal-fired power plants in Germany as of October 2020



* Based on the results of the first three auctions conducted by the BNetzA under the Coal Phase-out Act.

Source: Federal Environment Agency.

The outline of the regulations proposed by the government regarding the conditions for the phasing out of coal-fired power plants has met with an unfavourable reception from both industry representatives and the local governments that own the municipal companies operating the plants. The greatest controversy was caused by the fundamentally different treatment of operators of hard coal and lignite power plants, which, according to critics, discriminated against the former.[40] This concerns the schedule for shutting down power plants, which de facto makes the closure date of the last hard coal plants dependent on how quickly lignite plants are withdrawn from the market. If RWE and LEAG decide to keep their last units in operation until the very end (i.e. 2038), then according to the law the last hard coal units will have to be shut down by 2034 at the latest. This means breaking the compromise reached in the coal committee, which recommended maintaining parallel paths for both technologies. Moreover, the significant disproportion in the amount of compensation that can be claimed by operators of power plants closed down before 2030 was deemed unjustified. On a per MW basis, they are, in the case of RWE and LEAG, about three times higher than the maximum funds that owners of coal-fired plants were likely to receive during the first auction – and with each subsequent round, the compensation amounts drop significantly.

In a letter to the federal government, representatives of more than fifty Rhineland local authorities who are shareholders in power plants through municipal companies protested against the proposed legislation.[41] The letter's signatories, including the mayors of Dortmund, Bochum, Duisburg and Essen, warned the authorities that the too rapid decommissioning of the plants located on their territories (especially those commissioned after 2010, which have not yet had time to depreciate), combined with the lack of adequate compensation, would cause enormous financial problems for the local authorities, and would prevent unit operators from investing in replacing the decommissioned units, which in addition to electricity also provide heat. The governments of the federal states where coal-fired power plants operate – North Rhine-Westphalia, Lower Saxony, Saarland and Baden-Württemberg – have also threatened to veto the bill.[42] The industry itself has also tried to put pressure on the government.

40 K. Witsch, 'Steinkohlekraftwerksbetreiber sehen sich im Nachteil und fordern mehr Geld', Handelsblatt, 22 May 2020, handelsblatt.com.

41 K. Wiedemann, 'Steinkohle: Oberbürgermeister warnen vor entschädigungslosen Stilllegungen', Energate Messenger, 26 February 2020, energate-messenger.de.

42 H. Bünder, Ch. Geinitz, 'NRW torpediert Kohleausstieg', Frankfurter Allgemeine, 5 March 2020, faz.net.

Legal studies commissioned by the industry showed that the regulations in the proposed form are contrary to the constitution, which posed the risk of legal action.[43] In the end, the operators of power plants commissioned after 2010 approached the government with a proposal to transfer their plants after 2030 to a special "Energiewende reserve", whereby they would remain on standby in return for appropriate compensation.[44]

The pressure was only partially successful. The final version of the law included, among other things, maximum compensation values in the auctions that were higher than originally planned and, for units commissioned after 2010, the possibility of adjusting the conditions for shutting down power plants in case of overloads (*Härtefallregelung*) as part of the evaluation of the law. Most operators have welcomed these changes, but have indicated that they may sue at a later date if the evaluation results are unsatisfactory.

4. Criticism of the mechanism

The outline of the document proposed by the authorities, and especially the regulations concerning the dates of switching off lignite power plants, met with a sharp reaction from environmental organisations. Their eight representatives who were part of the coal committee, led by its co-chair Prof. Praetorius, in a special manifesto considered the government to have gone back on their promise to faithfully implement the committee's recommendations and deemed it a rejection of the compromise they had worked out.[45] In their opinion, the departure from the suggested solutions is primarily at the expense of climate protection, and the adopted regulations will not guarantee the required reduction in emissions. The solutions proposed by the government would therefore not be supported by the majority of committee members.[46] According to the authors of the statement, the new content of the regulation will result in the emission of up to 40 million tonnes of CO_2 into the atmosphere by 2030, more than originally assumed. This is due to the schedule, which assumes that power plants will not be shut down evenly, but in a cumulative "cascade" manner, especially in 2025 and in 2028–2029 (according to the government, the lack of shutdowns in 2023–2024 is dictated by reasons of energy

[43] D. Wetzel, 'Gutachten hält Kohleausstieg für verfassungswidrig', Welt, 27 February 2020, welt.de.
[44] Ch. Geinitz, 'Wie die Steinkohleallianz junge Kraftwerke retten will', Frankfurter Allgemeine, 22 May 2020, faz.net.
[45] Stellungnahme der ehemaligen Mitglieder der Kommission Wachstum, Strukturwandel und Beschäftigung (KWSB), 21 January 2020, after: oeko.de.
[46] Ch. Geinitz, N. Záboji, 'Neuer Streit um den deutschen Kohleausstieg', Frankfurter Allgemeine, 24 May 2020, faz.net.

security and is connected with the withdrawal of the last nuclear power plants at the end of 2022). In addition, allowing as many as seven lignite plants to operate until 2038, while less polluting hard coal units will be closed earlier, could be a source of additional emissions.

The launch of the Rhine power plant Datteln IV in mid-2020 was also met with criticism from some committee members and environmentalists. The project, which began in 2007, was originally supposed to be completed five years later, but due to design flaws and litigation, the construction was delayed until 2019. Environmental groups tried to block its opening, citing climate protection arguments. In its final report, the coal committee recommended that the government find an amicable solution with Uniper, the owner of the plant, to stop the project and not connect the unit to the grid. In the perception of both German and international public opinion, the Datteln IV problem has become a litmus test for Berlin's credibility in climate policy. It has been argued that the commissioning of a new coal-fired power plant while work is underway to phase out coal is incomprehensible and even hypocritical. However, failure to commission the completed plant would have necessitated the payment of compensation, estimated at €1.5 billion.[47] The Prime Minister of North Rhine-Westphalia, Armin Laschet, spoke out against this. He tried to explain the need to include Datteln IV by its higher efficiency and lower emissions compared to the units that would be shut down in its place. Environmentalists countered that the modern plant would be in use more often than the older units, which under current market conditions produce less and less energy. Data from the first months of operation of the power plant show that it is one of the most frequently used hard coal plants in Germany – on a daily basis it often accounts for even more than 20% of electricity generation from this fuel. Uniper has declared that it wants to keep the power plant on the market for as long as possible and, in return, to phase out the company's other power plants in Staudinger, Gelsenkirchen, Heyden and Wilhelmshaven by 2025.[48] In the latter three cases, the corporation successfully participated in the auctions for 2020, 2021 and 2022 – it will receive compensation from the state budget for their closure.

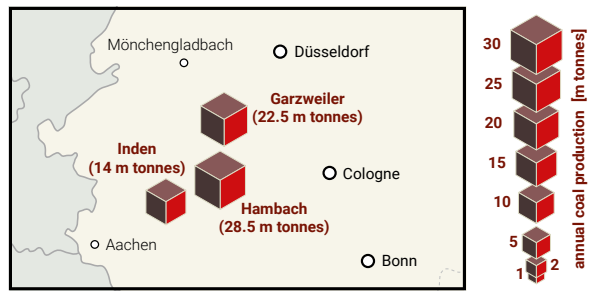
[47] J. Flauger, 'Uniper kämpft um Pannenkraftwerk Datteln – Abschreibungen belasten die Bilanz', Handelsblatt, 12 March 2019, handelsblatt.com.

[48] 'Uniper nimmt Steinkohlekraftwerke vom Netz – außer Datteln', Zeit Online, 30 January 2020, zeit.de.

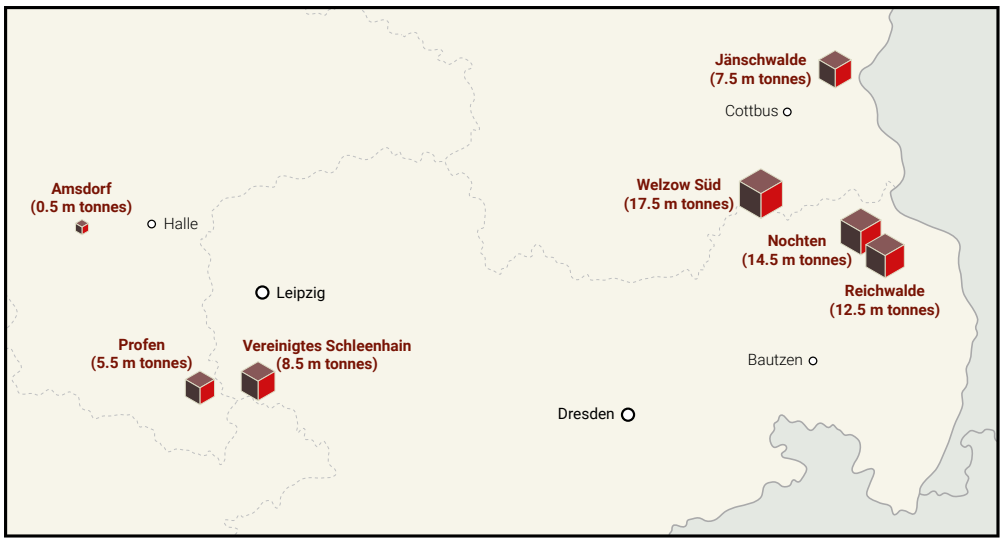
IV. RESTRUCTURING COAL REGIONS – GAINING PUBLIC ACCEPTANCE

Following the closure of the last hard coal mines in Germany in 2018, only lignite coal is now being mined. Due to the characteristics of this raw material, which is not suitable for long-distance transport (it easily loses its thermal properties and quality when exposed to moisture), power plants fired by it were built close to the mines. Their close relationship (in terms of capital also, as they are usually owned by the same owner) meant that in the process of shifting away from coal use in electricity generation initiated by the federal government, the problem of successive decommissioning of power plants and reduction of output in nearby open pits had to be treated jointly. As hard coal is no longer mined in Germany, the negotiations on the restructuring of mining regions focused almost exclusively on the lignite sector.

Map 2a. Annual coal production in the Rhineland Basin (2019) ▶



Map 2b. Annual coal production in the Central German and Lusatian basins (2019) ▼



Source: Federal Association of the Lignite Industry.

1. Economic and social situation of the coal basins

Lignite is currently mined in ten mines across three basins – the Rhineland (North Rhine-Westphalia), Central German (Saxony/Saxony-Anhalt) and Lusatian (Brandenburg/Saxony). Until 2016, raw material was also extracted in the vicinity of Helmstedt (Lower Saxony/Saxony-Anhalt), but compared to the other basins, extraction there was negligible (about 1%) and its energy and economic significance was marginal.

The overall socio-economic situation in the mining regions is highly differentiated, which is mainly due to their characteristics, different locations and varying degrees of development. The German mining basins (in whole or in part) are classified as areas with structural problems. Those in the eastern regions are also still feeling the effects of the rapid transformation of the 1990s.

Table 2. Comparison of selected socio-economic indicators in the mining districts

	Rhineland Basin	Central German district	Lusatian Basin	Germany as a whole
Population decline (2000–2015)	0%	9%	16%	0.4%
Decrease in the number of people aged under 40 (2000–2015)	12%	21%	38%	13%
GDP per capita in € (2015)	32,769	27,640	28,434	37,128
Disposable income per capita in € (2015)	20,961	18,163	18,722	21,583
Unemployment rate (2015)	7.8%	9.9%	9.4%	6.4%
Gross value added (2016)	2.4%	0.9%	4.3%	0.2%
Share of employees in the sector among those with an employment contract (2016)	1.8%	0.5%	3.3%	0.2%
Share of the industry in revenues to local government budgets from business tax (2016)	2.4%	0.9%	4.3%	-

Source: Leibniz Institute for Economic Research (RWI).[49]

[49] Comparative data on the economic importance of the lignite sector for the mining basins in Germany and their economic and social situation are taken from reports prepared by the Leibniz Institute for Economic Research (RWI) on behalf of the Federal Ministry of Economic Affairs and Energy: *Strukturdaten für die Kommission „Wachstum, Strukturwandel und Beschäftigung"*, September 2018; *Erarbeitung aktueller vergleichender Strukturdaten für die deutschen Braunkohleregionen*, January 2018, rwi-essen.de.

Rhineland Basin

This is the largest of the mining regions still functioning in Germany. It consists of three mines owned by RWE: Garzweiler, Hambach and Inden. In 2018, they produced a total of 86.3 million tonnes of the resource (half of Germany's mining), which was used for power generation in the nearby Niederaußem, Neurath, Weisweiler and Frechen power stations owned by the same company. The lignite industry employs nearly 9,000 people directly in the area and another 5,400 indirectly.

The Rhineland Basin is located in the western part of the most populous and highest GDP state, North Rhine-Westphalia, and is part of an economically well-developed and highly industrialised region. It includes two large cities (Mönchengladbach and Aachen), and the thriving conurbations of Cologne and the state capital Düsseldorf are also in the immediate vicinity. As a result of this location, the municipalities have a high level of urbanisation and transport links, both with each other and with the surrounding economic, industrial and cultural centres (with a serious problem being the many years of neglect and under-investment in local infrastructure). The region is also home to a number of well-known university, scientific and research centres (including branches of the Fraunhofer Society, the Max Planck Society and the Jülich Research Centre). As a result, the Rhineland region possesses a number of advantages over other lignite mining areas – high economic development, a relatively benign labour market situation and more favourable demography. The lignite industry (especially with regards to RWE – one of the most influential energy companies in Germany) is an important economic actor in the surrounding municipalities and a major tax contributor to local government budgets, as well as an important employer – in 2016 its employees accounted for 1.8% of all employees with a contract of employment, and in towns such as Bedburg even one in ten residents is associated with the sector.

Central German district

The Central German area is the smallest of the lignite mining regions in Germany. It comprises two large mines owned by MIBRAG – Vereinigtes Schleenhain and Profen (2018 output: 18.7 million tonnes) – from which the raw material goes to the power plants at Lippendorf (LEAG and EnBW have one unit each there) and Schkopau (Saale Energie), as well as the small Amsdorf mine (annual output of 0.5 million tonnes), owned by Romonta, a coal wax producer. The lignite industry employs 2,400 people directly and another 1,400 indirectly.

The basin consists of both poor and backward rural areas and urban areas. It includes two large centres – Leipzig and Halle. The first of these, with a population of more than half a million and dynamic growth in recent years, has been the driving force behind the region's economic development with companies from the energy, automotive, chemical, glass and optics industries as well as numerous start-ups. Thanks to its central location, the area enjoys a well-developed road infrastructure (with motorways linking north to south and east to west), as well as a major airport, Leipzig/Halle. In spite of certain advantages which have contributed to the current faster economic development, the Central German area still lags significantly behind the national average and suffers from the effects of the transformation during the 1990s. The GDP per capita index here (clearly inflated by Leipzig) was only 74% of the German average in 2015, and disposable income was 84%. The unemployment rate, in turn, was about 50% higher than in Germany as a whole. The demographic situation of the region is also unfavourable: both depopulation and a process of rapid population ageing are evident. Between 2000 and 2015, the number of inhabitants fell by a tenth, and those below the age of 40 – by as much as just over 20%. According to forecasts, the negative trends will continue until 2035 – the population of the basin may fall by another 13%, with a significant increase in the proportion of people over 60 (from 33% in 2016 to 39% in 2035).[50] Unlike the other two mining regions, the lignite industry does not play a particularly prominent economic role here.

Lusatian Basin

The Lusatian Basin, located on the Polish border, is Germany's second-largest coal-mining region. There are currently four opencast lignite mines in operation there – Welzow-Süd, Nochten, Reichwalde and Jänschwalde. In 2018, they extracted a total of 60.7 million tonnes of the resource, which was used for the Boxberg, Schwarze Pumpe and Jänschwalde power plants. The Lusatian mines and power plants have been managed by LEAG since their purchase from Vattenfall in 2016, which currently employs 8,300 people there. An additional nearly 5,000 employees are indirectly linked to the coal industry in the region.

The basin is characterised not only by its peripheral location, but also by the predominance of rural areas. There are no large cities that could serve as

[50] J. Dehio, T. Schmidt, *Gesamt- und regionalwirtschaftliche Bedeutung des Braunkohlesektors und Perspektiven für die deutschen Braunkohleregionen*, *RWI Materialien*, Heft 126 (2018), Leibniz Institute for Economic Research, rwi-essen.de.

a natural development engine for the region. The largest city is Cottbus with a population of around 100,000, just over 100 km from Dresden, the capital of Saxony. The municipalities of the Lusatian Hinterland complain about their underdeveloped transport infrastructure (roads and railways), which constitutes a serious barrier to development. The painful transformation process in the wake of German reunification, which in the 1990s resulted in far-reaching de-industrialisation, including a drastic reduction of employment in the coal sector, has clearly affected the economic and social situation of the region. In 2015, GDP per capita here was 77% of the average, disposable income per capita was around 13% lower and the unemployment rate was almost 50% higher than in Germany as a whole. The lignite industry remains the only significant economic actor in the area, and its role is clearly greater than in other mining basins. The LEAG concern is not only one of the largest but also one of the most attractive employers (average wages are up to 50% higher than the average wage in Saxony and Brandenburg). The most serious structural problem of the region is the difficult demographic situation. Between 2000 and 2015, its population fell by a sixth, and the population of Cottbus – the former bastion of the GDR's energy industry – by almost a quarter. It was mainly young people who decided to move because of the lack of prospects, which is why the number of residents under 40 fell by as much as 38% in this period. According to forecasts, the unfavourable trends may continue until 2035. Further depopulation is expected (by as much as one fifth), as well as a significant increase in the percentage of people over 60 (from 35% in 2016 to 45% in 2035).

2. Attitudes of basin residents towards the coal phase-out

The inhabitants of the different areas where lignite is mined differ significantly in their attitudes towards the plans to abandon the use of this resource. In North Rhine-Westphalia, this proposal enjoyed strong support even before the coal commission undertook its work. In a survey of the state's residents in 2016, as many as 71% of those surveyed were in favour of a swift end to the extraction and use of lignite.[51] This high approval rating is linked to the level of importance public opinion gives to arguments concerning environmental protection and the fight against climate change, as well as the controversy surrounding the demolition of further settlements for mine expansion. In this context, the Greens, who have continuously sat in the Landtag since 1985 and twice (in 1995–2005 and 2010–2017) co-founded a governing coalition with the

[51] A. Höning, 'Mehrheit fordert raschen Braunkohle-Ausstieg', RP Online, 26 September 2016, rp-online.de.

SPD, played an important role in shaping the debate. The relatively good economic and social situation in the region is also an important factor supporting the coal phase-out.

The attitude towards this issue in the eastern federal states is quite different. In a survey from January 2019, only 34% of the inhabitants of Saxony, Saxony-Anhalt and Brandenburg were in favour of the rapid closure of mines and power plants. A clear majority of respondents – 61% – was against it (the results for Germany as a whole, on the other hand, were the other way round – 59% vs. 36% in favour of a rapid phase-out of coal power).[52] On the one hand, such a critical stance is a consequence of the more difficult situation and structural problems in the local coal basins, which naturally lead to fears of losing a key industry and one of the few attractive employers. On the other hand, the experience of transformation at the beginning of the 1990s is very important (also of a psychological nature).

During the communist era, the Lusatian and Central German basins were the energy base of the country, for which lignite was the key resource (in the 1980s, over 80% of electricity was produced from lignite, and the GDR, with an annual output of 300 million tonnes, headed the global ranking of countries with the largest mining output).[53] Due to the role of lignite in the economy, the profession of miner was not only associated with attractive salaries, but also with prestige and social recognition, and the energy sector became – especially in the Lusatian region – an important element of regional identity. As part of the changes introduced in the final decade of the last century, a large part of the local industry was dismantled within a few years. Most of the mines (considered to be unprofitable) were closed and the number of jobs in the lignite sector fell by up to 90%. This was followed by the collapse of many production facilities in other related industries. In Lusatia alone, industrial employment is estimated to have fallen by a total of 180,000 jobs, 70,000 of which were due to the lignite opencast mines being closed. The current structural problems are largely the result of these events, and former East Germans still regard the "first exit from coal" of 30 years ago as a deep, unhealed wound. In the current debate, their fears are often justified precisely by the risk of a repetition of that scenario.

[52] Infratest dimap institute survey for ARD television 'Mehrheit wünscht sich schnellen Braunkohle-Ausstieg', WDR, 24 January 2019, presse.wdr.de.

[53] J. Kahlert, *Die Energiepolitik der DDR. Mängelverwaltung zwischen Kernkraft und Braunkohle*, Friedrich Ebert Foundation, Bonn 1988, epub.ub.uni-muenchen.de (shared collections of the University of Munich library).

At the same time, the majority of residents in the East German mining regions see the need for restructuring and moving away from the coal monoculture towards new, future-oriented industries. In both the Lusatian and Central German regions, around two thirds of those surveyed (69% and 61% respectively) are in favour of profound transformation, while only one in five (18% and 20% respectively) do not see any need for change. However, the situation is made more complicated by the public's scepticism as to the effectiveness of the government's actions and thus the success of the entire process. In Lusatia as much as 87% of those surveyed admit that they expect politicians to do a better job of counteracting the adverse effects stemming from the closure of the coal sector. The critical attitude of the inhabitants of the mining regions towards the plans presented in January 2019 was reflected in the way they voted in September's parliamentary elections in Saxony and Brandenburg. In the areas comprising the Lusatian Basin, the most important force was Alternative for Germany (AfD), the only major grouping in Germany to completely reject both the phase-out of coal power and the energy transition itself. Its representatives won in 12 of the 19 single-member constituencies, and the support for the party fluctuated around 30–40%, although there were municipalities (such as Heinersbrück, located near the Jänschwalde coal mine) where it reached as much as 50%. The issue of phasing out coal was one of the main themes used by AfD candidates in their campaign, and a vote for this grouping became an opportunity for many voters to demonstrate their disapproval of the plans to phase out energy based on this resource.

The critical attitude of local residents and the economic significance of the coal industry in the basins translated into a tough stance adopted by the authorities in the eastern federal states (Saxony, Brandenburg and Saxony-Anhalt), firstly during the work of the coal commission and later during the legislative process. Their prime ministers significantly influenced the final arrangements, often publicly using the threat of a veto or prolonging the negotiations in order to put pressure on the other parties and obtain far-reaching concessions at the negotiating table. Firstly, they demanded that concrete plans for the restructuring of the regions be agreed before talks could begin on a date for the definitive phase-out of coal power. Secondly, they demanded that significant financial resources be allocated from the federal budget to cover the costs of the transformation (while Berlin initially offered an amount of several billion euros, the eastern federal states estimated their needs at €60 billion). Thirdly, they pushed to make the process of moving away from coal start from the better-off Rhineland Basin. The closure of power plants and mines in the other basins, on the other hand, was to take place only at the end of the second

decade, in order to allow time for key investments to take place and for attractive new jobs to be created in other sectors in place of the coal industry. Finally, while the proponents of phasing out coal pushed for the 2030 date as meeting the needs of climate policy, the prime ministers of the eastern federal states called for ending its use in the power industry only in the mid-2040s.

At key points, the prime ministers of the eastern federal states worked in tandem with the head of the North Rhine-Westphalia government, Armin Laschet, who also positioned himself as an opponent of moving away from coal too quickly, a defender of jobs and the interests of the economy and industry, and an advocate of the transfer of massive funds from the federal centre for infrastructure investments. Due to the high level of support for the phasing out of coal power in his home state, the growing importance of the climate issue for German public opinion, and RWE's readiness to accelerate the closure of its Rhineland power plants (which are older and less efficient than those in the eastern federal states), Laschet has also agreed to start phasing out units in North Rhine-Westphalia first. The CDU politician is now keen to use this argument in public debate, presenting himself as the author of concrete climate protection measures.

Although the media were most interested in the date of Germany's departure from coal, the problem of the restructuring of coal regions became the focus of the committee's work as a result of political action (by both state and federal authorities). The priority was to develop convincing future prospects for them (especially those in the eastern federal states). A new development model was prepared for each district, taking into account local conditions, along with recommendations for its implementation. The common denominator for these measures is the will to maintain the industrial character of the regions with an emphasis on the traditional energy sector, where they can make use of their existing infrastructure and competences. As part of the restructuring, the coal sector is to be replaced by other, future-oriented and innovative energy sectors that will develop technologies for decarbonisation (from electricity to industrial processes to low-carbon transport). Not only the RES sector, but also the rapidly gaining importance of the hydrogen economy in a broad sense (including production, transport, storage and application of this fuel for decarbonisation) are considered attractive directions.[54] The development concept for the Lusatian Basin puts the focus on Power-to-X technologies (related to the

[54] M. Kędzierski, 'Wodór – nadzieja niemieckiej polityki klimatycznej i przemysłowej', *Komentarze OSW*, no. 330, 6 May 2020, osw.waw.pl.

conversion of renewable energy into hydrogen and hydrogen-based fuels and synthetic gases) and on the combination of sectors. The Central German model prioritises the decarbonisation of industrial processes, especially in the chemical, glass and logistics industries developed in the region. The concept for the Rhineland Basin, on the other hand, focuses on the development of competencies for the creation of the energy system of the future, as well as issues of energy security and supply of raw materials. In this way, the mining areas are to make an important contribution to the sustainable modernisation of Germany's economy and industry.

The modernisation and expansion of road and rail transport infrastructure (better connections to the nearest conurbations and to key transport arteries) and telecommunications infrastructure (fast and widely available internet) was considered to be of key importance for increasing the economic attractiveness of the regions and creating favourable conditions for new projects. Improving the availability of skilled workers by opening research and development centres dealing with innovative technologies is also among the important elements encouraging investment in the basins and enabling the models mentioned above to be implemented. In order to stop depopulation and attract young people, projects aimed at improving general living conditions, such as those related to health, education and entertainment, are to be implemented.

3. The restructuring package

The Act on the Structural Strengthening of Coal Regions (*Strukturstärkungsgesetz Kohleregionen*) was finally adopted by the Bundestag and Bundesrat on 3 July 2020 together with the Act on the Phase-out of Coal. Despite pressure from the federal states, which were keen to mobilise the funds as quickly as possible, the federal government insisted on the simultaneous adoption of both drafts. The document regulates the amount, distribution, allocation and spending of money for the restructuring of coal regions. The development concepts for the three coalfields referred to above, which were worked out at the coal commission stage, form an integral part of the law. In line with the recommendations of this body (and a political agreement between the federal government and the states), a total of €40 billion from the central budget will be allocated to these measures under two pillars:

1) €14 billion for domestic investments to support the restructuring process will be distributed to the four states where lignite mining basins are still in operation. The largest portion of the funds – €6 billion (43%) – will be spent

on projects in the Lusatian Basin, with Brandenburg receiving €3.6 billion and Saxony €2.4 billion. For the transformation of the Rhineland Basin, North Rhine-Westphalia will receive €5.2 billion (37%). The Central German Basin will receive €2.8 billion (20%), which will be shared between Saxony-Anhalt (1.7 billion) and Saxony (1.1 billion). According to the law, these sums are to be distributed among projects aimed at evening out differences in economic potential and supporting structural change, especially for creating new jobs and increasing the attractiveness of investment. The area to which these projects are to belong is very broad – it includes road and rail infrastructure (except for that which is subject to the federal authorities), education, health, culture, renovation of urban spaces, digitalisation, tourism, research and innovation or environmental and climate protection. The funds from this pool may be allocated by the federal states for projects carried out until the end of 2038, with the possibility of their settlement by 2041. The contribution, which must be covered by local government units (federal states, districts, municipalities), will only be 10%, so that this requirement does not limit the possibilities of the poorest regions. Disbursement of the money will be approved and supervised by a mixed control body consisting of representatives of the federal government and local authorities.

2) €26 billion is earmarked for projects implemented directly from the budgets of central government ministries. In particular, they concern specific investments in the expansion of the federal road and rail infrastructure, and improving transport links, both within the basins and with key nearby arteries and agglomerations. Such projects include: construction of new road sections with motorway junctions (e.g. B2, B86, B96, B115, B156, B176), construction of new long-distance railway routes and extension or electrification of existing ones, with their adaptation to the launch of high-speed connections of ICE class (e.g. Leipzig–Cottbus, Leipzig–Chemnitz, Dresden–Cottbus, Dresden–Zittau, Aachen–Cologne), expansion of the suburban railway (S-Bahn) infrastructure between conurbations and basins (e.g. new sections and stations on routes Cologne–Mönchengladbach, Leipzig–Gera, Leipzig–Merseburg), as well as the modernisation of railway stations (Cottbus, Berlin Schönefeld – a direct rail link between the Lusatian Basin and the capital airport is planned). From a Polish perspective, infrastructure projects which improve cross-border communication are important. These include the widening of the A4 motorway connecting the Dresden-North junction with the Polish-German border near Zgorzelec to six lanes, as well as the electrification and extension (enabling trains

to travel at 160 km/h) of the Berlin–Cottbus–Görlitz/Zgorzelec(–Wrocław) and Dresden–Bautzen–Görlitz/Zgorzelec(–Wrocław) routes and the electrification of the Cottbus–Guben/Gubin(–Zielona Góra) route.

Another objective of the investments supported under this pillar is the development of universities and the establishment of new branches of research institutes, especially those working in the field of innovative and green technologies. The list includes a total of 32 such projects, including research institutes for alternative fuels and hydrogen economy at the Jülich research centre in North Rhine-Westphalia, a centre for the development of a sustainable chemical industry in the Central German Basin, research on aviation electrification at the branch of the German Aerospace Centre in Cochstedt near Magdeburg, the low-emission research institute for jet engines and the competence centre for decarbonisation of the energy-intensive industry (both in Cottbus), expansion of the innovative electronics and microsensor studies campus at the Brandenburg University of Technology (BTU) in Cottbus–Senftenberg, alongside the creation of a skills centre for the use of Power-to-X technology in Lusatia.

In addition, the central government has pledged to create a total of 5,000 new jobs in branches of federal administrative offices in the basin by 2028 (including the establishment of an exposition of the Federal Office of Economics and Export Control in Weißwasser in Lusatia).

Although the Act on the Structural Strengthening of Coal Regions focuses on the three existing lignite mining basins, it also provides for additional funding to support the restructuring of areas where hard coal power plants still play an important economic role. The federal government is to allocate an amount of €1.1 billion for this purpose, of which North Rhine-Westphalia will receive the largest part (€662 million) (for the cities of Duisburg, Gelsenkirchen, Hamm and Herne). The remaining money will go to Lower Saxony (€157 million for the city of Wilhelmshaven), Saarland (€128.5 million for the districts of Saarlouis and Saarbrücken) and Mecklenburg-Vorpommern (€52.5 million for the city and district of Rostock). In addition, Lower Saxony will receive €90 million to help the Helmstedt region. The allocation and spending of these funds is subject to the same regulations as the first (federal state) pillar of support for lignite basins.

V. CONSEQUENCES AND PERSPECTIVES

The abandonment of coal is associated with a major restructuring of the German electricity system and represents another stage in the country's energy transformation, following the abandonment of nuclear energy. It is worth mentioning here that in the years 2020–2022 the two processes overlap, which means that their consequences, especially in the short term, should be viewed jointly. In the first phase of the transition away from coal (by the end of 2022), there will be an accumulation of nuclear (8 GW) and coal (12 GW) plant closures, resulting in the system losing nearly a quarter of its installed capacity in stable conventional generation sources. By 2030, a further 13 GW of coal-fired units are to be taken off the market, and by 2038 – the remaining 17 GW.

In the official narrative, the simultaneous discontinuation of electricity generation from the sources mentioned above is presented as evidence of Germany's ambitions in terms of climate policy. However, behind the scenes, it is often argued that the implementation of the Energiewende would be easier to achieve in terms of ensuring the security of energy supplies and reducing greenhouse gas emissions faster if the transformation were carried out in the reverse order. However, due to the anti-nuclear stance of the majority of citizens, turning back from the path of departure from nuclear energy remains politically out of the question. None of the major parties (with the exception of the AfD) or even the energy companies are calling for an extension of nuclear power plants.

The move away from coal has four main consequences for the German electricity system. Firstly, the withdrawal of more power plants from the market will lead to a decrease in the generation of energy from this fossil fuel, but due to the architecture of the entire process, the rate of this decrease remains difficult to predict. Coal units are disadvantaged first and foremost by the rapidly rising price of emission allowances under the EU ETS – on the day the law was passed on 3 July 2020 it was €28 per tonne, and in the summer of 2021 it was already hovering around €60. Such high emission costs hit the profitability of coal-fired power generation the hardest. In turn, the closure of the last six nuclear power plants will probably give the coal-fired facilities a second wind and may even lead to a paradoxical situation in which the share of this fuel in the mix (despite the fact that some units have already been shut down) will temporarily increase again, as the remaining coal-fired units will be used to a greater extent than now to fill the gap. Much will also depend on the economic situation on the fossil fuels market – very high natural gas

prices (such as those observed in mid-2021) will favour the use of cheaper coal (especially lignite).

Secondly, the process under discussion will inevitably result in an increase in the importance of natural gas as a transition fuel. In the short to medium term, a clear increase in electricity generation from natural gas can be expected, supported by the withdrawal of coal and nuclear power plants from the market, as well as rising prices of allowances in the EU ETS, affecting gas units to a lesser extent than coal units.[55] Above all, a significant increase in the load factor for gas-fired power stations (which has been relatively low in recent years) is to be expected, as well as the conversion of some coal-fired plants to natural gas (fuel switch). Many energy companies have already started investing in fuel switching in existing units.[56] However, experts say that new facilities will be needed to ensure security of energy supply, with differences in the scale of the need for new gas capacity (between 13 and 33 GW by 2030, depending on the model adopted). According to BNetzA data from the beginning of 2021, gas-fired units with a total capacity of 2.4 GW are to be built by 2023. According to some experts and representatives of the energy industry, such projects are currently financially unattractive in Germany due to the state of the market, which allows only partial utilisation of the facilities' capacities, thus significantly reducing their profitability. Furthermore, the intention to fully decarbonise the electricity sector by the 2040s makes investments in natural gas medium-term at best. Most of the large industry players have already made public their planned carbon neutrality dates, with RWE aiming for 2040 and Uniper and EnBW already in 2035. Estimates by think tanks indicate that the peak in electricity generation from natural gas will occur in the first half of the fourth decade, and the share of this fuel in the mix may then reach about 25%. In the long term, natural gas-fuelled power stations would switch to the use of hydrogen.

Thirdly, a significant reduction in the available marketable stable generation capacity in conventional power plants will bring an increase in electricity imports. According to various government-independent institutions, during

[55] This process has already begun as a result of the increase in the price of emission allowances under the EU ETS, which places the greatest burden on the most emission-intensive coal-fired power plants. From 2019 onwards, gas/steam power stations have started to overtake coal-fired units in the Merit Order price ranking, and in 2020 often also those burning lignite.

[56] The most advanced plans in this respect are presented by the company EnBW from Baden-Württemberg, which intends to convert the facilities in Stuttgart, Karlsruhe, Heilbronn and Altbach/Deizisau, which currently generate electricity from hard coal, to natural gas. Similar intentions are also shared by Uniper for its power plant in Gelsenkirchen and Mainova for the one in Frankfurt.

periods of so-called dark wind lull (mainly in winter), i.e. low generation from wind and solar power, Germany will not always be able to cover its demand from its own sources. The Federal Court of Auditors (the equivalent of the Supreme Audit Office) has estimated the gap in the system at around 4.5 GW of capacity in 2023,[57] and the transmission grid operators at up to 7.2 GW.[58] Although Germany will not be threatened by a blackout during these periods, it will be necessary to increase energy supplies from neighbouring countries. A number of scenarios indicate that Germany will move from being a net energy exporter to an importer in the mid-2020s as a result of increasingly frequent imports. An additional challenge in this context is the fact that Germany's neighbours are also deciding to decommission parts of their conventional (mainly coal-fired) power plants, which will further reduce the number of potential import sources. In view of the growing import needs, Berlin attaches great importance to the further integration of energy markets in the EU (including the construction of new interconnectors)[59], which will enable a freer exchange between the member states. The government is also pinning considerable hopes on the creation of hybrid offshore wind farms, from which energy could flow directly to various countries depending on demand, thanks to multi-directional connections.

Fourthly, the reduction of available capacity in conventional power plants will result in the need to increase the number of plants in reserve – those that remain outside the market and only come online in specific situations. Germany has three mechanisms for this – the main grid reserve (*Netzreserve*) as well as the supplementary power reserve (*Kapazitätsreserve*) and the security reserve (*Sicherheitsbereitschaft*). For example, the Institute of Energy Economics at the University of Cologne (EWI) estimates that the total capacity of reserve power stations should increase from 12 GW in 2019 to as much as 45 GW in 2030 and 58 GW in 2040.[60] Coal-fired plants (mainly hard coal-fired) withdrawn from the market are likely to become an important part of the reserve, as confirmed

[57] M. Kędzierski, 'Niemcy: Federalny Trybunał Obrachunkowy krytycznie o realizacji Energiewende', OSW, 1 April 2021, osw.waw.pl.

[58] *Bericht der deutschen Übertragungsnetzbetreiber zur Leistungsbilanz 2018–2022*, Amprion, 18 February 2020, amprion.net.

[59] Three new interconnectors were commissioned between 2020 and 2021: with Norway (NordLink with a capacity of 1,400 MW), with Belgium (ALEGrO with a capacity of 1,000 MW) and with Denmark (Combined Grid Solution with a capacity of 400 MW through a bidirectional connection of offshore wind farms). Once these are operational, Germany has direct interconnectors with 11 countries. For more details, see M. Kędzierski, 'Niemcy: rola połączenia elektroenergetycznego z Norwegią', OSW, 27 April 2021, osw.waw.pl.

[60] M. Gierkink, D. Lencz, F. Arnold, *Auswirkungen einer Beendigung der Kohleverstromung bis 2038 auf den Strommarkt, CO_2-Emissionen und ausgewählte Industrien. Eine Analyse des Abschlussberichts der WSB-Kommission*, EWI, May 2020, ewi.uni-koeln.de.

by the Federal Network Agency's decision to keep the Rhineland Heyden power plant, selected for shutdown in the first auction, in the reserve until September 2022.[61] Increasing the number of units remaining in reserve will further increase the cost of managing the system, which will hit energy consumers who pay a network fee (*Netzentgelt*). This has increased by 35% over the last decade and by 2020 will account for a quarter of electricity prices, making it the largest item on bills. High electricity prices are a major social, economic and political problem in Germany.

The extent to which the aforementioned consequences occur will depend on three main factors, which are outlined below.

The rate of expansion of RES capacity. The architects of the Energiewende envisage that electricity generation in nuclear and coal-fired power plants will be replaced in the first place by electricity generated from renewable sources. Ultimately (in the early 2040s), the system is to be based 100% on RES. According to the RES Act amended in December 2020, by 2030 the capacity of onshore wind farms is to increase by one third (from 54 to 71 GW), offshore by almost three times (from 7.7 to 20 GW), and photovoltaics by almost two times (from 53 to 100 GW).[62] As a result, by the end of the decade the share of renewables in electricity consumption is expected to reach at least 65% (46% in 2020). The rest of the mix would be made up of gas-fired power plants and the remaining coal-fired units. However, the government's plans regarding the pace of RES development raise serious doubts – they are considered unrealistic. While photovoltaic panels are experiencing a real renaissance in Germany (an increase of 4 GW in 2019 and 4.9 GW in 2020), the crisis in the wind industry remains unresolved. Problems with obtaining permits, public protests, lawsuits, as well as barriers regarding the distance of windmills from buildings have caused the number of newly built facilities of this type to drop sharply in recent years.[63] At the current rate of growth in the capacity installed in RES, Germany will not be able to achieve the targets it set prior to the Energiewende, and the less energy from "green" sources there is in the system, the greater the gap will have to be filled by conventional (gas and coal) power plants and imports.

61 'Unipers Kohlekraftwerk Heyden 4 soll länger in Reserve bleiben', Reuters, 1 June 2021, reuters.com.

62 M. Kędzierski, 'Nowelizacja niemieckiej ustawy o OZE. Reforma rozłożona na raty', OSW, 23 December 2020, osw.waw.pl.

63 While in 2015–2017 the average growth was 4.5 GW, in 2018 it fell to 2.5 GW and in 2019 to the lowest level since 2000 – 1 GW. Despite efforts to unlock expansion, onshore wind capacity increased by just 1.2 GW in 2020. For more details, see M. Kędzierski, 'German wind power sector in crisis. Energiewende under further threat', *OSW Commentary*, no. 309, 25 September 2019, osw.waw.pl.

The speed of expansion of the electricity transmission grid. The growing role of wind energy in the electricity mix (24% in 2020) makes it necessary for Germany to increase the capacity of the connections between the windy north, which has an excess of electricity from renewable sources, and the industrialised south. At present, bottlenecks in the system prevent some of the energy from wind farms from being transported, so that they are increasingly being forcibly disconnected from the grid to avoid overload.[64] The rate of expansion of electricity grids is still too low in relation to the changes taking place in the system. Of the projects adopted in 2009 and 2013 covering 7,700 km of routes, which were to be ready by the end of 2022, only 20% have been completed so far, and they are not expected to be completed until 2031. The three energy freeways, which are crucial from the perspective of the Energiewende, will be put into operation with a delay of at least three years (until 2025). The low capacity of the system results in the need to leave more conventional power plants in southern Germany, an increase in the number of power plants in reserve, and the need to import energy more often.

The scale of electricity demand growth. The federal government, when preparing reforms to move away from coal or to amend the Renewable Energy Act, relied on a forecast stating that the rate of electricity consumption would be 590 TWh in 2030, i.e. it will remain at a similar level as in previous years (the average for 2014–2019 is 585 TWh).[65] However, almost all independent centres indicate that a clear upward trend is to be expected in the coming years – mainly due to factors such as the shift to electromobility in transport, the use of heat pumps in heating or the production of green hydrogen for industrial purposes. Prognos, Öko-Institut and Wuppertal Institut, for example, estimate that electricity demand will increase by 9% (643 TWh)[66] by the end of the decade and, according to EWI, by up to 16% (685 TWh)[67], which is an estimate exceeding the authorities' calculations. The faster electricity consumption grows, the higher the increases in RES capacity will need to be in order to meet the targets set for the Energiewende. The lack of a sufficiently high level of generation from renewable sources will result in a greater demand for energy from natural gas, coal and imports.

[64] In 2019, 6.5 TWh, or 5% of the electricity generated by windmills, was lost in this way. For more information, see M. Kędzierski, 'Niemcy: coraz większy zakres rozbudowy sieci elektroenergetycznej', OSW, 11 February 2021, osw.waw.pl.

[65] 'Bruttostromverbrauch in Deutschland', Federal Statistical Office, de.statista.com.

[66] *Klimaneutrales Deutschland*, Prognos, Öko-Institut, Wuppertal Institut (commissioned by Agora Energiewende, Agora Verkehrswende, Stiftung Klimaneutralität), June 2021, agora-energiewende.de.

[67] M. Gierkink, T. Sprenger, *Auswirkungen des EEG 2021 auf den Anteil erneuerbarer Energien an der Stromnachfrage 2030*, EWI, April 2021, ewi.uni-koeln.de.

The architecture of the *Kohleausstieg* process will also lead to an increase in the wholesale price of electricity. This is primarily due to the withdrawal from the market of a large amount of power available from conventional sources (reduced supply and competition on the exchange). Depending on various variables (including the prices of emission allowances in the EU ETS, natural gas and coal), it is estimated that the scenario of abandoning coal will result in an increase of between 10% and 35% by 2030.[68] More pessimistic forecasts assume that especially in the short term, due to the simultaneous withdrawal of numerous coal and nuclear power plants by the end of 2022, it may be even more severe and temporarily reach 60%.[69] Such predictions raise fears among local businesses, for which additional increases in energy prices (already among the highest in the EU) may constitute a serious blow to their competitiveness. Despite intensive lobbying by the most influential business associations, including the Federation of German Industries (BDI) and the Association of German Chambers of Industry and Commerce (DIHK), the document contains only vague promises that the price changes in this market will be verified as part of the planned evaluations of the Coal Phase-out Act and that compensation measures may be taken.

Finally, the accepted mechanism will involve a significant burden on the federal budget in the coming years. The government's plans have been heavily criticised by, among others, the German Taxpayers' Union (Bund der Steuerzahler), which listed them as an example of a waste of public money in its annual *Black Book*.[70] According to its authors, the adopted solution is much more expensive than the alternative options presented in the debate, and its effects in the form of emission reductions remain difficult to estimate. The total budget expenditure related to the abandonment of coal will exceed €50 billion.[71] In addition, the cost side will also include lower revenues from the sale of emission allowances under the EU ETS (those falling on withdrawn power plants are to be cancelled). At a price of €23 per tonne of CO_2, it was estimated that these revenues would fall by around €5 billion by 2030. By mid-2021, however, the cost of allowances had already doubled.

[68] *Auswirkungen der Schließung von Kohlekraftwerken auf den deutschen Strommarkt. Analyse im Auftrag des BDI und des DIHK*, Federation of German Industries (BDI), 22 January 2019, bdi.eu.

[69] S. Schultz, 'Strompreise könnten bis 2022 um mehr als 60 Prozent steigen', Der Spiegel, 11 October 2019, spiegel.de.

[70] 'Kohleausstieg – hohe Kosten, wenig Wirkung', Bund der Steuerzahler Deutschland e.V., 12 March 2020, steuerzahler.de.

[71] This sum includes funds for restructuring of coal regions (€40 billion), compensation for operators of lignite (€4.35 billion) and hard coal power plants (difficult to estimate due to the choice of market auctioning mechanism – the first one awarded a total of €317 million), benefits for lignite mine workers over 58 years old for the time transition to retirement (€4.8 billion) and administrative costs (€180 million).

Perspectives

The increase in the EU's emission reduction target for 2030 from 40% to 55% (compared to 1990) has forced Germany to revise the assumptions of its national climate policy, which were in force at the time the law on the transition from coal was passed. According to an expert report presented in April 2021 by the expert council for climate issues advising the federal government, the EU's more ambitious plans mean that Germany will have to cut its emissions by 62–68% by the end of the decade, depending on the scenarios adopted.[72] In the end, the CDU/CSU-SPD coalition, under pressure from the ruling of the Federal Constitutional Court on Germany's climate protection law, decided to change its existing national reduction target for 2030 from 55% to 65% and to bring forward the date for achieving carbon neutrality from 2050 to 2045.[73]

The new EU climate policy target and the associated far-reaching change in plans to decarbonise Germany's economy mean that the energy transition there must be accelerated. The former will have a direct effect in the form of a sustained increase in the price of emission allowances in the EU ETS, which will increasingly reduce the profitability of electricity generation from fossil fuel sources, especially coal.[74] This will lead to a consistent displacement of hard coal-fired power plants from the market in the first instance, with lignite-fired plants following later. Most forecasts predict that the increase in emission allowance acquisition costs will significantly accelerate the decline in coal-fired power generation by the end of the decade. In 2030 the share of this fuel in the German electricity mix would be between 2.3% (Prognos/Öko-Institut/Wuppertal Institut) and 5.1% (EWI). The withdrawal of the last coal-fired power plants from the market would thus take place due to market pressure probably still in the first half of the 2030s. Such scenarios are confirmed by the aforementioned amendment to the Climate Protection Act, which stipulates that the power sector will only be able to discharge

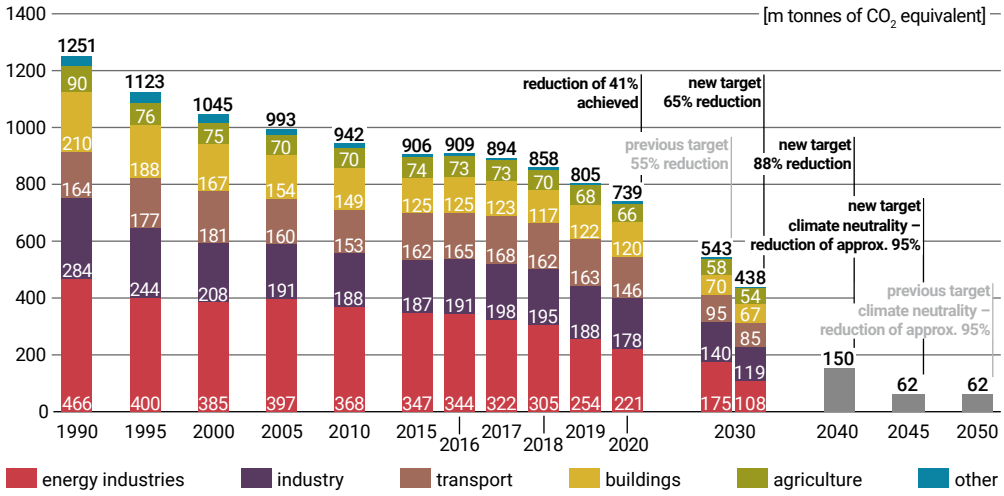
[72] *Bericht zur Vorjahresschätzung der deutschen Treibhausgasemissionen für das Jahr 2020*, Expertenrat für Klimafragen, 15 April 2021, expertenrat-klima.de.

[73] M. Kędzierski, 'Niemcy: nowelizacja ustawy o ochronie klimatu – neutralność emisyjna do 2045 roku', OSW, 30 June 2021, osw.waw.pl.

[74] The speed of the EU ETS emissions allowance price increase is not clear. According to the Potsdam Institute for Climate Impact Research (PIK), at the end of the decade they could cost as much as €130 per tonne of CO_2 (in June 2021 their price hovered around €50 and was twice as high as the average in 2019). A less radical forecast is presented by EWI, which estimates that allowances will cost €61 in 2030 and €85 in 2038. For more details, see 'The new EU climate target will increase carbon prices and could phase out coal power in Europe as early as 2030', Potsdam Institute for Climate Impact Research (PIK), 27 April 2021, pik-potsdam.de; M. Gierkink et al., *Auswirkungen einer Verschärfung der europäischen Klimaziele auf den deutschen Strommarkt*, EWI, 17 March 2021, ewi.uni-koeln.de.

108 million tonnes of CO_2 equivalent into the atmosphere in 2030. These emissions will overwhelmingly come from power plants burning natural gas. With worsening market conditions, operators of coal-fired units may themselves decide to close them earlier (than required by the law) or invest in fuel switching.

Chart 7. German greenhouse gas emissions by sector, and existing and new reduction targets



Source: own study based on data from the Federal Environment Agency.

The expected acceleration of the transition away from coal increases the scale of the challenge that the architects of the Energiewende will face in the coming years. Achieving the new climate policy objectives means above all that the rate of growth in the capacity of RES installations will have to be drastically increased. According to the minister for the environment, Svenja Schulze, by 2030 the total capacity of photovoltaic panels should be almost tripled (to 150 GW), and the capacity of onshore wind farms should be almost doubled (to 95 GW). On the other hand, faster phasing out of coal-fired units will further increase the demand for gas-fired and reserve capacity, as well as increase the risk of the country's dependence on energy imports. Accelerated decarbonisation also means an increased pace of electrification of subsequent sectors of the economy, and consequently a faster growth in electricity consumption.

The new assumptions of the EU and national climate policies have made the issue of a timetable for shifting away from coal in the power sector one of the campaign themes ahead of the elections to the Bundestag on 26 September 2021 (climate change and the broader decarbonisation of the economy were

among the main issues raised by the parties).[75] The Greens and the Left have demanded that the phasing out of coal-fired power plants be significantly accelerated and have called for the future government to take measures resulting in the closure of the last power plants by 2030. The Greens favour the use of fiscal incentives (e.g. the introduction of a minimum price for EU ETS emissions allowances in Germany), which will further reduce the profitability of coal-fired power plants and encourage operators to stop operating them themselves. On the other hand, the Left prefers the implementation of an amendment to the law on moving away from coal containing an earlier date for the ban on the use of this raw material for electricity generation (2030 instead of 2038). Although the CDU/CSU, the SPD and the FDP are open to moving away from coal-fired power generation sooner than stated in the document, they are opposed to setting a clear date for this. The Christian Democrats and Social Democrats emphasise the importance of the social consensus reached by the coal commission and the need to guarantee the mining regions time to restructure and introduce the necessary changes to the electricity system to ensure security of electricity supply. These parties, like the liberals, want to rely on market mechanisms (especially the rising prices of emission allowances), which they believe will be enough to reduce the production of energy from coal and induce operators to withdraw units from the market earlier. The advantage of such a solution from the budgetary perspective is that there is no risk that energy companies will start to demand additional compensation related to state-enforced business activities. We should also take into account the opposition of both the inhabitants and political representatives of the mining basins to the plans of accelerating the end of coal mining.

Carrying out the green transformation of the economy at an accelerated pace will be among the biggest challenges facing the new governing coalition after the Bundestag elections. The incoming government will have to adopt an implementation programme for more ambitious decarbonisation that will enable the new national climate policy targets to be met. With a view to 2030, this means that the pace of action will have to be stepped up, particularly in the electricity sector, where the new provisions of the Climate Protection Act envisage the fastest emissions reductions in the next decade (by 51% compared to 2020 – from 221 to 108 million tonnes of CO_2 equivalent). In order to fulfil its obligations, Germany will have to significantly increase the growth of its RES capacity and create new incentives for investing in gas-fired power

[75] 'Orzeczenie w sprawie polityki klimatycznej – prezent dla Zielonych', *Monitor OSW: Wybory w Niemczech*, no. 5, 12 May 2021, osw.waw.pl.

plants or for switching from coal to natural gas in existing power plants. Due to the bridging effect of blue fuel in the transition to a fully renewables-based system, emerging gas-fired power plants will probably already include the future use of hydrogen. In 2040, all sectors of the economy are expected to emit a maximum of 150 million tonnes of CO_2 equivalent into the atmosphere, which means that – due to the larger scale of the challenge in other areas – the full decarbonisation of the German electricity industry, and thus the shift away from natural gas in electricity generation, must take place by the early 2040s at the latest.

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The text was completed in September 2021.