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European Lignite-Mining Regions in Transition

Challenges in the Czech Republic and Germany

Sabrina Schulz, Julian Schwartzkopff (E3G)

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PREFACE

A Czech-German Dialogue on the Future of Lignite Mining Regions and Structural Change

Dear Reader,

Climate and energy policy decisions have moved to the centre of the European political agenda. The Paris Agreement on climate change has put the European Union on a path to decarbonisation. Meanwhile, technological change has caused new energy technologies using renewable energy sources and digital system technologies to become economically competitive. Old state-run energy monopolies have been broken up and new players have entered an increasingly competitive market. This new European energy age provides many opportunities to make Europe's economies more competitive, resilient to external shocks, and environmentally friendly. Most importantly, the boost in renewables at the expense of coal, oil, gas and nuclear will help Europe to achieve its climate policy targets and to decarbonise its economy by 2050 at the latest.

While the growth in renewables has created winners and losers, the net effect on Europe's economy has been increasingly positive. Europe is now leading on renewable energy and other green technologies. Export opportunities are growing and will recuperate the initial upfront research and development expenditures here in Europe. This rapid transformation has come at a cost, however, particularly to people in regions that are strongly dependent on the old energy economy based on fossil fuels. For Central European countries like Germany and the Czech Republic, these effects are mostly impacting traditional coal regions. In contrast to hard coal mining – the backbone of Europe's energy economy in the post-war era which has been in a stably managed decline since the 1970s – lignite mining has retained a high level of productivity to the present day. Consequently, Germany's lignite regions in the Rhineland, Lusatia and in Saxony-Anhalt, as well as Czech lignite regions in northern Bohemia, have much to lose if the transition to a decarbonised future without coal is not managed well.

This report, which was commissioned by the Heinrich Böll Foundation's Prague Office and Deutsche Umwelthilfe (Environmental Action Germany – DUH), in close collaboration with Glopolis and E3G – Third Generation Environmentalism, examines lignite mining regions in the Czech Republic and Germany. The report explores how these regions' current development models can be transformed in an economically sustainable and socially just manner.

The report is based on confidential discussions by an expert group comprised of members with experience in government, public administration, the energy industry, labour unions, science and civil society in both countries. The expert group's exchange of ideas also contributed to the Strategic Dialogue between the Czech Republic and Germany, which was initiated in 2015. Senior officials from both governments involved in the ongoing strategic dialogue were also involved in parts of our meetings.

The group had the opportunity to meet six times between September 2016 and October 2017. Meanwhile, national elections have taken place in both countries and will lead to new perspectives on energy policymaking, as well as on Czech-German and European collaboration.

This report and its recommendations will therefore be presented to both governments with a view to stimulating further debate on what a just model of structural change in Europe's lignite mining regions could look like.

Among the key insights of our report is that a managed phase-out of electricity production from hard coal and lignite will be necessary in order to meet the targets of European climate policy and to achieve the decarbonisation of the European economy by 2050. Lignite is by far the most polluting fossil fuel. Moreover, lignite strip mining, as it is practised in the Czech Republic, Germany, and other Central and Eastern European countries, incurs lasting damage to the environment, cultural landscapes, and whole regional hydrological systems. Regenerating these landscapes, however, offers multiple opportunities for economic and community development. A number of best practice examples are identified in our report, all of which rely on active citizen participation and inclusive management of change processes.

At the same time, entire regional economies are based on "cheap" lignite mining and electricity production, and entire industrial clusters of energy-intensive industries have been built around lignite producing chemical products, steel, aluminium, cement, and paper. These industries have traditionally provided well-paid, unionised jobs to regions that otherwise have a very weak economic base. Public co-ownership and/or sponsoring schemes have created local entanglement between the coal industry, local political elites, and municipalities dependent on tax revenues from the utilities operating coal mines and power plants. In order to be successful, any transition process must therefore create new coalitions of winners and offer new opportunities to those who have been relying on the old economic system.

The German and Czech lignite regions are closely connected. Companies in both the mining sector and the renewable energy industry have made cross-border investments. This is why shared experience can be so useful.

The lignite regions in both countries also operate within a European framework. The next generation of EU climate targets, the EU Winter Package of energy policy reform, the EU electricity market reform, the reform of the ETS, and new pollutant emissions standards under the Industrial Emissions Directive will put additional pressure on current lignite assets as well as future development. On the other hand, EU support schemes, e.g. from the structural funds, could be utilised to accelerate and shape a just transition in lignite regions. Our report therefore situates all of its recommendations in a European context.

This report has only been possible because all the members of our Czech-German expert group contributed their time and their wisdom. We owe special thanks to Julian Schwartzkopff and Sabrina Schulz from E3G, who wrote and edited the report and provided multiple draft versions for our discussion. We would also like to thank the teams from all partner organisations for their substantive assistance in this important endeavour.

We hope that you, the esteemed readers of our report, will find its conclusions interesting. Please feel free to enter into further discussions with us and all other partners involved.

With kind regards,

Eva van de Rakt
Head of Prague Office
Heinrich Böll Foundation

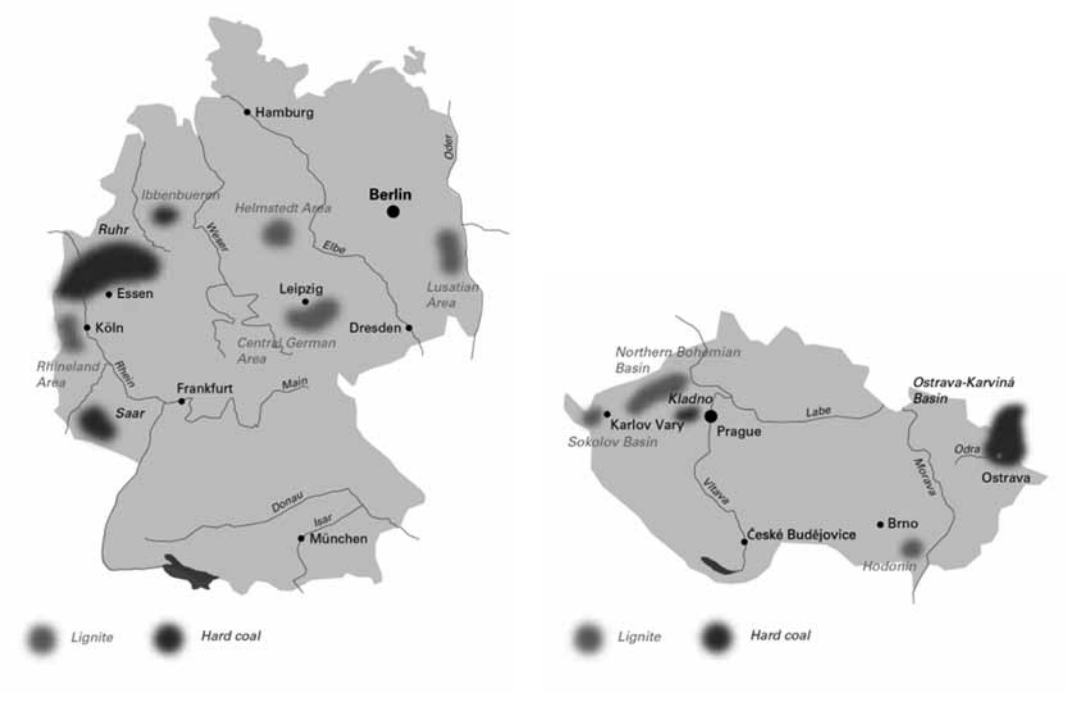
Sascha Müller-Kraenner
Executive Director
Deutsche Umwelthilfe

Prague and Berlin, April 2018

Chapter 1: Lignite area profiles

This chapter analyses the key differences and similarities between the main Czech and German lignite mining regions. It includes case studies covering the general economic profile, the role of lignite and an outlook for the Ústí region in the Czech Republic, as well as Lusatia, the Rhineland and the Central German lignite area.

Figure 1: Coal regions in Germany and the Czech Republic



Source: Euracoal

Table 1: Overview of the lignite regions included in this report

	Ústí	Lusatia	Rhineland	Central Germany
Population	826,000	1.1 million	2.1 million	2.4 million
Lignite power capacity*	3,500 MW	5,787 MW	8,513 MW	2,655 MW
Lignite production (2015)	52.3 MT	60.1 MT	95.2 MT	18.9 MT
Lignite jobs (direct)	~7,000	8,278	8,961	2,613
CO_2 emissions of lignite plants (2015)*	16.25 MT (2015)	46.6 MT (2016)	77.5 MT (2016)	15.6 MT (2016)
Share of local lignite plants in national CO_2 emissions (2015)	13%	5%	9%	2%
Active lignite companies	Czech Coal (mining), ČEZ (mining and power)	LEAG/EPH	RWE	Mibrag/EPH, Romonta

* Capacity and emissions for German lignite regions exclude the 2.7 GW of lignite capacity set to close as part of an agreement with energy companies (*Sicherheitsbereitschaft*)

Sources: Euracoal, Agora Energiewende, Beyond Coal Database, DEBRIV

1.1 The Ústí region (Ústecký kraj), Czech Republic

General characteristics

The Ústí region is located in north-western Bohemia, the heartland of the Czech energy industry, and shares a border with the German state of Saxony. The region encompasses the North Bohemian Coal Basin, where the vast majority of Czech lignite is mined. It has undergone complex changes since the collapse of the communist economy after 1989, which have resulted in a range of social, economic and environmental challenges today.

The region has over 820,000 inhabitants, making it the fifth most populous region in the Czech Republic. Its largest settlement is Ústí nad Labem, the regional capital, with roughly 95,000 inhabitants. Population density is higher than the national average, and the most densely populated areas are situated around the lignite basin. This is partly for historical reasons.

The region became severely depopulated when the German-speaking population was expelled in 1945. This was especially problematic as the Ústí region was a key centre of Czech mining and industry. The communist regime adopted a carrot-and-stick approach to move people to the region and fill the gap. While some were moved forcibly, often from lower social classes or minorities, others came voluntarily, drawn in by subsidised housing or economic opportunity. As a result, many people are first- or second-generation inhabitants, and there is less of a traditional mining culture and "local patriotism" than in German lignite regions.

In 2015, the Ústí region accounted for 6% (or €10 billion) of Czech GDP, with 7.7% of the Czech population living there. The regional economy has a very strong industrial orientation,

even stronger than is typically seen in German lignite mining regions, with the industry sector accounting for 43.9% of regional GDP and 27% of employment.[1]

Only a small portion of this wealth generation actually remains in the region, however, as most of this production is situated at the lower end of the supply chain. While unemployment has fallen markedly in 2016 and 2017, as elsewhere in the Czech Republic, the Ústí region had an unemployment rate of 8.1% in 2016 – the highest of all Czech regions.[2] It also has an elevated share of people qualifying as socially excluded, as well as poor coverage of social and health care services.[3] Air quality is among the worst in the Czech Republic, exceeding official air pollution limits, which is largely due to coal power generation and heating.[4]

Poor health care coverage and high air pollution have resulted in the highest mortality rate in the Ústí region out of all Czech regions (11.2 deaths per 1,000 inhabitants).[5] Decades of lignite mining and heavy industrial production have left the region with a severely damaged environment, requiring serious and costly efforts to reclaim and recultivate large areas of land. At the same time, there is a lack of higher education facilities and little capacity for innovation.[6] Almost a fifth of the population above 15 years of age had only compulsory or no education in 2015.[7] Despite being a comparatively young region, the prospects for young professionals are very limited. Unemployment among secondary school graduates is particularly high in the Ústí and the neighbouring Karlovy Vary region, compared to Prague and its surrounding areas.[8] The situation is particularly bad for women, who consequently have a much higher propensity to leave the region than men. As a result, there are 5% fewer women than men in the age group below 65, even though this age group counts more women than men overall.[9] Women earn 19% less than men on average, with an average gross income of CZK 22,411 (€840), compared to men who earn CZK 27,825 (€1,041).[10] The comparatively well-paid lignite industry jobs are predominantly held by men, with the share of female employees varying between 17% and 24%, depending on the facility.[11]

While significant amounts of Foreign Direct Investment (FDI) were dedicated to the Ústí region, much of its industrial manufacturing is at the lower end of the supply chain and is directed by foreign companies. This is a general problem of the Czech economy, but it is particularly pronounced here. The resulting focus on intermediate rather than final products leads to low value-added production that provides only limited benefits for the region or the country. Apart from lignite mining and power generation, the major economic activities are the production of cars and car parts, mineral and metal products, as well as machinery and chemicals.

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1 Czech Statistical Office (2011) Census in 2011 – Ústecký kraj – Outcome analytics, p. 45
2 European Commission (2017) Labour Market Information: Czech Republic - Ustecky kraj
3 Czech Ministry of Regional Development, Partnership Agreement for the Programming Period 2014-2020, p. 81
4 Czech Hydrometeorological Institute (2012) Emise hlavních znečišťujících látek v České republice podle krajů (''Emissions of the main pollutants in the Czech Republic: by region'')
5 Czech Statistical Office (2016) Statistical Yearbook of the Ústecký Region, p. 24; European Observatory on Health Systems and Policies (2015) Czech Republic: Health System Review
6 Czech Ministry of Regional Development (2016) Partnership Agreement for the Programming Period 2014-2020, p. 32
7 Czech Statistical Office (2016) Statistical Yearbook of the Ústecký Region, p. 82
8 Czech Ministry of Regional Development (2016) Partnership Agreement for the Programming Period 2014-2020, p. 21
9 Czech Statistical Office (2016) Statistical Yearbook of the Ústecký Region, p. 69
10 Czech Statistical Office (2016) Statistical Yearbook of the Ústecký Region, p. 89
11 Severočeské doly group (2015) Annual report for 2015, p. 59

Role of the lignite industry

The importance of the lignite industry in this economically challenged area is amplified by the fact that its entire supply chain, from mining to the sale of electricity and heating fuel to consumers, is located in the region. This is because lignite is typically not transported over long distances for reasons of economic efficiency. Six lignite mines and power plants are located in the region, operated by subsidiaries of Czech Coal as well as the mainly state-owned utility ČEZ. Almost all of these power plants operate as cogeneration plants, providing heat to district heating systems.

The lignite industry provides close to 7,000 jobs in the Ústí region. Overall, mining and quarrying provide 2.4% of jobs in the region, and the electricity, heating and cooling sector a further 1.4%.[12] As the lignite industry provides the majority share of jobs in both fields, a maximum estimate of lignite-related jobs is 3.8% of local employment.

As in Germany, lignite jobs are comparatively well paid, with average monthly wages in mining (CZK 29,616; €1,109) and power generation (CZK 37,757; €1,413) far above the regional average of CZK 25,301 (€947). This is mainly due to the strong bargaining position of the trade unions, which arose from the high degree of specialisation of the workforce and the industrial scale of the business. As a result, any potential reduction in lignite jobs is highly contentious.

Outlook

A long-standing controversy about lignite mining limits, which had been introduced by decree in 1991, was finally ended in 2016. While the regional government as well as the trade unions and coal companies all pushed for an extension of the mining limits, the Czech government decided to only extend them for the Bílina mine. As a result, the ČSA mine will close by 2025 due to reaching the mining limits, while the other mines in the region are projected to run until 2040 and beyond.[13] The government will be discussing the breach of mining limits in this mine again in 2020, which could allow for mining operations to end beyond 2050.[14] However, the compromise is very likely to stay in place under an ANO-led government, as the party has argued for maintaining the limits in the past.

In 2013, the Vršany mine concluded a contract with the Počerady power plant to supply lignite for up to 50 years,[15] while coal reserves in the mine are estimated to last beyond 2050.[16] However, ČEZ is planning to sell the Počerady power plant, as the mine is operated by Czech Coal, leading to higher fuel costs than in the mines ČEZ operates itself. The supply contract includes an option for the owner of the Vršany mine, currently Pavel Tykač, the effective owner of Czech Coal, to buy the power plant from ČEZ. In 2017, an attempt to sell the Počerady power plant to Mr Tykač was blocked by the ČEZ supervisory board, but the issue is likely to resurface in a few years.

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12 Czech Statistical Office (2016) Statistical Yearbook of the Ústecký Region, p. 87

13 VUPEK-ECONOMY (2015) Dlouhodobá prognóza trhu s hnědým uhlím (“Long-term Forecast of Lignite Market Situation”), pp. 26-30

14 Melichar, J., Máca, V. (2016) Externí náklady prolomení limitů těžby hnědého uhlí v Severočeské hnědouhelné pánvi (“External Costs of Breaches of Mining Limits in the North Bohemian Coal”)

15 ČEZ Group (2017) ČEZ uzavřel dlouhodobou smlouvu na dodávku uhlí pro elektrárnu Počerady se skupinou Czech Coal (“ČEZ Has Concluded a Long-Term Contract on Coal Supply for Počerady Power Plant”)

16 VUPEK-ECONOMY (2015) Dlouhodobá prognóza trhu s hnědým uhlím (“Long-term Forecast of Lignite Market Situation”)

Overall, the Czech national energy strategy foresees lignite jobs falling substantially in the coming years.[17] However, regional and federal governments, as well as local stakeholders, are preparing for this transition under the umbrella of the recently adopted *Strategic Framework for the Economic Restructuring* of the country's mining regions.

1.2 Lusatia (Lausitz), Germany

General characteristics

The Lusatian mining region is a predominantly rural area in the east of Germany running along the Polish border, and stretches across t he federal states of Saxony and Brandenburg. Its largest city is Cottbus (100,000 inhabitants). The closest urban agglomerations are Dresden (to the south), Leipzig (to the west) and Berlin (to the north).

Around one million inhabitants live in Lusatia; however, the population has already declined by 18% since 1995.[18] Eastern Germany in general is facing a negative net migration trend as well as a continuously aging population.[19] In 2012, the population density lay between 100 and 130 inhabitants per km² outside of the bigger towns such as Cottbus, Bautzen and Görlitz; this figure is substantially lower than Germany's national population density average at the time: 229 inhabitants per km².[20]

With many young people moving away and more workers commuting to areas outside of Lusatia rather than into it, a shortage of skilled labour is among the most serious issues facing the region.[21] Initiatives to attract or retain potential employees in the region (''*Rückkehrerinitiativen*'') have steadily increased in recent years. For instance, job centres and various organisations offer support and contact networks to job-seekers, helping them find opportunities for work, further education, etc.[22]

GDP per capita in Lusatia is substantially lower than the German average (€21,729 vs. €35,045 in 2013).[23] However, this is comparable to other areas in Eastern Germany, which lags behind the economic development of Western Germany as a whole. The unemployment rate is also at a similar level to Eastern Germany (7% as of October 2017), with some areas like Dahme-Spreewald significantly lower (4.5%) and others like Cottbus significantly higher (8.5%).[24] While unemployment has been falling for several years now, this trend is partly explained by parts of the working-age population moving away from Eastern Germany.

Similar to other lignite areas, but in contrast to the rest of Eastern Germany, the region has a very strong industrial orientation.[25] Lusatia is known for its lignite mining, but it is

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17 Czech Ministry of Industry and Trade (2014) Doplňující analytický materiál k návrhu aktualizace Státní energetické koncepce (''Additional analytical material on the draft State Energy Concept'')
18 ifo Institut (2017) Strukturwandel in der Lausitz – Eine wissenschaftliche Zwischenbilanz
19 rbb (2017) Abwanderung von Ost nach West auf Rekordtief; Lausitzer Rundschau (2015) Die Lausitz, die Demografie bis 2030 und das Reallabor
20 ifo Institut (2014) Industrie- und Wirtschaftsregion Lausitz: Bestandsaufnahme und Perspektiven
21 ifo Institut (2017) Strukturwandel in der Lausitz – Eine wissenschaftliche Zwischenbilanz
22 Förderverein Lausitz e.V. (2017) Rückkehrerinitiativen
23 ifo Institut (2014) Industrie- und Wirtschaftsregion Lausitz: Bestandsaufnahme und Perspektiven; Statista (2017) Deutschland: Bruttoinlandsprodukt (BIP) pro Kopf von 1991 bis 2016
24 Bundesagentur für Arbeit, October 2017
25 ifo Institut (2014) Industrie- und Wirtschaftsregion Lausitz: Bestandsaufnahme und Perspektiven

also home to chemical, food, glass, mechanics, metallurgical, plastic and textile industries.[26] Around 23 % of the region's workforce are employed in the industrial sector, which provides 30% of regional GDP.[27]

Lusatia has had difficulties attracting companies looking to invest or open offices, partly because it exhibits a low degree of specialisation in business-related services, as well as a regional economy mainly composed of small and medium-sized enterprises with comparatively low innovation capabilities.[28] However, the region has established multiple hubs of education and science in the form of the University of Görlitz/Zittau, Brandenburg University of Technology Cottbus-Senftenberg and the Berufsakademie Bautzen.[29] A variety of different business and scientific networks have also been founded to foster synergies between Lusatia's businesses and academia.[30]

Role of the lignite industry

Lusatia has 11.8 billion tonnes of geological lignite reserves of which 3.3 billion tonnes are commercially extractible.[31] In 2016, 62.3 million tonnes of lignite were extracted. 94% of the region's lignite production is used to generate power and heat (in CHPs). There are three lignite-fired power plants in the region (Jänschwalde: 3 GW; Schwarze Pumpe: 1.6 GW; Boxberg: 2.6 GW), which produced 55 TWh of electricity in 2015. They are supplied by open-cast mines in Welzow-Süd, Nochten, Jänschwalde and Reichenwalde.[32]

While mining already took place on an industrial scale in the early 20th century, it massively increased in the 1950s as lignite was the only major domestic energy source for Eastern Germany, contributing to more than 87% of the electricity generation. In 1988, almost 80,000 miners were employed in the region, producing 200 million tonnes of lignite.[33] After German reunification, a massive modernisation effort was undertaken, significantly raising productivity. However, large parts of the industry collapsed, unable to compete at the same level in a market economy system.

Since 2016, when EPH bought these plants and mines from Vattenfall, the region's coal assets have belonged to EPH-subsidiary LEAG (*Lausitz Energie Bergbau GmbH*). Nowadays, the number of people directly employed in the lignite industry is 8,278,[34] with about the same number of jobs in supplier industries. Overall, the lignite industry still provides about 3% of regional employment.[35] Wages are comparatively high, boosting regional purchasing power. Average annual wages in the energy sector in Saxony (€49,820) and Brandenburg (€47,716), most of which is made up of the lignite industry, are substantially higher than the German average.[36]

However, the region has also suffered considerable environmental degradation due to lignite mining, particularly in the communist era when environmental oversight was extremely

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26 Förderverein Lausitz e.V. (2017) Lausitzer Industriekultur; Förderverein Lausitz e.V. (2017) Standort mit Profil
27 ifo Institut (2014) Industrie- und Wirtschaftsregion Lausitz: Bestandsaufnahme und Perspektiven
28 ifo Institut (2014) Industrie- und Wirtschaftsregion Lausitz: Bestandsaufnahme und Perspektiven
29 Förderverein Lausitz e.V. (2017) Wirtschaftsstandort Lausitz
30 Förderverein Lausitz e.V. (2017) Innovative Netzwerke
31 DEBRIV (2015) Braunkohle in Deutschland 2015
32 DEBRIV (2017) Heimische Braunkohle: große Vorräte, moderne Tagebaue und Kraftwerke 2016
33 Statistik der Kohlenwirtschaft e.V. (2017) Website
34 Statistik der Kohlenwirtschaft e.V. (2017) Website
35 Lausitzer Rundschau (2017) Das wirkliche Wirtschafts-Problem der Lausitz
36 ifo Institut (2014) Industrie- und Wirtschaftsregion Lausitz: Bestandsaufnahme und Perspektiven

weak. In 1994, the LMBV (*Lausitzer und Mitteldeutsche Bergbau-Verwaltungsgesellschaft*) was founded to manage the reclamation of the many legacy mines left from the German Democratic Republic (GDR) era. Since the beginning of lignite mining, over 87,000 ha of land have been devastated in Lusatia.[37] The region has also been affected by groundwater lowering as well as air and water pollution.[38] Since 1945, between 25,000 and 30,000 citizens have had to be relocated to make way for lignite mines.[39]

Outlook

To reduce CO2 emissions, the German government negotiated a lignite reserve deal with German utilities in 2016 which will lead to the closure of 2.7 GW of lignite capacity by 2024. In 2017 and 2018, two out of six units at the Jänschwalde power plant, or close to 1 GW of capacity, will be moved into a capacity reserve and closed permanently in 2021 and 2022. This will entail a significant loss of employment already in the medium term.

Given the likelihood of further political intervention to bring down coal emissions, there is a lot of uncertainty regarding the prospects of the energy industry in the region. Environmental organisations have also raised concerns about EPH's financial structure and business practices, arguing that the financial reserves for land reclamation would not be secure should EPH's German subsidiary LEAG go bankrupt.[40]

LEAG has recently announced that it plans to shut down Jänschwalde by 2030.[41] This will require a reorientation of Brandenburg's Energy Strategy 2030,[42] which is based on the assumption that the plant will be retrofitted with CCS to run beyond 2030. LEAG has no closure plans for the Boxberg and Schwarze Pumpe plants, however. The Jänschwalde Nord mine will already be depleted by 2023, but can be supplied via a dedicated train line from other Lusatian mines for another 8-10 years. While LEAG has significantly reduced a planned extension of the Nochten II mine, a decision on the planned expansion of the Welzow-Süd mine has been postponed until 2020.[43]

The Welzow-Süd, Reichwalde and Nochten mines are not close to being depleted any time soon, though. At current production, Welzow-Süd and Reichwalde would last 26 years while Nochten would be depleted in 23 years. If the Welzow-Süd expansion is cancelled, the mine will run out of coal within 15 years instead.[44]

Regulatory initiatives to limit lignite emissions proposed at the federal level during 2015 and 2016 have fuelled debate on how to manage structural change and promote economic diversification in the region. For instance, regional business associations, together with a range of other actors including academic institutions, founded the *Innovationsregion Lausitz* in 2016 as a grassroots initiative to identify promising future development opportunities and boost the region's capacity.[45]

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37 Aktionsbündnis Zukunft Statt Braunkohle (2017) Lausitz
38 Grüne Liga (2017) Website; Brandenburgische Landeszentrale für politische Bildung (2013) Das Lausitzer Braunkohlerevier
39 Aktionsbündnis Zukunft Statt Braunkohle (2017) Lausitz; Deutschlandfunk (2015) Wie die Braunkohle die Lausitz verändert
40 Greenpeace (2017) Update: Schwarzbuch EPH
41 LEAG (2017) LEAG legt Revierkonzept für die Lausitz vor
42 The Ministry for Economic Affairs and Energy of the Federal State of Brandenburg (2017) Energiestrategie 2030
43 LEAG (2017) LEAG legt Revierkonzept für die Lausitz vor
44 Agora Energiewende (2017) Die deutsche Braunkohlenwirtschaft
45 Innovationsregion Lausitz (2017)

1.3 Rhenish lignite area (Rheinisches Revier), Germany

General characteristics

The Rhenish lignite mining area is located in North Rhine-Westphalia (NRW) in Western Germany on the border to the Netherlands and Belgium. With close to 100 million tonnes of annual lignite production and about half of German lignite capacity, it is the largest German lignite area and one of the largest in Europe. The area is home to around 2.1 million people with a slight downward trend, as a population decrease of 2.1% is expected by 2030.[46] Population outflow is much less severe than in Eastern German lignite areas, however.

North Rhine-Westphalia is heavily urbanised and one of the country's main centres of economic activity, generating over 21% of Germany's GDP. GDP per capita is at €36,509, which is slightly lower than the German average of €37,099.[47] The Rhenish lignite mining area, in turn, generates 11% of the federal state's GDP.[48]

Being Germany's largest coal state and a centre of industrial activity more generally, NRW has comparatively high greenhouse gas emissions. Per capita CO2 emissions in NRW were 14.7 t in 2014 compared to the German average of 9.1 t.[49] Moreover, the state was also responsible for 45% of national coal- and lignite-related emissions in 2014.[50]

The unemployment rate in the Rhenish lignite mining area is 7.4%, one percentage point below the federal state's rate.[51] Nearly 30% of the Rhenish lignite mining area's population is currently employed, which is lower than the federal state average of 34%.[52] While large parts of NRW were affected by the collapse of the hard coal and steel industries due to international competition after the 1960s, the Rhenish lignite area was spared the worst consequences as the lignite industry was largely unaffected by this crisis.

As a knock-on effect of the long-standing presence of hard coal and lignite power generation, many energy-intensive industries have settled in the region, such as chemical, paper and plastics, aluminium and copper production as well as processing and food industries. This industrial orientation has also contributed to the development of an extensive transport network.[53] The region is well connected to the dense web of urban agglomerations that characterise NRW, which produces economic spill-over effects.

The Rhenish lignite mining region is also home to some of the most renowned German universities, such as *RWTH Aachen*, the University of Cologne and research centres such as the *Forschungszentrum Jülich*. As the manufacturing sector, e.g. the mining, metal and electrical industries are continuously declining, the services sector is increasingly important for attracting skilled workers and thereby creating new employment opportunities.[54]

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46 Innovationsregion Rheinisches Revier, IRR (2014) Daten und Fakten
47 Statistische Ämter (2017) Volkswirtschaftliche Gesamtrechnungen der Länder
48 Innovationsregion Rheinisches Revier, IRR (2014) Daten und Fakten
49 Statista (2017) Entwicklung der Pro-Kopf-CO2-Emissionen in Deutschland in den Jahren 1990 bis 2016; Renewable Energies Agency (2017) Nordrhein-Westfalen. More recent figures for NRW are unavailable.
50 Energiestatistik-NRW (2017) CO_2-Emissionen
51 Innovationsregion Rheinisches Revier, IRR (2014) Daten und Fakten
52 Innovationsregion Rheinisches Revier, IRR (2014) Daten und Fakten
53 Maaßen & Schiffer (2016) The German lignite industry in 2015
54 Innovationsregion Rheinisches Revier, IRR (2013) Potenzialanalyse zur intelligenten Spezialisierung in der Innovationsregion Rheinisches Revier (IRR)

Role of the lignite industry

The Rhenish lignite mining area has produced coal since around 1870. It has lignite reserves of around 55 billion tonnes of which some 35 billion are commercially recoverable.[55] Currently, three large-scale open-cast mines – Garzweiler, Hambach and Inden – are in use by RWE AG and produce between 90 and 95 million tonnes of lignite per year, amounting to between 53% and 57% of Germany's annual lignite output.[56] 85% of the region's lignite output is used for power production, with the rest being used for heating or in processing plants. The share of lignite for electricity generation in North Rhine-Westphalia was 48% in 2015.[57]

The lignite industry constitutes a crucial economic sector in the Rhenish lignite area, not least because its entire value chain is located there. In 2016, some €700 million were paid to the region's lignite industry employees, contributing to regional purchasing power. Contracts awarded to supplier companies accounted for a further €800 million the same year.[58]

The lignite industry currently employs over 8,900 people in the region directly,[59] while indirect employment in supplier industries has been estimated at 7,376 (2009).[60] In the past three decades, employment in the Rhenish lignite sector has dropped by around 60% overall, but has remained stable from the early 2000s onwards. At the end of 2013, more than two-thirds of the Rhenish lignite workforce were over age 45.[61] This situation is different for employees in the supply chain and indirect employment related to the lignite cluster.

Despite having provided substantial economic benefits to the region for decades, the lignite industry has also taken its toll on both the population and the environment. The prevalence of air-borne particulate matter has substantially increased, and cases of mercury leakage have occurred as a result of the operation of the power plants, leading to 2,700 annual deaths and 1,300 new annual cases of chronic bronchitis.[62] Moreover, open-cast mines are responsible for decreases in groundwater levels as well as fundamental changes in landscape.[63] In addition, 42,000 people have had to relocate to make way for new mines since the 1950s.[64] On the other hand, the region is known as a particularly successful example of land reclamation, especially projects involving the creation of near-natural forests on former mining sites and public participation in planning the lake reclamation of the Inden mine.

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55 RWE (2012) Special Braunkohle
56 Innovationsregion Rheinisches Revier, IRR (2014) Daten und Fakten
57 Energiestatistik NRW (2017) Strom
58 Kulik (2017) Future alignment of lignite in harmony with Germany's energy transition, World of Mining – Surface & Underground Vol. 69, No. 2
59 Statistik der Kohlenwirtschaft e.V. (2017) Website
60 EEFA (2010) Bedeutung der rheinischen Braunkohle – sektorale und regionale Beschäftigungs- und Produktionseffekte
61 Greenpeace Energy & IÖW (2017) Mehrwert einer regionalen Energiewende im Lausitzer und im Rheinischen Revier
62 Die Welt (2013) Studie beziffert Schäden durch Kohlekraftwerke
63 Die Grünen NRW (2013) Unterwegs im rheinischen Revier – Unsere INFO-Tour 2013
64 Innovationsregion Rheinisches Revier, IRR (2014) Daten und Fakten

Outlook

The NRW state government took a guideline decision in 2016 reducing the prospective size of the Garzweiler II mine while confirming the approved boundaries of the Hambach and Inden mines.[65] As a result, the Garzweiler mine will only deliver 400 million tonnes of lignite instead of the originally envisaged 713 million tonnes, and the Holzweiler village will be spared resettlement.[66] The security standby reserve for lignite power plants decided by the federal government in 2016 will also lead to the closure of several of the power plants in the Rhenish lignite area.

RWE has adopted a roadmap on the basis of these decisions which foresees standby and eventual closure of the Frimmersdorf power station by 2021, as well as two 300 MW units in Niederaußem by 2022 and one 300 MW unit in Neurath by 2023.[67] The Inden mine and the connected Weisweiler power plant are planned to be shut down by 2030. The Garzweiler and Hambach mines will be closed by 2045 and 2040, when their respective permits expire. At the same time, the company is still planning a new lignite power station (BoAplus) in Niederaußem.

Significant job losses are to be expected in the medium term, but due the high number of older employees in the sector, retirement is a valid option to address this. The region itself has produced ideas to address the coming changes. The *Innovationsregion Rheinisches Revier*[68] and *Indeland*[69] are two good practice examples of planning ahead for regional structural change. The coalition treaty of NRW's CDU-FDP government elected in May 2017 proclaims similarly that lignite will remain an important cornerstone of NRW's energy strategy for the foreseeable future. A transition away from coal is seen as a reality, but not in the immediate future. Nor did the coalition present a strategy to scale up renewable energy; to the contrary, it aims to curb the expansion of wind power.[70]

1.4 Central German lignite area, Germany

General characteristics

The Central German mining area cuts across the federal states of Saxony, Saxony-Anhalt and Thuringia, encompassing the areas from Gräfenhainichen in the north to Altenburg in the south, Röblingen in the west and Leipzig in the east. It also includes a small area around Aschersleben and Nachterstedt.[71] The Central German mining area is home to just under 2.2 million inhabitants. Its population density (270 inhabitants per km²) is significantly above the German average.[72] Historically, this region was the Germany's largest lignite mining area until it was overtaken by Lusatia in the late 1960s.[73]

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65 Landesregierung Nordrhein-Westfahlen (2016) Leitentscheidung der Landesregierung von Nordrhein-Westfalen zur Zukunft des Rheinischen Braunkohlereviers / Garzweiler II

66 Agora Energiewende (2017) Die deutsche Braunkohlenwirtschaft

67 Kulik (2017) Future alignment of lignite in harmony with Germany's energy transition, World of Mining – Surface & Underground Vol. 69, No. 2

68 Innovationsregion Rheinisches Revier, IRR (2017) Website

69 Indeland (2017) Website

70 CDU & FDP (2017) Koalitionsvertrag für Nordrhein-Westfalen 2017 - 2022

71 Bund-Länder-Geschäftsstelle für die Braunkohlesanierung (2017) Website; Anke Walther (2002) Die Braunkohlelagerstätten Deutschlands: Genese, Stratigraphie und wichtige Rohstoffeigenschaften

72 HWK Halle, HWK Leipzig, IHK Halle-Dessau & IHK Leipzig (2016) Wirtschaft in Mitteldeutschland 2016; Initiativkreis Europäische Metropolregionen in Deutschland (2016) Mitteldeutschland

73 Statistik der Kohlenwirtschaft e.V. (2017) Braunkohle

Prior to reunification, Central Germany constituted one of the strongest economic regions in the GDR as the main centre of the lignite, chemical and automotive industries. After 1991, however, the region experienced an extensive industrial collapse, which led to mass unemployment and outward migration. Despite this, it was possible to establish and expand knowledge-intensive industries like optics and semiconductor technology, biotechnology and microelectronics in the region. In addition, Central Germany is now home to several successful universities and research centres.[74]

Besides its wealth of lignite resources, the region is known for its chemical industry, which constitutes both a large employer and a major source of income in the region, far surpassing the role of the lignite industry.[75] This so-called "chemical triangle" ("*Chemiedreieick*") around Halle, Merseburg and Bitterfeld has been an important factor in the region's industrial and infrastructure development.[76]

With a GDP of €68 billion in 2013, GDP per capita in the Central German region was around €30,000 in 2013.[77] Unemployment is around 10%.[78] There are numerous universities and colleges in the greater area of Central Germany.[79] Due to the high density of higher education facilities as well as a variety of research institutes (such as *Fraunhofer*, *Leibniz* and *Max-Planck*), both innovation and R&D are of great importance to the region.[80]

Role of the lignite industry

The Central German mining area has 10 billion tonnes of geological lignite reserves, of which 2 billion tonnes are commercially extractible – this is considerably less than the other two major German lignite mining areas in North Rhine-Westphalia and Lusatia.[81] Just under 18 million tonnes of lignite are extracted per year, nearly all of which are used for electricity and heat generation; the power generation capacities total 3,344 MW.[82] The main regional mine operator is MIBRAG (*Mitteldeutsche Braunkohlengesellschaft*), which was bought jointly by EPH and ČEZ in 2009 before EPH bought ČEZ's shares in 2011. MIBRAG operates the Profen and Schleenhain open-cast mines, which produce the lignite for the Deuben, Lippendorf, Schkopau and Wählitz power plants, totalling 2,900 MW.[83] The company Romonta operates the Amsdorf mine which is much smaller and produces bituminous lignite suitable for the production of montane wax.[84]

Overall, the Central German lignite area is much less dependent on the lignite industry than the other regions examined in this report. Around 2,613 people remain directly employed by the lignite industry in the Central German mining area, constituting a mere 12% of total

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74 Nolte et al. (2013) Erfolgreiche regionale Transformationsprozesse – Mögliche Zukünfte für die Region Ruhr ("Successful regional transformation processes – possible futures for the Ruhr region"); Institute for Economic Research Halle (2012) Cluster in Mitteldeutschland – Strukturen, Potenziale, Förderung, Conference Transcript, Special Issue 5/2012 ("Clusters in Central Germany – Structures, potentials, support"

75 LMBV (2017) Mitteldeutsche Industrieparks

76 Metropolregion Mitteldeutschland (2017) Chemie und Kunststoffe

77 Initiativkreis Europäische Metropolregionen in Deutschland (2016) Mitteldeutschland

78 HWK Halle, HWK Leipzig, IHK Halle-Dessau & IHK Leipzig (2016) Wirtschaft in Mitteldeutschland 2016

79 Metropolregion Mitteldeutschland (2017) Zahlen und Fakten

80 Metropolregion Mitteldeutschland (2017) Hochschulen und Forschungseinrichtungen

81 DEBRIV (2016) Daten und Fakten

82 DEBRIV (2017) Heimische Braunkohle: große Vorräte, moderne Tagebaue und Kraftwerke 2016

83 Euracoal (2017) Germany

84 Aktionsbündnis Zukunft Statt Braunkohle (2017) Mitteldeutschland; Euracoal (2017) Germany

lignite-related employment in Germany.[85] The contribution of the sector to the regional economy is significant, with around €133 million spent on salaries and €53 million in investments in 2009,[86] but far less important than other industries.

Beyond its economic significance, lignite mining has had negative impacts on the region's inhabitants and environment. 50,000 people in the area have had to be resettled to make way for mines.[87] Vast areas of land have been devastated, particularly during the GDR era, and land reclamation is still ongoing. The region has also suffered environmental degradation in the form of groundwater lowering as well as iron and sulphate pollution in rivers.[88]

Outlook

The Schkopau and Lippendorf power plants were rebuilt completely after reunification. As such, they are comparatively efficient and are unlikely to be the first plants targeted by emissions reduction efforts. The CDU-SPD-Green governing coalition of Saxony-Anhalt, elected in 2016, has already agreed on an end to energy-related lignite use when the Profen mine has been depleted, however.[89] This will be in 2032, at the current rate of extraction, and will lead to the closure of the Schkopau power plant. The Amsdorf mine operated by Romonta is set to be depleted by 2031, while the Schleenhain mine would last until 2045 at current production.[90]

MIBRAG and the state government of Saxony are currently planning to expand the Schleenhain mine as well as open a new open-cast mine in Lützen, however. This would necessitate the relocation of around 1,200 people.[91] It is doubtful whether EPH-owned MIBRAG will push to implement these plans, however, given a recent decision by the other EPH subsidiary, LEAG, to cut back on planned mining expansions in Lusatia.

Overall, the Central German lignite region has managed to reduce its dependence on lignite successfully and is well equipped to handle a coal phase-out. While losing the lignite industry will pose challenges to the region, it will be able to absorb the impact much more easily than Lusatia, for instance. In contrast to many areas in Eastern Germany, Central Germany is heavily urbanised and has benefitted considerably from spill-over effects from its industrial centres.

In addition, there are well-established regional development structures, such as the *Metropolregion Mitteldeutschland* (Central German Metropolitan Region), which hosts the project group *Innovation im Revier*, a network which promotes the economic, social and cultural development of Central Germany. The Innovation im Revier group is composed of various stakeholders such as MIBRAG, the Chamber of Commerce (IHK) in Halle-Dessau, the College of Merseburg, the planning association of Leipzig-West Saxony and various districts.[92]

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85 DEBRIV (2016) Daten und Fakten

86 EEFA (2011) Die Rolle der Braunkohlenindustrie für die Produktion und Beschäftigung in Deutschland

87 Aktionsbündnis Zukunft Statt Braunkohle (2017) Mitteldeutschland; Archiv und Wirtschaft (2010) Entstehung, Entwicklung und Bedeutung der Lausitzer und mittleldeutschen Braunkohlenindustrie im Spiegel ihrer Überlieferung im Bergarchiv Freiberg, Vol. 43, No. 1

88 German Federal State of Saxony (2017) Grundwasser im Braunkohlenbergbau

89 German Federal State of Saxony-Anhalt (2016) Koalitionsvereinbarung Sachsen-Anhalt 2016

90 Agora Energiewende (2017) Die deutsche Braunkohlenwirtschaft

91 Aktionsbündnis Zukunft Statt Braunkohle (2017) Mitteldeutschland

92 Metropolregion Mitteldeutschland (2016) Mitteldeutsche Braunkohleregion: Projektgruppe "Innovation im Revier" Gegründet

Chapter 2: Drivers of change

This chapter analyses the different political, economic and regulatory factors that will drive change in lignite mining regions in the future, and how they differ in their impacts in Germany and the Czech Republic. It also gives an impression of the timescales that transition regions will have to work with.

The identified drivers of change comprise the age of power plants, national climate policy, the European Emissions Trading System (ETS), low power prices, international fuel prices, and air pollution standards.

2.1 Introduction

While there are few in either Germany or the Czech Republic who suggest that lignite power generation and mining can continue indefinitely, there are major disagreements over the technological, financial and systemic conditions necessary to successfully decarbonise the energy sector in line with the Paris Climate Agreement and EU decarbonisation goals. The question of how quickly coal should be phased out or whether political intervention is justified or necessary to achieve this is particularly contentious. It is clear, however, that a coal phase-out will have to happen eventually, as both Germany and the Czech Republic need to decarbonise the energy sector to deliver on their commitments under the Paris Agreement and the EU's climate and energy framework.

Lignite regions also need to be aware of a range of other factors which make a continued decline of lignite more likely. Conventional energy generation as a whole is currently facing serious challenges as a result of regulatory and economic pressures. Euracoal, the European coal industry association, sums this up in its recent market report: "[t]he European coal market has continued to decline since 2012 because of low wholesale electricity prices, loss of market share to subsidised renewables and pressure from environmental regulation as well as the limited availability of public and private finances for new projects."[93]

93 Euracoal (2016) Euracoal Market Report 2/2016

It should be emphasised that lignite typically has the lowest power generation costs among fossil fuels.[94] If it was left to the market alone, lignite would likely be the last fossil fuel to disappear from the energy mix to be replaced by renewables, energy storage and demand-side flexibility mechanisms. But lignite is a prime target for regulation as it has the highest external costs among fossil fuels.[95]

As a result, market actors and project developers are moving decisively away from coal for electricity generation. In 2010, power companies and investors in the EU were still planning for a considerable expansion of coal power. Yet about 90 GW of proposed coal power plants in the EU-28 have been cancelled or shelved since then.[96] 27.3 GW are still in various stages of development, but few of these projects are likely to be completed. Eurelectric's recent pledge that no new coal power plants beyond the existing pipeline will be built in the EU after 2020 confirms this reality.[97]

If the lignite industry is in trouble, this has obvious and far-reaching implications for lignite mining regions. Therefore, it is crucial to think ahead and prepare the conditions that will enable such regions to transition away from coal in an economically viable and socially fair manner. Even in the absence of a concrete phase-out plan, the ongoing decline of the lignite industry makes it essential to support these regions while diversifying their economic base.

2.2 Age of plants and lack of investor interest

Significant parts of the lignite power plant fleets in both countries are already very old. As older plants are generally less efficient and have higher maintenance costs and equipment depreciation, they are facing increasing pressure to shut down. The low likelihood of new power plants, in combination with tighter air quality standards that will require expensive retrofits, suggest that a "natural" phase-out is already underway. On its own, lignite power generation is not declining quickly enough to meet climate targets, however. This makes legislative action to accelerate the trend likely. The resulting uncertainty has contributed to investors' unwillingness to finance new coal capacity.

German lignite plants are 33 years old on average and 14% of this capacity is over 45 years old already. The Czech lignite fleet is significantly older, with an average age of 38 years and 30% of plants older than 45 years. For comparison, the average lifespan of lignite power plants is 55 years in Germany.[98] In Germany, most of these older plants are situated in the Rhenish lignite mining area, while they are concentrated in the Ústí and Karlovy Vary regions in the Czech Republic, suggesting that age-related closures will affect these areas first.

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94 Fraunhofer ISE (2013) Stromgestehungskosten Erneuerbare Energien

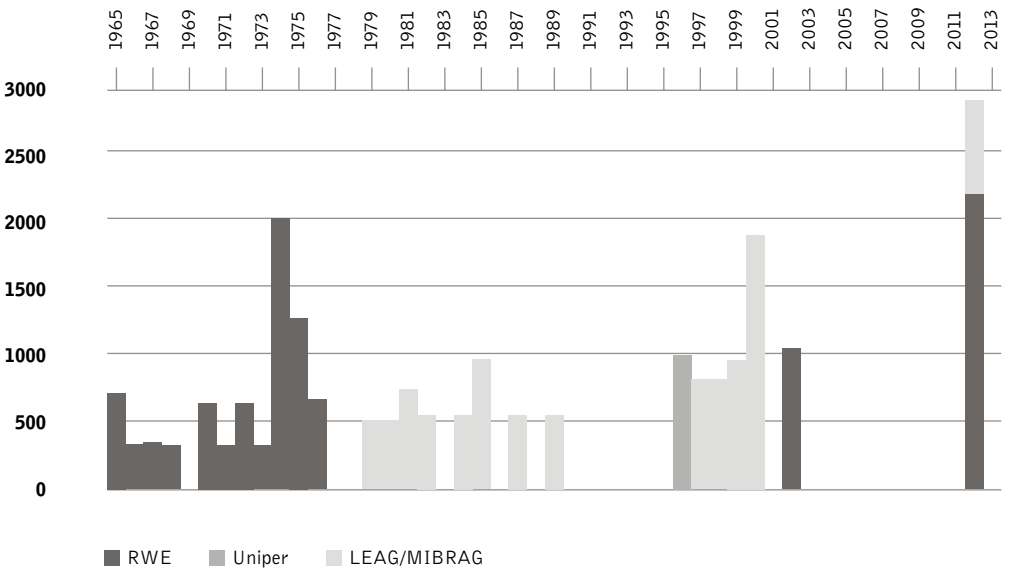
95 IRENA/REmap (2016) The True costs of Fossil Fuels: Saving on the Externalities of Air Pollution and Climate Change

96 Global Coal Plant Tracker (2016) Proposed Coal Plants by Region

97 The Guardian (2017) The end of coal: EU energy companies pledge no new plants from 2020

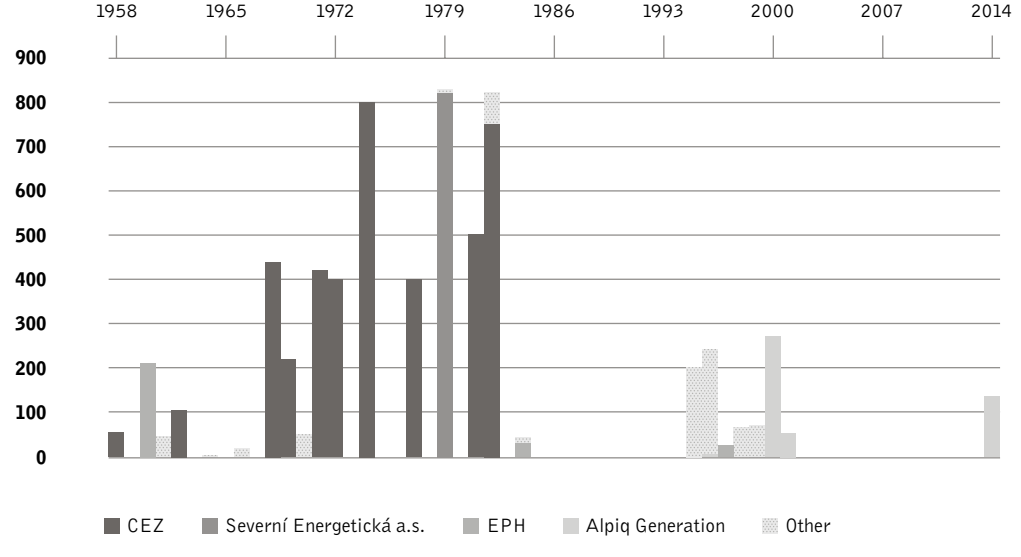
98 Green Budget Germany (2015) Entwicklung von Stein- und Braunkohlekapazitäten im deutschen Kraftwerkspark

Figure 2: German lignite capacity by year of commissioning (power and CHP only)



Source: Europe Beyond Coal database

Figure 3: Czech lignite capacity by year of commissioning (power and CHP only)



Source: Europe Beyond Coal database

A number of lignite power plants in both countries are already subject to closure plans. ČEZ's current strategy is to close 3000 MW of the existing 4600 MW coal capacity by 2035. Only the Ledvice, Prunerov, Tusimice and Melnik plants are envisaged to remain operational beyond 2035.[99] The Czech national energy strategy expects the number of mining jobs to fall by 50% between 2015 and 2035, from 20,000 to 10,000. The number of coal plant employees is expected to fall from 5,000 in 2015 to 2,000 by 2035.[100]

In Germany, two units of the Jänschwalde plant, as well as the Buschhaus plant and two units at both Niederaußem and Grevenbroich will be shut down by 2023 as part of an agreement to move 2.7 GW of German lignite capacity into a capacity reserve. The primary motivation for this deal was to reduce CO2 emissions from lignite. This alone will result in the loss of several hundred lignite jobs. Before closing down, the plants will spend four years in the reserve, where they will only be reactivated in supply emergencies.

As keeping a power plant in reserve requires much less staff than operating it for regular power production, job losses will start accumulating well before these plants are closed down for good. MIBRAG, for instance, has recently stated that moving the Buschhaus power plant, located in the Helmstedt lignite area, into the reserve will result in the loss of 320 jobs.[101] This represents more than half the current employment in the plant and the connected mine.

2.3 National climate and energy policy measures

Climate policy, including the promotion of renewables, is putting the lignite industry under increasing pressure, as lignite is the most carbon-intensive fossil fuel available. Lignite plants emit around 1 tonne of CO2 per MWh of electricity generated, compared to specific emissions of 0.64 tonnes of CO2 per MWh for natural gas.[102] Lignite alone is responsible for 18% of carbon emissions in Germany and 27% in the Czech Republic.[103]

Even though not many lignite power plants have closed yet because of climate policy in the two countries, profit margins have shrunk considerably compared to only a few years ago. The long-term decarbonisation objectives that both countries have agreed to under the EU's 2030 climate and energy targets as well as the Paris Agreement will require significant additional efforts to cut CO2 emissions. It is likely that the energy sector, which accounts for most emissions in both countries (see Figures 4 and 5), will be required under regulation to deliver proportionally higher cuts than other sectors. Lignite, with its high specific emissions, would be an obvious starting point for lawmakers seeking to reduce carbon emissions.

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99 Hospodářské noviny (2017) ČEZ plánuje v Česku odstavit více než polovinu kapacity uhelných zdrojů. V provozu zůstanou jen nové elektrárny ("ČEZ plans to shut down more than half of the capacity of coal resources in the Czech Republic. Only new power plants will remain in operation")

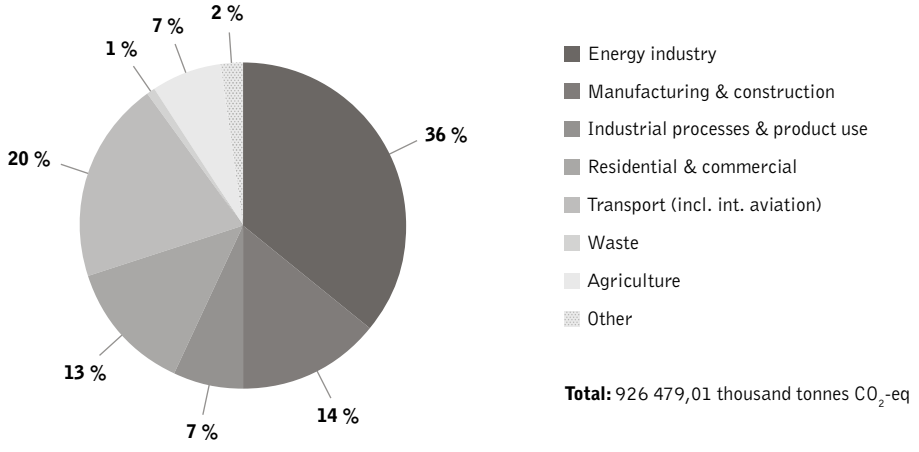
100 Czech Ministry of Industry and Trade (2014) Doplňující analytický materiál k návrhu aktualizace Státní energetické koncepce ("Additional analytical material on the draft State Energy Concept")

101 MIBRAG (2016) Beginn der Sicherheitsbereitschaft im Helmstedter Revier

102 German Bundestag (2007) CO_2-Bilanzen verschiedener Energieträger im Vergleich

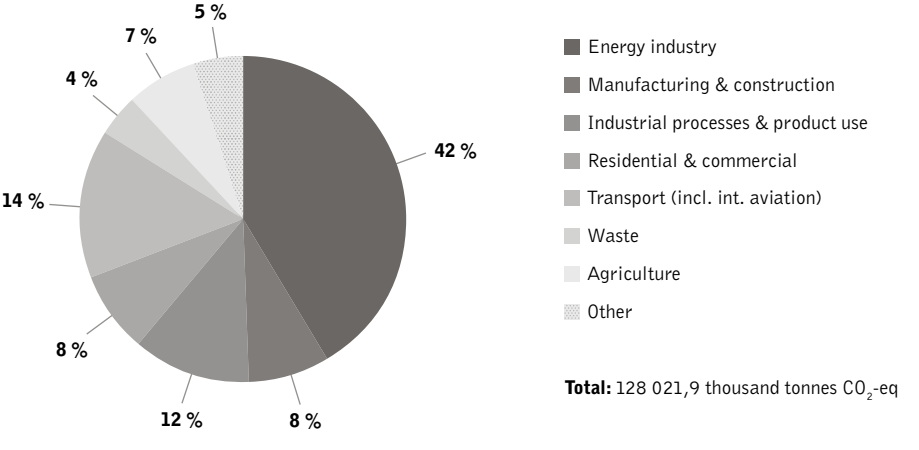
103 EUTL data for 2015

Figure 4: German CO2 emissions by sectors (2016)



Source: Eurostat

Figure 5: Czech CO2 emissions by sectors (2016)



Source: Eurostat

Until a few years ago, Carbon Capture and Storage (CCS) was still seen as an option to decarbonise fossil fuel power plants – and coal in particular. In Germany, the technology seemed poised to be developed at scale, with RWE, Vattenfall and E.ON all pursuing demonstration projects. In Lusatia, regional universities and Vattenfall invested heavily into this technology, building a demonstration unit at the Schwarze Pumpe industrial park which was operated for five years. However, the technology was never brought to industrial scale, as CCS-retrofits planned by RWE (Hürth) and Vattenfall (Jänschwalde) were cancelled in 2010 and 2011, respectively.

The background to these decisions was a heated political debate, with protests against CCS in several German *Länder* (federal states) with large underground storage capacity, such as Schleswig-Holstein. In 2012, a new CCS law authorised regional governments to ban CO2 storage on their territory. Utilities, in turn, argued that this was causing an unacceptable degree of uncertainty. At the same time, the surplus of allowances (EUAs) from the EU Emissions Trading System (ETS) led to a collapse of the carbon price, which made it much cheaper for utilities to buy allowances than to invest in CCS. Today, CCS no longer provides a realistic solution for the Czech or German power sector, as it raises power generation costs by between 37 and 94%.[104]

While the Czech Republic launched a CCS cooperative project with Norway in 2015, including a €5 million grant by Norway to develop the technology, its application in lignite power plants does not look promising. This cooperation encompasses an assessment of geological CO2 storage capacity as well as feasibility studies for CCS in coal-fired power plants.[105] However, a demonstration unit is only being constructed at the Vresova gas power plant, where the technology is judged to be more likely to be economical.[106] The greatest hurdle to implementation at scale is the loss of efficiency, estimated at 10.7% for a typical Czech lignite unit, which would substantially increase power generation costs.[107]

It is clear that long-term lignite combustion at current levels will be incompatible with the EU's plans to cut greenhouse gas (GHG) emissions by the envisaged 80 to 95% by 2050 (based on 1990 levels). Lignite-related emissions are already declining at a rate of 2.3% per year (2005-2014 average). However, the International Energy Agency (IEA) energy mix scenario compatible with the 2oC limit states that European coal power emissions must fall from 940 mt in 2012 to 90 mt by 2040, which means emissions must decrease by 8% per year on average from 2012 to 2040.[108] In other words, lignite emissions would have to fall by more than three times the current rate to be in line with a global warming scenario of 2°C above pre-industrial levels, and much more quickly to be in line with the 1.5°C target.

Germany is currently set to miss its 2020 climate target of -40% emissions (on a 1990 basis) by up to 10 percentage points.[109] Drastic additional measures will have to be taken to bring emissions in line with the country's climate targets.[110] This also follows from the federal government's Climate Action Plan, which was adopted at the end of 2016 and sets an energy

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104 Global CCS Institute (2015) Levelised Costs of Electricity with CCS
105 Bellona (2015) Norway and Czech Republic establish cooperation on CCS
106 SINTEF (2015) EEA project: We are cooperating to promote implementation of CCS in the Czech Republic
107 The Holistic Approach to Environment (2013) CCS Technology Issues in Conditions in the Czech Republic, Vol. 4 No. 2
108 IEA (2016) World Energy Outlook
109 Agora Energiewende (2017) Das Klimaschutzziel von -40 Prozent bis 2020: Wo landen wir ohne weitere Maßnahmen?
110 IZES (2016) Reichen die beschlossenen Maßnahmen der Bundesregierung aus, um die Klimaschutzlücke 2020 zu schließen?

sector emissions limit of 175-183 mt CO2 in 2030.[111] Although these figures are not yet legally binding (as of December 2017), they stand in stark contrast to the federal government's official projections that envisage 18-25% higher emissions from the energy sector if policies do not change (see Table 2).[112]

Table 2: German 2030 sector targets vs. official projections

	2030 sector target (MT CO_2-eq)	Official projection for 2030* (MT CO_2-eq)	Difference to target
Energy	175–183	217,1	+ 18–25%
Transport	95–98	123,3	+ 26–30%
Industry	140–143	144,9	+ 0,04%
Agriculture	58–61	68,3	+ 18%

Sources: German Federal Government Projections, Climate Action Plan 2050

* "With additional measures"-scenario

Many actors expect the new government to take additional regulatory measures to reduce coal and lignite power generation in Germany, regardless of the current political impasse. This was already the rationale behind a failed proposal in 2015 for a "climate levy" for the coal sector and the introduction of the lignite reserve, which marks the first time the German government has ever adopted legislation specifically to reduce CO2 emissions from lignite.[113] Before coalition talks between the CDU, CSU, FDP and Green party collapsed, the prospective coalition partners had already reached agreement on a coal phase-out in line with 2030 climate targets. This would have taken the form of a budgetary approach to coal-fired power plants, similar to the first nuclear phase-out agreement in 2000.

There is a widespread perception that in the affected communities, however, that they will have to make a disproportionate contribution to the national decarbonisation effort; it is believed that the government is pursuing this course of action because it is "the path of least political cost", as the impact is regionally concentrated and only affects relatively few voters and companies. For this very reason, it is essential to make the debate on the future of lignite mining regions as inclusive and transparent as possible.

No similar action has been taken in the Czech Republic, where the debate revolves more around mining limits and creating economic alternatives in lignite regions than reducing emissions per se. However, it is conceivable that future climate policies, possibly triggered by the EU climate and energy framework, could have an impact on the fate of Czech lignite mining regions as well.

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111 German Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (2016) Klimaschutzplan 2050

112 German Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (2016) Projektionsbericht der Bundesregierung 2015 compared to "mit-weiteren Maßnahmen" scenario

113 Clean Energy Wire (2016) Climate levy – the debate and proposals for cutting CO2 emissions

The Paris Agreement stipulates a review of emissions reduction targets in 2018, with a view to "ratcheting up" – i.e. increasing without the option of falling back – ambition. While the EU framework does not yet reflect the Paris Agreement, a similar ratcheting mechanism will have to be adopted in the Energy Union governance mechanism. The political momentum created by this review cycle will put additional pressure on both countries to cut lignite use in order to reduce carbon emissions.

2.4 EU Emissions Trading System (ETS)

Due to its high emissions intensity, lignite power generation is impacted more heavily by the EU ETS than any other fossil fuel. Lignite tends to emit around 0.98-1.23 tonnes of CO2 per MWh of electricity produced,[114] which means that 98-123% of the carbon price is added to the generation costs per MWh. For natural gas, it is only 64%.

However, the high overall limit of allowances, other emissions-reducing policies as well as the economic downturn following the Euro crisis in 2008 have resulted in an ETS price which is much lower than initial predictions. EUAs currently trade at around €7.60 per tonne of CO2, which is far below expectations.[115] Forecasts on average envisage a carbon price of only €14.70/tonne by 2020.[116] Thus, the ETS does not yet constitute an immediate threat to the economic viability of lignite, and at the same time does not deliver emissions reductions in the power sector that are compatible with the Paris Agreement.

The situation is different in the Czech Republic, where the power sector still enjoys free allocation of certificates due to a derogation granted to some new Member States.[117] For the 2013-2020 period, for example, ČEZ received 72% of the free certificates allocated to the Czech Republic, which is not surprising since it owns the vast majority of the country's power plants.[118] In Germany, as in the rest of the EU, free allocation for the power sector ended with the last trading period in 2013. In the period after 2020, the impact of the ETS on lignite will depend crucially on the outcome of the ETS reform process.

2.5 Low power prices

Wholesale power prices have fallen by 47% between 2012 and 2016.[119] This has compressed profit margins to the point of becoming uneconomical for some lignite power plants. Back in 2013, the CEO of RWE Generation said in an interview that their 300 MW lignite units, which tend to be older and have comparatively low efficiencies, had "massive difficulties to earn their full costs".[120] At that time, baseload electricity still sold at €38/MWh.[121] After several years of power prices between €20 and €30, baseload year futures have recently risen to around

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114 German Bundestag (2007) CO2-Bilanzen verschiedener Energieträger im Vergleich
115 EEX (2017) Website, price on 30 November 2017
116 Reuters (2017) Analysts trim EU carbon price forecasts as supply swells
117 European Commission (2017) Transitional free allocation to electricity generators
118 Climate Observer (2012) Czech Republic approves free allocation plan
119 EEX (2017) Website
120 Ingenieur (2013) Unrentabel: RWE überprüft jedes Kraftwerk; RWE owns 11 such units, all of which are located in the region of North Rhine-Westphalia (NRW) and were built in the 1960 and 1970s.
121 Power prices discussed in this and the following paragraph relate to baseload year futures on the EEX and PXE power exchanges.

€37/MWh in both the Czech Republic and Germany, but it is unclear if this indicates a general trend.[122] In Germany, fossil fuels have been finding it increasingly difficult to compete with renewable energy, which is operating at near-zero marginal cost.

In addition, lignite power plants remain comparatively inflexible despite remarkable technological improvements in day-to-day flexibility. While a state-of-the-art lignite unit like Boxberg R manages a ramp rate of 6% and a hot start-up time of 1.25 hours, older units typically have ramp rates of 1-2% and a hot start-up time of 4-6 hours. For comparison, state-of-the-art open-cycle gas turbines have average ramp rates of 10-15% and start-up times of 5-11 minutes, regardless of whether hot or cold.[123]

Due to market coupling in the EU, other markets are also affected by the imbalance in the German power market, independently of their own national energy policies. This situation has thus led to tensions with neighbouring countries like the Czech Republic, as the oversupply of cheap electricity from Germany has also contributed to pushing down power prices there. Since Czech power prices are strongly correlated with German prices, this has resulted in lowering the margin on generation from lignite. As in Germany, however, lignite remains in the merit order[124], which is why this has not severely affected load factors of lignite yet. While ČEZ's generation from Czech lignite plants was 32.5 TWh in 2011, this only fell slightly to 28 TWh in 2016.[125]

While the expansion of renewable energy and the resulting overcapacity on power markets in both countries is an important part of the story, it is not the sole factor driving the fall in power prices. Shifts in prices for gas and hard coal also affect electricity prices, as does the trend towards reduced electricity consumption. Moreover, initial carbon price expectations were much higher than actual prices, and this was priced into the products traded on the electricity exchange. A study quantifying the contribution of these different factors to the collapse of German power prices has found that CO2 price expectations (52%) had by far the largest impact, followed by power savings (16%), the expansion of renewable energy (11%) and fuel price shifts (10%).[126] Other studies have reached very similar conclusions.[127]

It should be pointed out, though, that the current low-price environment and the challenges it poses to operators of lignite power plants are not set in stone. Many analysts expect that German power prices might rise again when the nuclear phase-out is completed in 2022, thereby reducing overcapacity. A possible introduction of a capacity market would further boost power price and revenue expectations. On the assumption that Czech power prices will remain correlated with German prices, the same trend would occur in the Czech Republic. The future effect of sector coupling, i.e. the increasing electrification of the heating and transport sectors, should also be considered. Particularly if e-vehicles reach a high market penetration, this would lead to rising power demand overall, which would in turn drive up power prices again.[128]

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122 PXE (2017) F PXE CZ BL M06-17, prices on 6 May 2017

123 Agora (2017) Flexibility in thermal power plants, Table 1

124 "Merit order" refers to an order, in which the power plants within an electricity market are arranged, according to the marginal costs of the power generation.

125 ČEZ Group (2012) Annual Report; ČEZ Group (2016) Annual Report

126 Phasenprüfer (2015) Jenseits des Sündenbocks Erneuerbare: Was hat den Verfall des Börsenstrompreises wirklich verursacht?

127 Andres Bublitz, Dogan Keles & Wolf Fichtner (2017) An analysis of the decline of electricity spot prices in Europe: Who is to blame?

128 WWF (2017) Zukunft Stromsystem: Kohleausstieg 2035

2.6 (International) Fuel prices

Lignite is typically not traded on world markets. Transporting it over long distances tends not to be cost-effective due to its low energy and high water content. As a result, lignite power plants and mines usually operate as one vertically integrated economic unit, with dedicated infrastructure such as conveyor belts or train lines transporting the mined fuel directly to the power plant for combustion. Alternative fuel sources are not easily available, which grants lignite some degree of protection against international competition and fuel price volatility. The situation of lignite is therefore very different from that faced by European hard coal mines, which are close to disappearing completely due to competition from low-cost producers in developing countries.[129]

In Germany, virtually all lignite mines are vertically integrated, meaning that the power plants and mines belong to the same company or a subsidiary. Lignite sales are handled in-house, which keeps the price low. In the Czech Republic, by contrast, ČEZ only owns two out of six lignite mines in the country (Bílina, Nástup Tušimice), despite owning the vast majority of lignite capacity. While 68% of its lignite supply is provided by its subsidiary, Severočeské doly, ČEZ faces significantly higher fuel costs operating power plants not supplied by its own mines. As ČEZ needs money to modernise and retrofit the lignite plants that it plans to operate in the near future, it is currently trying to sell plants that are supplied by mines owned by other companies such as Czech Coal or EPH. The recent attempt to sell the Počerady plant to Czech Coal is one such example, although Czech Coal's offer was rejected at the last minute by ČEZ's supervisory board.[130]

Producing electricity by burning lignite tends to be cheaper than natural gas- or hard-coal-based power production, placing lignite first among fossil fuels in the merit order.[131] However, as lignite power directly competes with hard coal and natural gas in electricity markets, some of the less economical lignite plants run the risk of being displaced by natural gas or hard coal plants if prices for these fuels fall low enough. This risk is much greater in scenarios with a high carbon price.

Gas prices have been on a downward trend since the massive development of shale gas production in North America and the increased volatility of regional gas markets through heavy investment in infrastructure for liquefied natural gas (LNG); they have fallen by 45% compared to 2013 following a collapse in international LNG prices.[132] This trend is likely to continue for some years, as the LNG market is structurally oversupplied for the foreseeable future while the cost of developing gas is falling.[133]

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129 Moreover, subsidies for uncompetitive hard coal in Germany as well as the entire EU will terminate in 2018. E3G (2015) G7 Coal Phase Out: Germany; ODI (2017) Cutting Europe's lifelines to coal

130 Reuters (2017) UPDATE 2-CEZ supervisory board rejects Czech Coal's offer for Pocerady plant

131 RWE (2015) Merit Order Stromerzeugung und –nutzung (conference presentation)

132 EEX (2017) Natural Gas Daily Reference Price, prices on 4 May

133 Fuel Fix (2015) LNG oversupply likely to burden spot prices

Hard coal prices had been falling since the beginning of 2012, but have recently rebounded sharply, increasing by 29% between October 2016 and 2017.[134] This price rally is overwhelmingly due to China reducing coal production as it attempts to restructure its industry and cut CO2 and pollutant emissions.[135] Market observers expect the trend to continue as China shows no signs of reversing its decision to cut coal use despite the United States' decision to pull out of the Paris Agreement.[136]

As a result of these price trends, natural gas has increasingly been replacing coal in the European power mix.[137] Between 2014 and 2016, power generation from natural gas increased by 29%, while coal fell by 13%.[138] Germany and the Netherlands experienced a temporary switch from hard coal to natural gas in the autumn of 2016 as gas became cheaper than hard coal.[139]

Lignite has not been strongly affected by these price shifts yet. Only 17% of the drop in coal power production observed last year came from lignite, and that was mostly due to plant closures rather than fuel switching.[140] If gas prices keep falling and ETS reform produces higher carbon prices in the post-2020 trading period, however, this could severely curtail the load factors of lignite, decreasing power generation revenues relative to the fixed costs.

2.7 Air pollution standards

The EU Industrial Emissions Directive (IED), which sets limits on how much pollution a power plant is allowed to emit, will also impose additional costs on lignite power plants in the coming years.[141] A new reference document for best available technologies, LCP BREF,[142] was adopted though a comitology vote on 28 April 2017, mandating new threshold values for nitrogen oxide (NO_x), sulphur dioxide (SO2) as well as dust particle emissions. Mercury emissions will also be subjected to dedicated limits and continuous monitoring requirements for the first time.[143] As the new standards have to be implemented with a maximum delay of four years, power producers must comply with the new limits by July 2021 at the latest. These limits will require many lignite power plants across the EU to invest in pollution abatement equipment in order to retain their operating permits.

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134 Hard coal import prices. See Federal Statistical Office (2017) Data on energy price trends - Long-time series from January 2000 to August 2017

135 Mining.com (2016) CHART: No stopping insane coal price rally

136 S&P Global Platts (2016) Global hard coking coal prices to rise, sharper adjustment in Q3: Wood Mac

137 Other factors contributing to this are coal power plant closures and the new Emissions Performance Standard in the UK, as well as widespread nuclear outages in France towards the end of 2016.

138 Agora Energiewende & Sandbag (2017) Energy Transition in the Power Sector in Europe: State of Affairs in 2016, p. 19ff

139 Ibid.

140 Ibid.

141 EUR-Lex (2017) Directive 2010/75/EU on industrial emissions

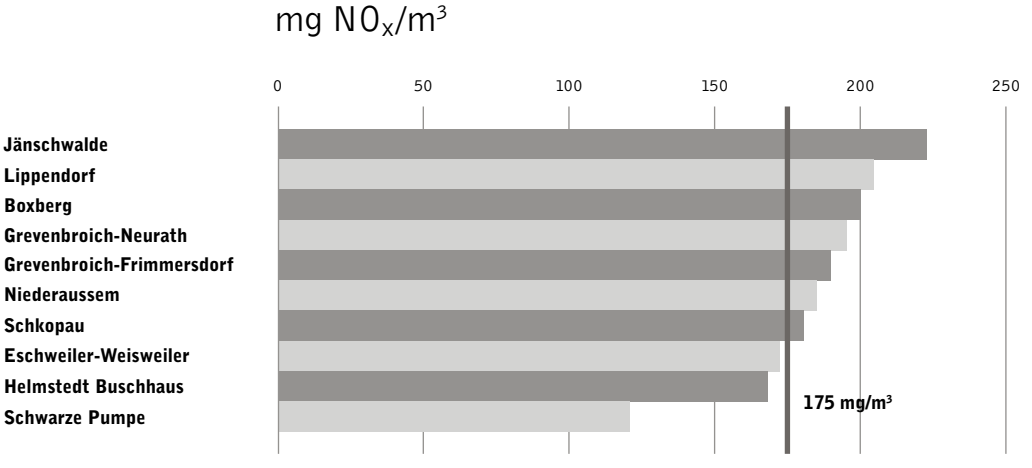
142 European Commission (2016) Best Available Techniques (BAT) Reference Document for Large Combustion Plants

143 Environment Minister Barbara Hendricks has already announced that Germany is prepared to go for even stricter mercury limits than prescribed by the IED when it comes to the implementation.

NO_x abatement will be particularly costly, as the new threshold value of 175 mg NOx per m3 will often require selective catalytic reduction (SCR) to be installed. This can cost tens of millions of Euros. To illustrate this, in 2013, Vattenfall conducted a cost assessment estimating that an SCR-retrofit for the Boxberg power plant in Lusatia would cost at least €46.9 million in capital expenditure and €4 million in yearly operating expenses. At the Schwarze Pumpe power plant, installing SCR would cost at least €82 million upfront and €14.2 million in operational costs per year.[144]

As Figures 6 and 7 show, the impact of the new pollution limits will be significantly more severe on lignite power plants in the Czech Republic than in Germany. While only a handful of German power plants might have difficulties meeting the new values, large plants of the Czech power fleet will be affected. Particularly for older plants it will often simply be more economical to shut down the plant than to retrofit it.

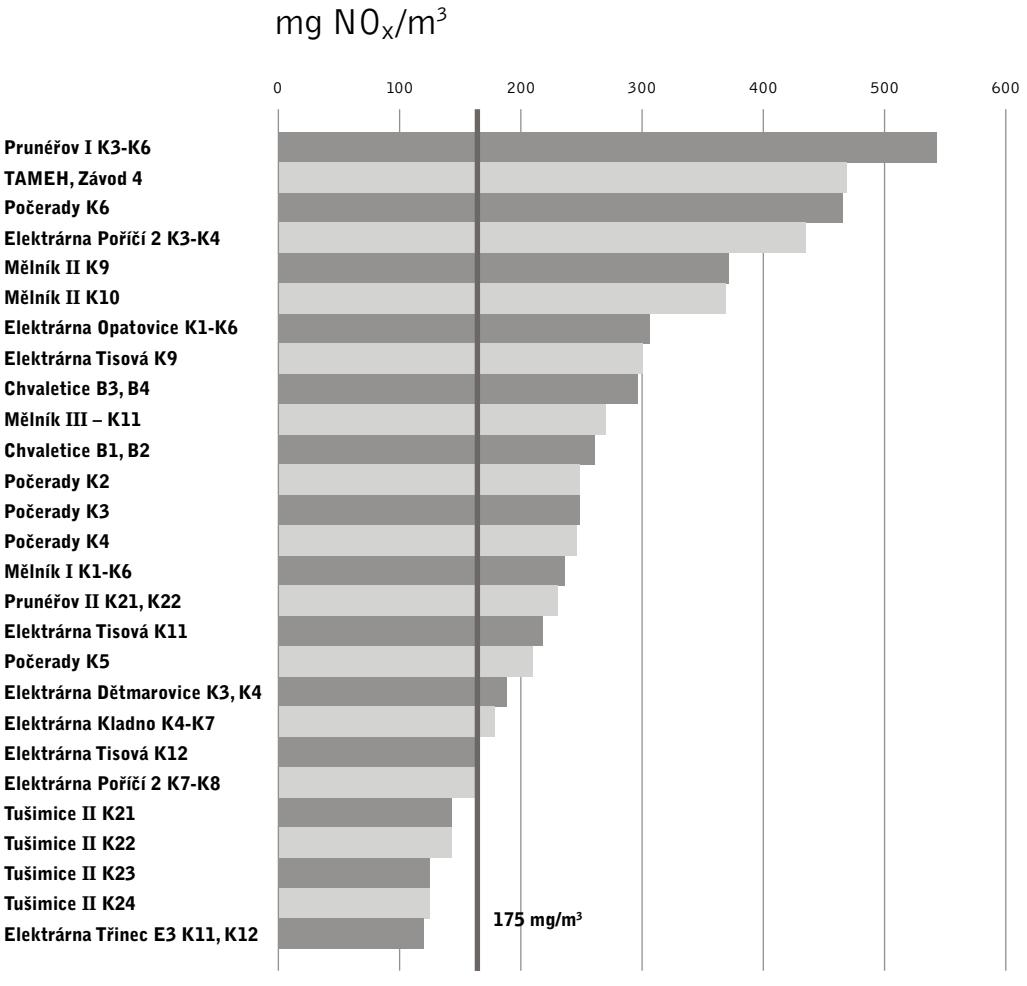
Figure 6: NOx release rate of German power plants (2016)



Source: E-PRTR

144 Vattenfall (2013) Transposition of the IED into German law - NOx ELV 100 mg/m³ for existing combustion plants

Figure 7: NOx release of Czech power plant units connected by a common stack (>300 MW)[145]



Source: Czech Ministry of Industry and Trade

145 Compliance with EU air pollution thresholds is assessed as pollutant release rate at the level of a common stack, which is why these data more accurately reflect the real emissions for BREF purposes than E-PRTR data.

Chapter 3: Key challenges and best practices

This chapter is dedicated to the practical challenges of structural change in lignite regions. It follows the discussions in the Czech-German expert group, highlighting specific issues and examples, rather than attempting to cover the subject comprehensively. It shows that energy and climate policy in both countries do not provide reliable guidelines for decisions on the future of lignite regions, as many issues around phasing out coal remain unresolved (3.1). The chapter further discusses good practices in regional economic revitalisation and diversification (3.2), especially with regard to public infrastructure financing, targeted support for local bottom-up initiatives as well as their limits, public participation and the opportunity to create cultural heritage sites. It goes on to explore the role of political intervention in the German energy transition and the development of lignite regions (3.2.2) as well as the use of EU funds in the Czech Republic, as these are among the most important sources of public investment for lignite regions. Section 3.3 addresses challenges and good practices in land reclamation as well as its financing.

3.1 Direction of travel: uncertain

The political debate on the future of coal and lignite in both Germany and the Czech Republic has been characterised by uncertainty for a number of years. In Germany, the long-term necessity of a coal phase-out is generally accepted. However, there remains considerable uncertainty over the timeline of ending coal production and combustion as well as on whether political intervention is needed to ensure compliance with the country's commitments under the Paris Agreement. A contentious public debate about this process was kicked off in Germany in 2015 when the Federal Ministry for Economic Affairs and Energy proposed a "climate levy" that would have fined older coal power plants for breaching a certain CO2 emissions threshold. The measure was proposed to ensure that Germany could meet its 2020 climate target (40% below 1990 levels) and to implement a government decision to deliver additional emissions savings reached with the adoption of the Climate Action Plan 2020 (*Aktionsprogramm Klimaschutz*) in December 2014. The climate levy would have required coal power plants to purchase additional ETS emissions certificates to keep generating power after surpassing a yearly emissions threshold, determined according to the age of the plant.[146]

146 German Federal Ministry for Economic Affairs and Energy (2015) Der nationale Klimaschutzbeitrag der deutschen Stromerzeugung Ergebnisse der Task Force „CO2-Minderung", see pp. 5 and 11 for the reasoning behind the policy design

The climate levy would have caused the early closure of several lignite power plants as well, leading to immediate job losses in lignite mining areas. At the time, RWE and the power sector union IG BCE predicted a domino effect that would take out the entire German lignite industry and affect other economic sectors as well.[147] Thus, against the background of a severe backlash from regional governments and trade unions which had not been consulted before the proposal was tabled, the government decided to replace its earlier proposal with a negotiated solution.

The deal subsequently agreed with utilities stipulates that 2.7 GW of coal power plants would be shut down and remain in a reserve state for four years, and would only be activated in case of supply shortages on 10 days' notice.[148] The utilities would be paid €1.6 billion as compensation for foregone revenue. In practice, this means that the plants will not run except in an improbable emergency situation in which Germany's considerable overcapacities would be unable to meet demand.

Germany is currently set to miss its overall emissions reduction target for 2020 largely because no pathway for a transition to reduced emissions was developed during a period of economic growth and an increase in population. In addition, there has been near complete inaction on emissions in the transport and agriculture sectors.[149] Significant additional reduction efforts will be needed to meet the -40% goal, but it is unclear how this burden will be shared, and when and how different sectors and regions will be affected. Utilities and politicians from lignite regions often argue that the emissions reduction burden should be distributed more evenly, away from the energy sector onto other sectors of the economy (in particular transport and heating) to ease the transition to a zero-emissions energy system.

Indeed, the energy sector has already contributed considerable emissions reductions, while transport emissions, for instance, are still rising. According to official projections, lignite emissions will have decreased by 48.5% between 1990 and 2020, whereas transport sector emissions will have increased by 5.8%.[150] However, as the energy sector remains the largest emitter by far (see Figure 4 and Table 2), it is difficult to imagine that it will be spared additional measures in the coming years.

The federal government's Climate Action Plan 2050 gives some indications on possible sectoral measures,[151] but these still have to be adopted by legislative bodies. The plan was also at the centre of heated political debates and was almost dropped entirely just before the COP22 climate summit in Marrakesh had it not been for the public embarrassment this would have caused. While the plan initially mentioned a "Coal Phase-out Commission", this idea was abandoned in favour of a future "Commission on Growth, Structural Change and Regional Economy" which is supposed to develop instruments to support structural change in regions negatively affected by the energy transition. A decision on the future of coal will therefore have to be taken soon.

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147 IG BCE (2015) Studie bestätigt Sorge um Arbeitsplätze in der Braunkohle

148 De Jure (2017) Energiewirtschaftsgesetz - § 13g Stilllegung von Braunkohlekraftwerken

149 Agora Energiewende (2017) Das Klimaschutzziel von -40 Prozent bis 2020: Wo landen wir ohne weitere Maßnahmen?

150 German Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (2017) Projektionsbericht 2017 für Deutschland; these are business-as-usual projections and do not include additional measures needed to reach the climate targets.

151 German Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (2016) Klimaschutzplan 2050

In the Czech Republic, there is no comparable public debate on phasing out coal – whether for climate-related or other reasons. However, there is a general understanding that further coal power plant closures are inevitable due to declining coal reserves and mining output, air pollution limits and other factors. There is little to no explicit debate about how to manage the transition to a climate-friendly energy system or what the social, economic and environmental costs of continuing on the current path actually are. The Czech State Energy Policy (SEP) from 2015 only describes some desired ranges of future coal energy production and envisages that between 11 and 21% of electricity generation will come from coal in 2040, most of which would be lignite. The corridor for nuclear is similarly wide.[152] However, 11 and 21% of coal in the power mix imply substantially different power systems as well as completely different framework conditions and coal reduction timelines for lignite regions.

When it comes to the debate on extending the territorial limits to lignite mining in the Czech Republic from 1991, the last few years have been characterised by a lot of controversy.[153] This measure was agreed upon after the end of the communist regime in Czechoslovakia, as environmental activism against air pollution from mining and industry had been a contributing factor to the 1989 Velvet Revolution. The question of whether to extend these limits or not has been hotly debated in recent years. Recently, the national government again discussed whether to extend these limits for two mines which have already reached the current limits. After a major public debate involving the media and the political establishment, accompanied by a significant mobilisation of civil society actors, the limits for the ČSA mine were left in place, leading to its closure. At the same time, the limits for the Bílina mine were extended in 2008 and again in 2015. Limits for other mines allow for lignite production to continue until well into the 2050s. While the debate has calmed down for now, it is likely to resurge once the next mine faces closure, as some actors are still calling for the abolition of the limits.[154] Czech environmental organisations keep stressing that the limits must remain in place and demand the implementation of the 1991 decision to formally write off coal reserves beyond those limits.

Mining limits in Germany are set based on lignite planning processes for the operational life of a mine, but the plans can be changed to accommodate new realities. There are no absolute limits set in law, as in the Czech Republic. Recent decisions by utilities and regional governments have greatly reduced planned mining extensions. In 2016, the government of the German federal state of North Rhine-Westphalia mandated that the planned Garzweiler II mine be significantly reduced.[155] In the spring of 2017, LEAG in the Lusatia mining region cancelled plans to expand the Jänschwalde Nord lignite mine and greatly reduced expansion plans for the Nochten II mine. The company has postponed a decision on the Welzow II mine until 2020.[156] This already reduces the uncertainty of local residents to some extent. Some 2,400 people in Lusatia[157] and up to 1,500 in the Rhineland mining area will be spared resettlement and the loss of their villages. The expansion of the Welzow-Süd II and Vereinigtes Schleenhain mines is still under consideration, however. There is still a contradiction between future lignite mining plans, which foresee continued extraction until 2050, and current climate

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152 Government of the Czech Republic (2014) State Energy Policy of the Czech Republic

153 Government of the Czech Republic (1991) Governmental Resolution No. 444/1991

154 See e.g. Economic and Social Council of Ústecký region – cf. resolution of the Assembly from September 12th 2016

155 Handelsblatt (2016) Für Braunkohle läuft die Zeit ab

156 Lausitzer Rundschau (2017) Leag gibt zwei geplante Tagebaufelder auf

157 Figures according to Grüne Liga (2017) Website

targets. The new German government will have to address the emerging emissions gap, as it seems unlikely that it will be closed without political action on coal. Until this is resolved, uncertainty will remain part of people's lives in the affected regions.

The legal rights of local residents affected by the expansion of mines are very different in the two countries. In the Czech Republic, the possibility of forced expropriation due to mining was abolished in 2013 by an amendment to the Mining Act.[158] The conflict of interest between the protection of private property and the use of mineral resources was resolved in favour of protecting the rights of property owners.[159] In Germany, expropriation is still a distinct possibility, even though recent jurisprudence has strengthened the rights of local residents.[160]

Although the previous Czech government was less engaged on mining limits, it adopted the Strategic Framework for the Economic Restructuring (hereafter, the Framework or the Strategic Framework) of the Ústí, Moravia-Silesia and Karlovy Vary regions, which takes a long-term perspective; it actively strives to promote economic diversification, upskilling and higher value-added production in mining regions. This is a major step forward and opens a new chapter in the Czech debate, which has been consumed by the question of mining limits for more than a decade. As this issue has now been settled and most actors accept the solution, it seems that the debate can move forward and turn to more constructive and positive issues like economic and environmental revitalisation.

The Framework addresses structural economic challenges in a comprehensive way across seven pillars (see Figure 8). It is designed to improve the coordination of national and regional decision-making processes in order to attract investment and make sure public funds are spent in the most effective and efficient way to promote economic development. Its implementation will be based on Action Plans that will be updated annually to allow for course corrections. The first of these Action Plans was adopted on 10 June 2017.

As the time frame for the elaboration of the first Action Plan was very tight, its scope is somewhat limited. It contains many projects and measures that had already been envisaged years ago, but that are now being accelerated. This addresses the well-known disbursement backlog of EU structural funds. The government also wants to free up additional EU funds for mining regions by opening specific calls within the Regional Operational Programme. The second Action Plan is expected to be more comprehensive and should be approved in May or June 2018.

The Framework is regarded as a step in the right direction by all stakeholders, including environmental organisations and trade unions. However, the former have objected that the consultations were not transparent and excluded environmental groups. Environmental organisations and anti-coal mayors were not invited to regional working group meetings. While there was an online platform to provide comments, the submissions were not made public so it remains unclear whether and how these were integrated into the Framework and Action Plan.[161] Trade unions, on the other hand, have objected that the Framework mainly aims at decreasing the public burden of social benefit payments and that it emphasises job creation over job quality.

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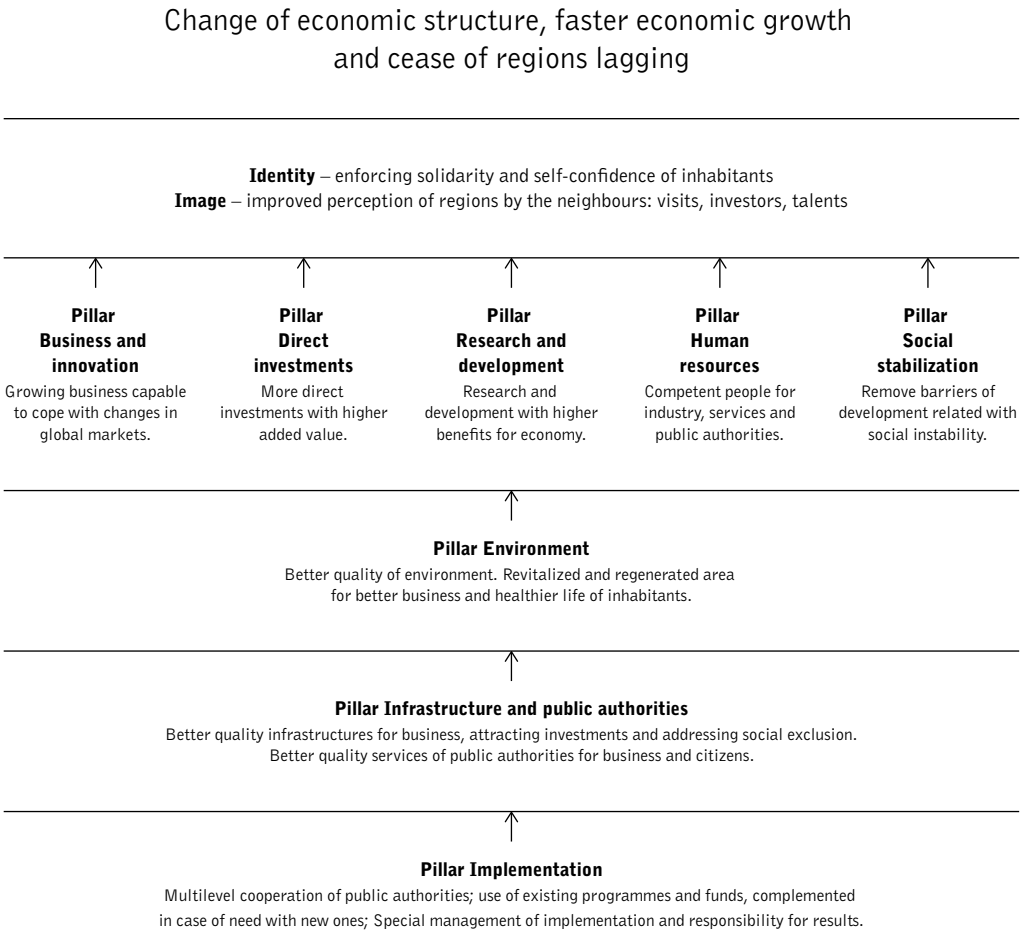
158 Parliament of the Czech Republic (2012) Amendment of the Mining Act No. 498/2012 Coll.

159 Explanatory memorandum to the Amendment of the Mining Act No. 498/2012 Coll.

160 Die Welt (2016) Klage-Erfolg nach Enteignung für Braunkohle

161 Greenpeace (2017) Ústecký kraj se odkloní od uhlí. Vládní Akční plán ale není moc akční ("The Ústí region is diverting from coal. But the Government Action Plan does not entail much action")

Figure 8: Czech Strategic Framework for Mining Regions



Source: Karel Tichý, Office of the Special Representative of the Government for Moravskoslezský, Karlovarský and Ústecký regions, presentation at 4th meeting, 25th February 2017.

Participatory elements in the design and the envisaged annual updates of the Action Plans suggest that consultation could become broader and more transparent in the future. Nevertheless, the Framework enjoys general support amongst Czech stakeholders, as it is a structured and continuous process to develop economic alternatives to coal. The Framework has the potential to move mining regions forward by providing a process for the proactive management of structural change. It can help attract targeted investment and bridge the silos in regional policymaking, dealing with the complex web of economic, social as well as planning issues around recultivation in an integrated way. Nevertheless, doubts over the implementation of the Framework remain.

In Germany, no similarly comprehensive Framework on the future of lignite regions has been developed by federal or *Länder* level administrations. Documents like the Lignite Roadmap developed by RWE for the Rhenish area do show a phase-out pathway, but not one that is compatible with the increase in ambition needed to meet the targets of the Paris Climate Agreement. Policy debates tend to focus on climate and social responsibility, as well as job impacts. Economic policy for these regions lacks a comprehensive approach. A provision in the official Climate Action Plan 2050 stipulates the creation of a "Commission on Growth, Structural Change and Regional Economy", however, which is intended to develop instruments to support structural change in regions negatively affected by the energy transition. It will be up to the German government to make this initiative a success.

The new governments in the Czech Republic and Germany have the chance to build on these initiatives. The new German government is facing the challenge to reach an agreement on the future of coal in Germany that provides economic certainty and decent living conditions for all affected stakeholders, including industry, trade unions, workers, and citizens. But such an agreement must also reflect Germany's commitments under the Paris Agreement to decarbonise its economy by the middle of the century, as well as the intermediate climate targets that have already been set for 2020, 2030 and 2040. The Czech government equally needs to comply with its climate policy commitments whilst promoting economic diversification in its lignite mining regions.

3.2 Economic reorientation and revitalisation

Lignite regions are typically highly dependent on the lignite industry for employment and economic stability due to prevailing economic monostructures. Power and mining companies are often important regional employers and contributors to the municipal tax base.[162] The higher the dependence on lignite, the stronger the impact of the long-term decline of the industry will be on the economic structure of these regions. Due to the high average age of lignite sector workers in both countries, early and regular retirement constitute options for large parts of the workforce, but younger workers, especially in mining, will need extensive retraining before they can work in other fields. Processes to diversify the economic base of these regions therefore have to be started as soon as possible.

In the past, a key challenge of structural change in Germany has been to compensate for declining coal and heavy industry employment by promoting the development of other economic activities. These were often, but not necessarily, in knowledge-intensive areas and the services

162 In Germany, mining companies pay commercial taxes which directly go to municipal households. In the Czech Republic, municipalities receive a share of mining royalties, but corporate taxes are not paid into municipal budgets.

sector.[163] In the Czech Republic, the specific problems of mining regions mirror those of the economy at large. The key issue of economic policy is how to move higher up the value chain, i.e. transition to higher value-added activities that enable more local wealth creation instead of creating intermediate products for foreign companies.

3.2.1 Best practices: How to support regional economic diversification and sustainable growth?

Policy measures can decisively influence regional development prospects, both negatively and positively. It is important, however, to realise that political intervention cannot create thriving industries overnight. It can only provide the right framework conditions and targeted support for sustainable growth to occur. It is clear that lignite regions will face high adjustment costs when the lignite industry shuts down.

At the same time, structural and economic policy can alleviate the situation. Probably the most prominent examples of large-scale structural economic policy programmes in Germany are the successive regional support programmes for the Ruhr area, as well as the rebuilding of Eastern Germany (*Aufbau Ost*). Yet another example is the massive reconstruction and industrialisation effort in Bavaria after 1945, which was heavily damaged by war and had a mainly agrarian economy at the time.[164]

The ambivalent nature of these massive structural support programmes becomes clear when considering their effects on the Ruhr area and Eastern Germany. Both programmes are generally considered successful as the economic fundamentals in the Ruhr area and Eastern Germany have improved markedly – albeit only after years of efforts and billions of Euros in aid. At the same time, significant socio-economic problems persist. In Eastern Germany, wages and living standards are still below those in the western part of the country, and outward migration continues especially among younger people.[165] Similarly, there is still a considerable wealth gap between the northern and southern Ruhr area.[166] There is also significant unemployment in Czech mining regions, and many jobs are insecure and poorly paid despite structural policy support on a considerable scale through the EU Cohesion Policy.

While there is no silver bullet, Germany in particular can draw on several decades of experience with structural policy and post-mining regional transformation to distil some of the lessons on how to manage the coming transition. Most importantly, in order to address the coming change proactively, regions need to start exploring economic alternatives early and plan ahead for a future beyond lignite.[167] This goes far beyond just compensating miners; regions need to look at putting in place structures for economically and environmentally sustainable development.

It is particularly important to make sure that public support gives long-term certainty to investors and that it goes to industries that are sustainable in the long run. If industries are supported only to collapse anyway, this constitutes a waste of public funds that could have been used to promote economic diversification and to improve infrastructure. The range of

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163 Nolte et al. (2013) Erfolgreiche regionale Transformationsprozesse – Mögliche Zukünfte für die Region Ruhr ("Successful regional transformation processes – possible futures for the Ruhr region")

164 Historisches Lexikon Bayerns (2012) Wirtschaft (nach 1945) – Die Ausgangslage

165 German Federal Ministry for Economic Affairs and Energy (2016) Jahresbericht der Bundesregierung zum Stand der Deutschen Einheit 2016

166 Jörg Bogumil, Rolf G. Heinze, Franz Lehner & Klaus Peter Strohmeier (2012) „Viel erreicht – wenig gewonnen: Ein realistischer Blick auf das Ruhrgebiet", Klartext-Verlagsges.

167 Peter Wirth, Barbara Černič Mali & Wolfgang Fischer eds. (2012) Post-Mining Regions in Central Europe

ultimately unsuccessful technology support programmes to revive the West German coal and steel industry by the German government in the 1970s constitutes one bad practice example.[168] Similarly, massive investments into solar power in Eastern Germany, promoted via a feed-in-tariff, built up an industry which collapsed in 2012 after the tariff was lowered unexpectedly and certainty over quantities and corridors disappeared.[169] The resulting wave of bankruptcies in this industry led to the closure of many production facilities and significant employment losses.[170]

Infrastructure and public services as enablers of economic diversification and growth

One key condition for economic development is high-quality infrastructure. Using Structural Funds to improve transport infrastructure is often a useful political intervention that can be easily identified and implemented. This was an early focus of structural policy, e.g. in the Ruhr area[171] as well as in the *Aufbau Ost*. A recent study on Lusatia similarly stresses the need to mobilise additional resources to improve transport and digital infrastructure, especially given that municipal budgets in the region are already suffering steep cuts as income tax payments by Vattenfall and now LEAG have collapsed.[172]

In the current context, it is particularly important to promote low-carbon infrastructure, e.g. prioritise train lines over roads and low-carbon over high-carbon energy infrastructure. The priority should be to invest in infrastructure which is fit for the future, not least to avoid stranded asset risks through later changes in regulation.

Transport infrastructure, e.g. train lines and roads providing good connections to other centres of economic activity and, going forward, charging infrastructure for e-vehicles, are crucial for drawing in new businesses and for facilitating commuting and mobility for the public in general. This is particularly important for generating spill-over effects, such as in the former mining town of Sokolov, which benefits from its proximity to the popular spa town of Karlovy Vary,[173] or the Rhineland, which benefits from its connection to the heavily urbanised Ruhr area.

Another increasingly important factor is digital infrastructure, i.e. having high-speed internet connections in place. This has been identified as a key factor for Lusatia,[174] as well as for Czech regions.[175] It is not only important *per* se to enable businesses and people to have

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168 Prognos (2015) Lehren aus dem Strukturwandel im Ruhrgebiet für die Regionalpolitik, Final Report project nr. 08/14 German Federal Ministry for Economic Affairs and Energy (''Lessons learned from the structural transition of the Ruhr region for regional policy''), p. 102

169 Another important contributing factor was strong competition from China, which was able to produce solar panels at much lower cost.

170 German Federal Ministry for Economic Affairs and Energy (2016) Bruttobeschäftigung durch erneuerbare Energien in Deutschland und verringerte fossile Brennstoffimporte durch erneuerbare Energien und Energieeffizienz

171 Prognos (2015) Lehren aus dem Strukturwandel im Ruhrgebiet für die Regionalpolitik, Final Report project nr. 08/14 German Federal Ministry for Economic Affairs and Energy (''Lessons learned from the structural transition of the Ruhr region for regional policy''), p. 99

172 Agora Energiewende (2017) Eine Zukunft für die Lausitz – Einemente eines Strukturwandelkonzepts für das Lausitzer Braunkohlerevier

173 Peter Wirth, Barbara Černič Mali & Wolfgang Fischer eds. (2012) Post-Mining Regions in Central Europe, p. 63ff

174 IHK & Innovationsregion Lausitz (2017) Das Lausitz Papier

175 European Union Cohesion Fund (2012) Integrated Regional Operational Programme

high-speed access to the internet. Some key areas of growth and innovation such as "smart" systems and cities as well as the internet of things rely critically on this.

Educational and childcare facilities, hospitals, and infrastructure for leisure activities are essential for improving the local quality of life and keeping people in the region. The infrastructure needs of the future are likely not the same as those of the past, however. Because it is impossible at this stage to predict future developments in regions such as Lusatia, this leads to contradictions in planning processes. An ageing population and lower population density with a growing share of temporary residents (e.g. owners of holiday homes) for instance, require a stronger focus on remote medical care and telemedicine and less on road transport. At the same time, when aiming to attract investors and qualified personnel to the region, first class medical care, primary and secondary educational facilities, and shopping centres will be essential. As demographic developments are difficult to foresee, regions will need an open planning process that allows readjustments over time.

Ensuring high-quality public services whilst winding down mining activities is crucial, as mining regions and cities – not least in Germany – often depend heavily on taxes paid by the lignite industry for their budgets. This gap needs to be filled. National and EU-level policies need to ensure that these basic conditions for people and businesses to thrive are in place.

Eastern German regions like Lusatia and Central Germany will face additional cuts in support due to the expiration of support from the national Solidarity Pact in 2019.[176] Even though it has been confirmed that there will be a replacement, it is unlikely to be as favourable as in the last funding period.[177] At the same time, the ongoing process around the EU's post-2020 Multiannual Financial Framework (MFF) is an opportunity to raise awareness for the infrastructure and investment needs of mining regions in Europe. The new seven-year programme setting down long-term financial planning for EU spending will have to take Brexit – and therefore fewer available resources – into consideration, and allocate funds in a much more coherent and efficient manner than in the past. Another process, led by the European Commission, aims to create a "coal platform" to operate from 2018 onward, helping coal regions to access dedicated funds and supporting them in promoting sustainable economic growth.[178]

Targeted support as an enabler for economic diversification and growth

In regions that depend heavily on coal, it is of utmost importance to promote economic alternatives and activate endogenous growth potentials. Since around 2000, the prevailing structural policy paradigm in Germany and elsewhere has shifted to a highly targeted approach, seeking to promote economic activity in clusters with a high growth potential.[179] This is generally known as cluster policy, the aim of which is to identify existing regional strengths in the context of global competition and to build on them. In other words, the idea is that economic growth requires complex systemic processes starting from existing local capabilities, which is summarised in the cluster policy approach.

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176 The Solidarity Pact is a long-running support programme aiming to improve living condition in the east to western German standards. It provides important support to local budgets and infrastructure.

177 Tagesschau (2017) Neue Hilfen für die neuen Länder

178 Euractiv (2017) EU initiative to help coal mining regions will start in autumn

179 This basic idea is generally referred to as the model of cluster policy. See e.g. Schmid et al. (Hg.) (2009) Strategische Wirtschaftsförderung und die Gestaltung von High-Tech Clustern, Baden-Baden ("Strategic promotion of economic development and the design of high-tech clusters"); Beck et al. (Hg.) (2014) Zukunft der Wirtschaftsförderung, Baden-Baden ("The future of the promotion of economic development"

However, the economic niches that are available for a region can usually best be identified in a bottom-up manner rather than defined from the top down. In practice, cluster policy has often failed in Germany when a politically driven approach prevailed, i.e. when economic clusters were defined by decision-makers at the federal or *Länder* level without a thorough examination of actual economic conditions.[180]

In German lignite regions, several such bottom-up initiatives, typically with the involvement of local business actors and academic institutions, have been instrumental in identifying regional funding priorities and economic potential. Recent examples include an idea competition organised by the *Innovationsregion Rheinisches Revier*,[181] a similar idea competition recently announced by the *Metropolregion Mitteldeutschland*,[182] and a business survey organised by the *Innovationsregion Lausitz*.[183] Beyond merely identifying fundable projects, these actors serve as focal points for transition-related expertise and as platforms for promoting a public debate on how to shape the coming transition. The pilot project *Unternehmen Revier*, which was recently started by the Federal Ministry for Economic Affairs and Energy, will contribute to bottom-up efforts by providing €4 million per year to generate ideas and enable stakeholders in lignite regions to take advantage of future opportunities.[184] Similar bottom-up initiatives by businesses, academia and other actors are picking up in the Czech Republic as well. Apart from the processes around the Framework, there is a long-standing cooperation between the chemical industry and the UniCRE public-private research institute in the Ústí region.[185]

Table 3: Overview of German "innovation regions"

	Innovationsregion Rheinisches Revier	Europäische Metropolregion Mitteldeutschland	Innovationsregion Lausitz
Founding year	2014	1997	2016
Background	Initiated by state government	Longstanding regional development association	Bottom-up initiative by business and academia
Legal status	Limited liability company (*GmbH*)	Limited liability company (*GmbH*)	Limited liability company (*GmbH*)
CEO	Heinz Weifels	Jörn-Heinrich Tobaben/ Reinhard Wölpert	Dr. Hans Rüdiger Lange

180 Kiese, Matthias (2014) Regionale Clusterpolitik in Deutschland. Bestandsaufnahme und interregionaler Vergleich, in: Beck, Rasmus; Heinze, Rolf G.; Schmid, Josef (Hg.): Zukunft der Wirtschaftsförderung, a.a.O., pp. 169-194.

181 Innovationsregion Rheinisches Revier GmbH (2015) Projektaufruf/Ideenwettbewerb: Das Rheinische Revier auf dem Weg zur Innovationsregion

182 Metropolregion Mitteldeutschland (2017) Weichen für erfolgreichen Strukturwandel im mitteldeutschen Braunkohlerevier gestellt

183 The Ministry for Economic Affairs and Energy of the Federal State of Brandenburg, Germany (2016) Strukturwandel in der Lausitz: Wissenschaftliche Auswertung der Potentialanalysen der Wirtschaft der Lausitz ab 2010 ; IHK & Innovationsregion Lausitz (2017) Das Lausitz Papier

184 German Federal Ministry for Economic Affairs and Energy (2017) Zypries: „Wir wollen den Strukturwandel in den Braunkohleregionen aktiv gestalten"

185 Unipetrol Centre for Research and Education (2017) About Us

Number of member organisations	14	78	17
Shareholders (Gesellschafter)	– 6 towns/districts – 3 Chambers of Crafts – 3 Chambers of Industry and Commerce – 1 association of municipalities – 1 trade union	– 12 towns/districts	– 2 business associations – 1 Chamber of Crafts – 1 Chamber of Industry and Commerce – 1 university
Members of advisory board (Beirat)	N/a	– 58 companies – 5 universities/ institutes – 2 Chambers of Industry and Commerce – 1 regional planning association	– 3 companies – 2 business associations – 2 towns/districts – 2 trade unions – 1 regional church association – 1 civic association – 1 university
Website	rheinisches-revier.de	mitteldeutschland.com/de	innovationsregionlausitz.de/

Due to its targeted nature, cluster policy typically results in a concentration of support in cities and industrial centres.[186] While this is desirable from the perspective of getting the largest economic boost per Euro or Czech Crown spent, there is a risk that it can lead to neglecting rural or geographically marginal areas. This risk applies particularly to lignite regions where municipal investments will have to be cut back as tax revenues from lignite decline. The EU-funded LEADER initiative in Brandenburg, for instance, is specifically designed to improve living conditions in rural regions. It focuses on areas like agriculture, forestry and nature protection, as well as social and cultural initiatives, in addition to promoting economic activity and job creation. Whatever approach is taken, special emphasis will be necessary to identify economic initiatives that can benefit rural areas as well. Even where this is challenging, ensuring public service delivery and good infrastructure will be key factors in preventing outmigration.

A recurring recommendation in mining regions and everywhere else is to improve regional innovation capacity. This is particularly important for ensuring that lignite jobs are replaced with high-quality, well-paying jobs, which are usually provided in industrial production and by the tech industry. It is also true, however, that miners who lose their jobs will not necessarily be employed in these industries, despite dedicated training and reskilling measures. It is thus very likely that many will either have to relocate, take early retirement or seek employment in the services sector – thereby not only suffering pay cuts, but potentially also impacts on their self-esteem.

186 Joachim Genosko et al. (2006) Wie hell strahlen Leuchttürme? Anmerkungen zur Clusterpolitik in ländlichen Räumen ; ifo Institut (2013) Industrie- und Wirtschaftsregion Lausitz: Bestandsaufnahme und Perspektiven, p. 124

Scaling up the innovation capacity of a region is particularly important for moving higher up the value chain. This is a well-known problem particularly in Eastern Germany as well as the Czech Republic, where large parts of the economy occupy an intermediate position in the value chains of Western German companies, especially car manufacturers.

This is particularly crucial if a regional economy is composed to a high degree of SMEs, such as in Lusatia, as these typically have difficulties investing in dedicated R&D capabilities.[187] For this reason, regional and national governments are often advised to strengthen higher education institutions and to improve cooperation between businesses and academia.[188] Other measures that have proved successful in fostering innovation are start-up centres or incubators that provide initial support for innovative entrepreneurs and young companies through access to infrastructure and expert advice.[189]

Local participation as an enabler for economic diversification and growth

In regional planning and development processes, bottom-up approaches that foster local participation and ownership are vital. This is especially important in the process of land reclamation, as it generates acceptance for landscape and land use changes and enables the local population to have a say in the development of their region. The Indeland project, in which the development around the future lake Inden is being shaped in cooperation with communities and the mining company, is regarded as a best practice example in this regard (see Section 3.3).[190]

Beyond mere spatial planning, local participation is also important in broader regional development strategies. The effectiveness of structural policy measures can be enhanced greatly by relying on local knowledge. Examples of this are the 14 bottom-up Regional Development Strategies elaborated as part of the LEADER initiative in Brandenburg.[191] The EU's LEADER instrument is specifically tailored to the needs of rural areas, and aims to maintain and improve living conditions for inhabitants and identifies funding priorities and projects based on the input of local stakeholders themselves.[192]

At the same time, early opportunities for participation can create a legitimising basis for long-term economic reorientation and restructuring by generating agreement on how to address the coming changes. The Europe-wide ReSource research project, which has evaluated the cases of a broad range of post-mining regions, stresses for instance that participative processes at the local and regional levels are an essential precondition for a successful reorientation. Integrating local stakeholders and civil society actors, such as citizen initiatives, trade unions and environmental groups, into regional policy processes and holding open discussions about possible regional development scenarios are among the project's key recommendations.

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187 ifo Institut (2013) Industrie- und Wirtschaftsregion Lausitz: Bestandsaufnahme und Perspektiven, p. 121

188 ifo Institut (2013) Industrie- und Wirtschaftsregion Lausitz: Bestandsaufnahme und Perspektiven

189 Sudorova, J.; Harfst, J. (2011) Integrative Approaches for Post-Mining Development, Final Report of the EU-financed ReSource Project

190 Indeland (2017) Website

191 Ministry of Rural Development, Environment and Agriculture of the Federal State of Brandenburg (2016) Kohärenzanalyse der Regionalen Entwicklungsstrategien 2014 - 2020 der lokalen Aktionsgruppen Brandenburgs; Die Raumplaner (2014) Regionale Entwicklungsstrategie der LAG Spree-Neiße-Land (Brandenburg); LAG Elbe-Elster (2014) Regionale Entwicklungsstrategie (RES) 2014 – 2020

192 Forum Netzwerk Brandenburg (2017) LEADER in Brandenburg

ReSource also emphasises that political decision-makers should seek the active cooperation of mining companies in managing structural transitions.[193]

The Czech Strategic Framework recognises this and places special emphasis on consultation and participation, although critics contend that participation has been lacking in practice.[194] By the same logic, it is crucial that the "Commission on Growth, Structural Change and Regional Development" envisaged in the German Climate Action Plan should enable a diverse set of actors in lignite areas to participate in a meaningful debate on the future of their respective regions, rather than deciding their future for them.

Specific potentials of lignite regions

While lignite regions have specific vulnerabilities, they have specific strengths as well. In promoting economic activity beyond coal, they can build on their industrial profile with the relevant infrastructure and supply chains. In the Central German lignite area, for instance, this has enabled the use of lignite as production input for the local chemical industry.[195] A recent commission of inquiry on the future of the chemical industry convened in North Rhine-Westphalia likewise found that the material use of lignite is an attractive option for the state.[196] The available workforce of qualified engineers and an infrastructure of suppliers from different industries is a further asset. Another possible option could be to convert former lignite sites into industrial parks, providing infrastructure and premises for locally active companies.[197]

As lignite regions are always "energy regions", existing grid infrastructure also makes them into ideal places to develop electricity storage, a rapidly growing sector that will gain in importance as renewables cover an increasing share of electricity demand.[198] Nor should the potential to promote electrification of heating and transport as well as energy efficiency be disregarded. Establishing wind parks in former lignite mines is promising if the geographical conditions favour such an approach.

By the same token, former mining sites can be used for bioenergy production. On farmland in particular, the cultivation of bioenergy crops competes with food crop cultivation. Mining sites offer advantages, as even polluted soils can be used to cultivate fast-growing plants for bioenergy production, as long as biodiversity conservation aspects are taken into account. In the Czech Republic, this approach has been taken with considerable success on former mining dumps in the Most region.[199] Rising mine water can also be a source of geothermal energy used to produce heat or electricity.[200]

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193 Sudorova, J.; Harfst, J. (2011) Integrative Approaches for Post-Mining Development, Final Report of the EU-financed ReSource Project

194 Greenpeace (2017) Ústecký kraj se odkloní od uhlí. Vládní Akční plán ale není moc akční

195 ibi (2017) Bü ndnispartner

196 NRW State Parliament (2015) Commission of Inquiry on the Future of the Chemical Industry in North Rhine-Westphalia

197 LMBV (2017) Industrieparks

198 Citigroup (2014) Energy Storage: Game Changer for Utilities, Tech & Commodities; KMPG (2015) The Rising Sun – Disruption on the Horizon; Lazard (2015) Levelized Costs of Storage Analysis – Version 1.0

199 Usťak, S. & Mikanová, O. (2008) Pěstování a využití komonice bílé při biologické rekultivaci důlních výsypek. Metodika pro praxi ("Cultivation and utilisation of Melilotus alba within biological reclamation of heaps"), Výzkumný ústav rostlinné výroby, v.v.i. Praha, p. 23

200 Wirth et al. (2012) Post-Mining Regions in Central Europe – Problems, Potentials, Possibilities, oekom, p. 69

Mining areas also have a particular cultural potential. Mining sites can be used for industrial tourism and to create a "historical memory culture" (*Erinnerungskultur*), such as in the case of the "Central German Lignite Road".[201] The terra:nova center overlooking the Hambach mine in the Rhineland offers space for cultural activities as well.[202] Ostrava, as a former centre of metallurgy and hard coal, is known in the Czech Republic for making particularly good use of its industrial heritage. The *Dolní Vítkovice* industrial site, for instance, was formerly an ironworks, a steelworks and a mine, and has been preserved as an open air park which regularly hosts cultural activities and festivals such as the annual "Colours of Ostrava" event. The Czech Republic has even submitted an application for it to be put on the list of UNESCO World Heritage Sites.[203]

Land reclamation in general also offers opportunities to promote tourism. It can be used to create lake resorts, for instance, or protected nature areas which can draw ecotourism. The open spaces offered by land reclamation can also accommodate activities that are difficult to establish elsewhere, such as extreme sports or other leisure activities. Former mining sites in the Czech Republic have been used to house a variety of recreational and industrial heritage sites.[204]

3.2.2 The German debate on political intervention and regional development

There is broad agreement, especially in the German debate, that lignite regions above all need certainty on the future framework conditions for their development. Without a clear perspective on what to expect from government policy in the future, it is very difficult to plan ahead. But there is fundamental disagreement on what planning security means in practice. Utilities and trade unions, as well as certain local politicians, tend to argue that certainty means no further government intervention that would artificially hasten the end of the lignite industry, so that lignite regions can develop economic alternatives in their own time. They also often contest the assertion that the energy sector should have to bear a larger share of the burden than other sectors.

Others, particularly environmental agencies and civil society groups, argue that the fundamental contradiction between pursuing climate targets and continuing lignite combustion must be resolved first. Accordingly, there can be no certainty until emissions reduction pathways are aligned with German, European and international climate targets through a clear step-by-step lignite phase-out roadmap.[205]

Connected to this is a disagreement about the role of "top-down management" of structural change and the involvement of higher levels of government in local affairs more generally. Local actors are frequently concerned that the top-down management of a structural transition can stifle local initiative and self-management, while others feel that only a top-down framework can provide the kind of certainty needed for a successful economic reorientation in line with climate targets. Business actors tend to argue that growth happens at the local level and that the federal government is solely concerned with imposing centrally administered objectives, such as climate targets, on local actors.

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201 Mitteldeutsche Straße der Braunkohle (2017) Website
202 Forum: terra nova (2017) Website
203 UNESCO (2001) The Industrial Complexes at Ostrava
204 Wirth et al. (2012) Post-Mining Regions in Central Europe – Problems, Potentials, Possibilities, oekom, p. 68
205 It is important to state that reductions in CO_2 emissions happen in steps, for example when a mine comes to the end of its lifetime and the connected power plants are shut down, instead of a smooth reduction pathway.

This is sometimes accompanied by the argument that it would be counterproductive for climate policy to force the issue against local interests, as this could provoke a public backlash. The counterargument, made primarily by environmental stakeholders, is that this effectively means giving up on reaching climate targets. Germany offers some useful lessons on top-down management of energy policy and its effects on companies and regions. A legitimate top-down approach can provide stable framework conditions and certainty on the general direction of progress, provided that all actors believe they can reasonably trust the longevity of the approach taken. In Germany, energy policy has been changing at a breath-taking pace throughout recent decades, as illustrated by the nuclear phase-out, which was negotiated between the government and utilities in 2000, only to be reversed by a different government in 2010, and then reconfirmed in 2011 after the nuclear disaster in Fukushima.[206]

Similarly, sudden reductions in feed-in tariffs for solar PV in 2011, decided against a background of competition from cheaper production facilities in China, contributed to the shut-down of numerous production facilities. Policy changes of this kind undermine the trust of investors in energy policy, with knock-on effects for the workforce and the regions where their production sites are based. Similar mistakes therefore need to be avoided when tackling the future of coal and lignite in Germany.

Learning from past experiments with top-down decision-making in this context is particularly important as questions of structural transition can quickly develop into distributional conflicts across sectors and regions. Where the collapse of entire industries is at stake, this leaves the fates of affected regions and people uncertain, deters investors and raises uncomfortable questions about the responsibility for social and environmental follow-up costs. Top-level framework agreements can alleviate this by providing a basis for concerted action by political, business and civil society actors. At the same time, however, an enabling approach has to be taken at the regional and local levels to realise their untapped potential for economic revitalisation and innovation.

German policy on coal in particular has traditionally relied on a consensus-oriented approach involving the highest levels of government. The objective of such processes in the 20th century was to manage the gradual reduction of hard coal subsidies and the resulting decline in employment by way of negotiation in successive Coal Roundtables (*Kohlerunden*). These involved federal and state-level politicians as well as utilities and trade unions. While this approach has been criticised for only including coal sector actors and prolonging uncompetitive economic activity, it has succeeded in cushioning the social impacts of phasing out hard coal mining. It has allowed for the gradual reduction and ultimate end of hard coal mining in 2018, a sector which employed over half a million workers at its peak in 1957.[207] Today, however, it seems far more important to provide the right kinds of incentives to succeed in the managed transition from one economic model to another, rather than to simply subsidise the decline of coal and pay off the affected workforce.

The German "Ethics Commission for a Safe Energy Supply" (*Ethikkommission für eine sichere Energieversorgung*), which was appointed shortly after the nuclear disaster in Fukushima to find a legitimate political agreement on the phase-out of nuclear and the transition to a renewables-based energy system in Germany, is another example of this approach. It was only partly successful in resolving outstanding issues, however. It did not put in place a long-term political process or a contractual agreement with the utilities, which is why the latter

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206 Ethik-Kommission Sichere Energieversorgung (2011) Deutschlands Energiewende – ein Gemeinschaftswerk für die Zukunft

207 Statistik der Kohlenwirtschaft e.V. (2017) Website

sued the government over foregone revenues and met with partial success.[208] However, its work did help create a legitimate basis for further political action and finally established clarity on the government's objectives. In June 2011, following the publication of the final Commission report, a complete nuclear phase-out by 2022 was agreed with a large majority in the German Parliament, thereby giving certainty to all stakeholders. It is important to realise that while expert commissions can provide legitimacy, their responsibility can only go so far. Ultimately, elected officials have to decide.

Replicating a negotiated approach for the future of coal in Germany through the Commission on Structural Change as announced in the German Climate Action Plan 2050 would be challenging as the stakes are high for the affected regions and businesses. A coal phase-out as such would therefore have to be based on a federal law rather than a negotiated outcome by a commission. However, a long-standing proposal by the German trade union umbrella association DGB calls for an "Ethics Commission 2.0" for coal and explicitly mentions economic transition as an integral part of such a body's agenda.[209] Given the climate rationale of a coal phase-out and the need to secure environmental outcomes in such a process, in particular with regard to the clean-up costs after the end of mining activities, there is an important role that environmental groups can play in such a process.

The process would have to be defined very carefully; one example is the Structural Change Fund envisaged in a proposal by the German think tank Agora Energiewende.[210] The trade union Ver.di has likewise argued for compensation for coal power plant workers who would lose their jobs earlier than anticipated as a result of climate policy. A study commissioned by the organisation estimates the related costs at €499 million.[211] The regional governments of Brandenburg and Saxony have also called for an increase in support to promote economic diversification and job creation in Lusatia.[212]

3.2.3 Challenges of structural policy in the Czech Republic

In the Czech Republic, Structural and Cohesion Funds are one of the most important sources of public investment, accounting for 34.3% of all public investment in the 2007-2013 period.[213] In the Czech Ústí and Karlovy Vary regions, which receive a large part of this money, this share is even higher. Therefore, the importance of using EU funds wisely in lignite regions can hardly be overstated and the practices around the spending of EU funds require particular attention and scrutiny.

The anticorruption effort by the previous Sobotka government (2013-2017) was particularly effective in fighting widespread corruption around the use of EU funds.[214] Several high-profile cases of corruption in the Ústí region have been uncovered in recent years, involving

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208 Handelsblatt (2016) Eon und RWE müssen entschädigt werden

209 DGB (2015) Ethikkommission 2.0 soll Vorschläge für Energiewende erarbeiten

210 Agora Energiewende (2016) Elf Eckpunkte für einen Kohlekonsens

211 ver.di (2016) Sozialverträglicher Kohleausstieg ist machbar

212 German Federal States of Brandenburg and Saxony (2017) Grundsatzpapier "Gemeinsam für die Zukunft der Industrieregion Lausitz"

213 Eurostat 2016

214 In 2017, the Czech government experienced a crisis after the then vice-prime minister Andrej Babiš had been investigated by the police and (after the Chamber of Deputies had removed his immunity) accused due to a suspicion of an EU-subsidy fraud. However, Babiš and his ANO-movement won the parliamentary election in October 2017 and his immunity was restored. In January 2018, the majority in the Chamber of Deputies reconfirmed the removal of Babiš's immunity. (Status: March 2018)

several former governors, directors in charge of Regional Operational Programmes as well as leading figures from both ČSSD and ODS.[215] In the largest of these cases, currently still before the courts, it is alleged that high-level government officials defrauded an unprecedented CZK 14 billion (€530 million) from EU Structural Funds in 2008.[216] The practices reported in these cases range from "VIP projects" that were pre-selected for approval, to high-level officials collecting a 10% "commission" on granted EU subsidies, leasing lucrative property to party-affiliated businessmen and large-scale building projects allowed to go ahead without a permit. Sentences have been handed down in several cases and several others are still being prosecuted.

The Czech Republic also has, for the first time, adopted one overarching Regional Operational Programme for all regions for the 2014-2020 funding period rather than separate ones,[217] which has reduced opportunities to make special (regional) deals on spending EU funds.

Nevertheless, while transparency and accountability regarding the use of Structural Funds are improving, problems of inefficiency of spending and a lack of focus remain to be resolved. Perhaps the clearest expression of this inefficiency is the fact that spending is massively back-loaded towards the end of the funding period. While EU funds provided around 34% of public investment over the entire last funding period (2007-2013), this share rises to over 60% if only the last three years are considered.[218] This rush to spend the available funds before time runs out severely impacts the quality of project selection and implementation, as well as evaluation and monitoring. There is an incentive to spend allocated EU money rather than lose it, which leads to it being used as a budget-filler rather than to finance sustainable and impactful projects. This is not conducive to a long-term approach based on prudent planning.

A key contributing factor to the inefficient administration of funds has been the long-standing practice that new governments, both at the regional and national levels, typically replace the upper echelons of staff in the bodies in charge of administering Cohesion Funds, such as the Ministry of Regional Development. This leads to a lot of inexperienced and politically dependent staff being in charge of projects, requiring long familiarisation periods to navigate the complexities of the EU Cohesion Policy. The experience they gain over the course of their appointments is then lost when the next reshuffling occurs. In the past, this has exacerbated the problem of inefficiency and backloads in spending structural funds. However, the new Civil Service Act, adopted in 2014, includes provisions to prevent this practice.[219]

A related problem is that of brain drain from the public sector to private consultancies. Accessing EU funds is a lucrative business, which has spawned an industry of EU advisory firms actively hiring current and former officials for their expertise in administering EU funds as well as their political contacts. The resulting brain drain is depriving the responsible government departments of their institutional memory and experience.

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215 Prague Daily Monitor (2016) Lawyer: Czech EU money fraud worth CZK 14 billion; Nadační fond proti korupci (2016) Case 15; Nadační fond proti korupci (2016) Case 16; Nadační fond proti korupci (2016) Case 17; Nadační fond proti korupci (2016) Case 20; Nadační fond proti korupci (2016) Case 22

216 Prague Daily Monitor (2016) Lawyer: Czech EU money fraud worth CZK 14 billion

217 European Commission (2017) Integrated Regional Operational Programme: Czech Republic

218 Bankwatch (2016) Climate's Enfant Terribles

219 Frank Bold (2015) Briefing on Implementation of Civil Service Act, Czech Republic

There are also concerns that monitoring and project evaluation by the Certifying Authority at the Ministry of Finance (*Platební a certifikační orgán*) is not up to the task of ensuring quality projects.[220] The Authority tends to only check compliance with formal rules and procedures. As very high level and hence unspecific progress indicators are common in the project selection process, projects can easily be declared successful. This central body is widely suspected of not investigating and even covering up breaches of rules. It has been openly criticised by the European Court of Auditors, which accused it of routinely submitting grossly inaccurate reports on EU Structural Funds projects.[221] In an ongoing corruption case, it is alleged that several projects selected to benefit high-level officials in the Ústí region financially had their external reviewers pre-selected and appointed directly rather than by lottery as stipulated by law.[222]

Overall, regional development funding in the Czech Republic is highly centralised and managed as a top-down process, with regional finances dependent on the national Finance Ministry and the Ministry of Regional Development. Bottom-up initiatives for setting regional development priorities are usually not supported. The regions themselves can only act within the Operational Programme determined at the national level.

The Strategic Framework represents a departure from this practice. It has been set up as a long-term process with annually updated Action Plans drawing on broad stakeholder consultations. It draws together the most important funding streams, such as ESIF and national budget contributions, and orients them towards one strategic vision. The Strategic Framework thus has the potential to set more sensible spending priorities and provide a clear and stable framework for the future development of the Czech Republic's mining regions.

The Strategic Framework can be seen as part of a broader trend of improving Czech public administration. The necessity to have at least formal strategies as a precondition to draw EU funds, along with increasing efforts to align the many different existing strategies, led to increased interest in strategic planning since 2013 under the Sobotka government. There are dedicated departments for expertise-sharing and networking at the Ministry of Regional Development, the Office of the Government and the Governmental Council on Sustainable Development. The umbrella strategy "Czech Republic 2030",[223] approved by the government in April 2017 and intended to implement the Agenda 2030 for sustainable development, can be seen as the culmination of this effort. This strategy is supposed to coordinate all other strategies of any public institution, and was drafted on the basis of broad-based input by public, civil society, academic and other stakeholders, which was gathered by the Government Council on Sustainable Development and its 9 committees.[224]

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220 Česká pozice (2012) Jak se v Česku rozkrádají evropské miliardy? Desatero slabých míst ("How do billions of Euros crash in the Czech Republic? Ten weak spots")

221 Aktuálně,cz (2012) Češi zatajili Bruselu 40 procent zfušovaných projektů ("Czechs concealed from Brussels that 40% of projects were unsuccessful")

222 Nadační fond proti korupci (2016) Case 15

223 The Strategy is presented here: Office of the Government of the Czech Republic (2017) Strategický rámec Česká republika 2030 ("Strategic Framework of the Czech Republic 2030")

224 European Sustainable Development Network (2017) Czech Republic

3.3 Reclamation and ecological revitalisation

Ensuring an appealing and healthy environment constitutes a key factor for attracting investors to a region. It is important for a region's image not to be seen as polluted, particularly when creating new industries and trying to attract highly skilled workers. Lignite regions face particularly tough challenges in this regard, as lignite extraction devastates large areas of land, can have negative long-term impacts on water and soil quality and can also result in future soil subsidence. The need to attend to damage to the natural environment as well as to maintain pumping and pipe systems over several decades and beyond is significant, and it is not always entirely clear whether the mining company is obliged to bear the long-term costs of these operations. As such, a healthy environment is a key objective of structural policy in lignite regions and rightly constitutes one of the foundational pillars of the Czech Strategic Framework for Mining Regions.

One example of a large-scale effort in land reclamation and recultivation is the specifically created agency *Lausitzer und Mitteldeutsche Bergbau-Verwaltungsgesellschaft* (LMBV). The LMBV was founded to address the monumental clean-up and land reclamation challenges resulting from GDR legacy mines. It is three-quarters financed by the federal government, and one-quarter by the states. The creation of numerous artificial lakes in the Lusatia Lake District is a particular hallmark of success. In addition to its environmental and mining-related tasks, the LMBV also served a very important social function. Initially employing 20,000 workers, it became a rescue company for workers who lost their jobs during the sudden crash of the East German lignite mining industry after reunification. Thus, activities around land reclamation served to address the environmental impacts of coal mining as well as the social impacts of mine closures in parallel.

As another example, the *Indeland* project in the Rhineland demonstrates that land reclamation offers an opportunity to local communities both to recreate old landscapes and to create new ones by shaping the future development of their land. *Indeland* was founded in 2000 on the basis of an inter-municipal agreement with the aim of ensuring an attractive business and living environment in the areas surrounding the Inden lignite mine. It acts as a development agency institutionalising cooperation between different actors and making sure their voices are heard in the reclamation and post-mining planning process. *Indeland* has successfully participated in planning the relocation of the Inde River and the creation of a lake area once mining has ceased. *Indeland* has developed both an intermediate utilisation concept for the period before lakes are created at the site and a long-term guiding document called Masterplan 2030, detailing its priorities for a future area development that is socially fair, environmentally and climate friendly as well as economically successful.[225]

225 Indeland (2015) Masterplan 2030

Land reclamation is costly – it is by far the most expensive aspect of the environmental clean-up related to lignite mining.[226] Current financial reserves of RWE, MIBRAG and LEAG for the reclamation of German lignite mines amount to €3.2 billion.[227] Environmental groups contend that the real costs could be much higher, however, as the models and criteria used by the companies to estimate future reclamation expenses are not made available.[228] At the same time, regulatory oversight is relatively strong in Germany, and part of the reclamation process already takes place during active mining.

Doing reclamation properly in a way that stimulates the development of regionally specific biodiversity and that protects the interests of local residents requires extensive and detailed planning, which in Germany takes at least 15 years before mining can even start.[229] A key challenge in reclamation planning is to make sure that enough high-quality land and water resources remain for nature conservation and the provision of necessary ecosystem services, as opposed to mere commercial land uses. Sustainable reclamation strategies also provide the opportunity for a fresh start to develop sustainable modes of agriculture, forestry or tourism. In the case of a politically accelerated coal phase-out, existing reclamation plans would have to be amended, invalidating previous planning by the mining companies, including with regard to resettlement efforts. In some cases, villages could remain in place although the population has already been fully or partially resettled. Mining companies often emphasise that mandating a coal phase-out by a pre-determined year would create considerable uncertainty around reclamation planning. Because a time-based restriction on coal mining would leave the amount of coal that can still be mined and burned unclear, it would be impossible to know for certain which areas will be affected by mining. A coal phase-out based on a limit imposed on the quantity of coal that can still be mined, on the other hand, would avoid this problem. While phase-out timelines for coal continue to appear in the public debate, a quantity-based restriction could therefore be an alternative to a politically negotiated phase-out date. This is also in line with the CO2 budget approach that is gaining popularity in the German environmental community, as a quantity-based restriction on coal mining can easily be derived from a carbon budget on the basis of the specific emissions of different power plants.[230]

3.3.1 Planning and regulatory issues

In both the Czech Republic and Germany, mining laws stipulate that a land restoration plan needs to be in place before mining is permitted at a site. While the general responsibilities regarding land restoration are set at the national level, partly based on EU environmental regulations, regional mining authorities approve the final restoration plans. Apart from these basic similarities, planning for land restoration, post-mining land-use and development are handled very differently in the two countries. In both cases, finding the right balance between cultural, environmental and economic objectives in this process is key to a successful land reclamation and structural change process.

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226 Agora Energiewende (2017) Die deutsche Braunkohlenwirtschaft
227 FÖS (2016) Finanzielle Vorsorge im Braunkohlebereich
228 Ibid.
229 Agora Energiewende (2017) Die deutsche Braunkohlenwirtschaft
230 WWF (2017) Zukunft Stromsystem – Kohleausstieg 2035

In Germany, post-mining plans are drawn up with extensive stakeholder involvement in successive rounds of consultation and planning over a period of several years.[231] The respective Länder governments organise the process based on regional development plans (*Landesentwicklungsplan/ Landesentwicklungsprogramm*) which aim to create a compromise between the demands of different stakeholders and are typically open for consultation. In a second step, lignite plans (*Braunkohlenpläne*) are set up and approved by the Länder governments. These describe, amongst other things, the planned land reclamation, necessary resettlements and mining limits for a given mine. Lignite committees (*Braunkohlenausschüsse*), which include affected municipalities as well as local associations and chambers of commerce, provide an important channel of stakeholder participation. From the point of final approval, it still takes 10-15 years for mining to start, thereby providing a long-term perspective and time to plan ahead for the affected communities.

Based on the outcome of this process, mining companies prepare general operating plans (*Rahmenbetriebspläne*) which usually cover the entire lifespan of a mine and further specify the details of the approved lignite plans.[232] These general operating plans include an environmental impact assessment and are usually also open to consultation. Environmental organisations play a particularly important role in providing input to the environmental impact assessment. After this process, which typically takes five years, the mining company prepares its main operating plans (*Hauptbetriebspläne*) for specified areas every two years.[233] Both types of operating plans are approved by the Regional Mining Authority.

Farmers, rangers' associations, the forestry sector, environmentalists, transport planners and various other stakeholder groups all have different priorities when it comes to the subsequent use of mining areas.[234] Ample consultation opportunities across several years give these groups space to negotiate often contentious compromises over land distribution.[235] Out of the 81,603 ha reclaimed by the LMBV for instance, 19% was converted to agricultural land, 46% to forests and 24% to lakes, while 11% was made available for other uses such as commercial and residential areas or transport routes.[236] About 10-15% of the reclaimed areas were transformed into protected nature conservation areas.[237]

Restoration planning and practice in Germany also benefit from a strong science-policy interface, with universities and specialist institutes supporting and monitoring the land reclamation process. Scientific expertise plays a particularly important role in the continuous refinement of reclamation methods and in monitoring biodiversity as well as soil and water quality. RWE has, for instance, created a research institute (*Forschungsstelle Rekultivierung*) to inform its reclamation practice.[238]

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231 Agora Energiewende (2017) Die deutsche Braunkohlenwirtschaft; RWE Rekultivierung im Rheinland

232 RWE Genehmigungsverfahren im rheinischen Braunkohlenbergbau

233 RWE Genehmigungsverfahren im rheinischen Braunkohlenbergbau

234 Farmers, a particularly important group, vary by composition in eastern and western Germany. In the East, these tend to be large agricultural conglomerates, whereas small farmers are more common in western Germany.

235 Lögters & Dworschak (2004) Recultivation of opencast mines – Perspectives for the people living in the Rhineland, World of Mining – Surface & Underground Vol. 56, No. 2

236 LMBV (2015) Daten und Fakten

237 Klára Řehounková, Jiří Řehounek & Karel Prach (eds.) (2011) Near-natural restoration vs. technical reclamation of mining sites in the Czech Republic

238 Forschungsstelle Rekultivierung (2017) Website

The German approach does not specifically aim to re-establish the landscape that existed before mining started, but rather to find a compromise between different uses of the land, based on public participation.[239] Citizens and environmental organisations have special participation and access rights under the Aarhus Convention in these processes. Former land use plays an important role in this, of course, and sometimes restricts the flexible use of the land after the end of mining activities.

This is different in the Czech Republic, since Czech legislation requires that the land be restored to a state stipulated by decades-old recultivation plans agreed before mining started. This usually means the creation of farmland or forests, as the regulatory framework provides strong protection against the loss of agricultural and forested land. In addition, the commercial interests of the companies conducting the restoration tend to dominate post-mining and land restoration plans – to the detriment of other stakeholders and new techniques.[240]

In the Czech Republic, what is lacking is not public participation in regional planning processes as such, but rather an integrated planning process for post-mining landscapes, combining land use, economic and environmental planning processes on the basis of broad public participation. In general, public participation in land use planning at the regional level is quite active. However, a series of government decisions in 2017 has curtailed the rights of NGOs to participate in planning and permitting processes that do not require an environmental impact assessment.[241] This applies to many areas relevant to land reclamation and post-mining development, such as land-permit use, building permits and water protection act proceedings.[242]

Another problem is that the methods commonly used in technical reclamation, such as ground levelling and a focus on dense even-aged forests, do not represent the current state of scientific knowledge for best practice in land restoration. Restoration schemes and environmental impact assessments are often prepared by non-specialists.[243] While mining and land reclamation plans have to be revised regularly in Germany, there is no legal obligation to revise land reclamation plans after they are in place in the Czech Republic, affording fewer opportunities to address problems when they arise.

According to several experts and commentators, Czech policy and practice regarding landscape and water management, biodiversity protection and forestry are out of synch with scientific findings.[244] Such management can have devastating environmental consequences, such as the elimination of indigenous wildlife species, the destruction of natural ecosystems and habitat depletion. Strengthening the science-policy interface in these areas is critical to ensuring that land reclamation practice is based on firm scientific underpinnings.

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239 Lögters & Dworschak (2004) Recultivation of opencast mines – Perspectives for the people living in the Rhineland, World of Mining – Surface & Underground Vol. 56, No. 2

240 Petřík, P., J. Fanta, and M. Petrtýl (2015) It is time to change land use and landscape management in the Czech Republic; Cornerstone (2015) Mining Site Restoration by Spontaneous Processes in the Czech Republic

241 Arnika (2014) Historie útoků na § 70 zákona o ochraně přírody a krajiny (''History of Attacks on Paragraph 70 of the Nature and Landscape Protection Act'')

242 Agency for Nature Conservation and Landscape Protection of the Czech Republic (2017) Účast veřejnosti na rozhodovacích procesech (''Public participation in decision-making processes'')

243 Prach (2015) Mining Site Restoration by Spontaneous Processes in the Czech Republic; Svoboda, Vrbova & Ondráček (2007) Surface Coal Mining and Land Reclamation in the Czech Republic

244 Prach (2015) Mining Site Restoration by Spontaneous Processes in the Czech Republic; Tomáš Chuman (2015) Restoration Practices Used on Post Mining Sites and Industrial Deposits in the Czech Republic with an Example of Natural Restoration of Granodiorite Quarries and Spoil Heaps

3.3.2. Natural and technical land reclamation

In the Czech context, the potential of near-natural restoration or natural succession to reclaim former lignite mines is of particular interest. During the early years of the communist era, the typical approach to reclaiming mining land was to let these areas revert to nature. While this was largely done for cost reasons, it proved a windfall for biodiversity. Since the 1970s, the policy has been intensive technical reclamation, which has led to many of the current problems. A variety of Czech studies have shown that biodiversity in areas left to natural succession is considerably higher than in those subjected to technical reclamation.[245]

Technical reclamation generally refers to either the creation of lakes or agricultural or forest land. Flooding mining pits to create lakes is the most cost-effective approach to technical reclamation. It is often attractive to local populations as the lakes can be used for recreational activities, thereby improving the living conditions in the region and attracting tourism. However, the creation of artificial lakes also entails risk. Soil stability is a major issue, and landslides have occurred several times in Lusatia[246] and North Rhine-Westphalia, for instance.[247] Other common issues are acidification, iron and sulphate pollution, and eutrophication, which can make a lake unusable for swimming and water sports, and can impact water quality beyond the lake itself.[248] When creating artificial lakes, it is therefore crucial to closely monitor water quality and the water table and adhere to proper draining techniques to ensure the stability of the mining pits.[249]

Generally, technical reclamation as conducted in the Czech Republic is based on the assumption that initial environmental conditions in post-mining sites are highly unfavourable, limiting the early establishment of plants and other organisms. However, often the opposite is the case as species requiring nutrient-poor site conditions are among the most endangered. Typically, it takes 10-20 years for sites left to natural succession to develop full vegetation cover.[250] Natural succession also counteracts the prevailing trend of wetland loss and degradation in Europe. In some conditions, however, natural reclamation is not advisable, particularly if sites are close to inhabited areas, if there is a lot of wind or if there are acid sands.[251] In addition, a rugged topography with many heaps and holes in the ground is actually very useful for biodiversity, as it offers more biological niches.[252]

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245 Klára Řehounková, Jiří Řehounek & Karel Prach (eds.) (2011) Near-natural restoration vs. technical reclamation of mining sites in the Czech Republic; Prach, K., Řehounková, K., Řehounek, J., & Konvalinková, P. (2010). Restoration of Central European mining sites: A summary of a multi-site analysis. Landscape Research, 36, 263–268; Tomáš Chuman (2015) Restoration Practices Used on Post Mining Sites and Industrial Deposits in the Czech Republic with an Example of Natural Restoration of Granodiorite Quarries and Spoil Heaps

246 Tageszeitung (2009) Zurückgegebene Landschaften

247 Pflug, Wolfram (2013) Braunkohlentagebau und Rekultivierung: Landschaftsökologie — Folgenutzung — Naturschutz, Springer-Verlag

248 Hüttl, Reinhard et al. (1999) Rekultivierung von Bergbaufolgelandschaften: das Beispiel des Lausitzer Braunkohlereviers, Walter de Gruyter; Pflug, Wolfram (2013) Braunkohlentagebau und Rekultivierung: Landschaftsökologie — Folgenutzung — Naturschutz, Springer-Verlag

249 Svoboda, Vrbova & Ondráček (2007) Surface Coal Mining and Land Reclamation in the Czech Republic

250 Klára Řehounková, Jiří Řehounek & Karel Prach (eds.) (2011) Near-natural restoration vs. technical reclamation of mining sites in the Czech Republic

251 Dworschak (2003) The role of succession in reclamation – opportunities and constraints: Experience gained in the Rhenish lignite area, Surface Mining Vol. 55, No. 1

252 Klára Řehounková, Jiří Řehounek & Karel Prach (eds.) (2011) Near-natural restoration vs. technical reclamation of mining sites in the Czech Republic

The Most region is widely considered to be a successful example of reclamation through natural processes. The extensive mining from the 1960s to the late 1980s destroyed over 60 villages and created a 250 km2 area degraded by mining, most of which has now been reclaimed or has renaturalised spontaneously.[253] Commonly referred to as "moon landscapes", the appearance of spoil heaps changed immediately after the start of natural succession. After 20 years of succession, the affected areas had reached a steady state as either semi-natural steppe forests or wetlands. Biodiversity in these areas kept increasing even after this point while it plateaued in the technically reclaimed areas. With regard to plants, biodiversity is almost twice as high as in technically reclaimed areas.[254]

Against this backdrop, a consortium of specialists convened by the University of South Bohemia has called for 20 to 60% of former mining areas in the Czech Republic to be left for natural succession. However, current restoration plans only prescribe the use of natural succession in 0.01% of the affected areas.[255] The potential of natural succession is thus massively underused in the Czech Republic.

Near-natural reclamation is generally much less costly than an active approach, especially since the arable lands on former mining areas produced by reclamation are typically not of high quality.[256] The lack of resources for the maintenance of reclaimed areas makes natural succession even more attractive. Increasing the area for natural reclamation could free up money to be used for other purposes, such as promoting regional development. However, current regulations in the Czech Republic do not allow money from land restoration funds to be repurposed in this manner. Czech environmentalists have proposed that this would be an obvious place to start when funding economic development in lignite areas.

German experts are less enthusiastic about the potential of increasing natural succession in Germany. Designated wilderness areas to protect biodiversity have long been part of the German reclamation approach. In addition, the requirement of leaving land that is safe for the public often inhibits natural succession. In Eastern German reclamation practice, large areas have been left to natural succession. Experience has shown that while biodiversity, especially among endangered species, tends to be higher, total biomass is lower than in technically reclaimed areas.[257] In current reclamation plans, 10-15% of the area is generally designated as priority area for nature so endangered species can find refuge.[258] It is also general practice for environmental foundations, such as the Heinz Sielmann Foundation, to buy up reclaimed areas.

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253 Klára Řehounková, Jiří Řehounek & Karel Prach (eds.) (2011) Near-natural restoration vs. technical reclamation of mining sites in the Czech Republic

254 Hodačová, D. & Prach, K. (2003) Spoil heaps from brown coal mining: technical reclamation vs. spontaneous re-vegetation, Restor. Ecol. Vol. 11; Málková, L. (2011) Porovnání diverzity spontánně zarostlých a technicky rekultivovaných výsypek na Mostecku ("The comparison of diversity on spontaneously re-vegetated and technically reclaimed dumps from coal mining in the Most Region, Czech Republic"), Msc. thesis, Faculty of Science USB, České Budějovice

255 Prach, K., Řehounková, K., Řehounek, J., Konvalinková, P. (2011) Restoration of Central European mining sites: a summary of a multi-site analysis, Landscape Research Vol. 36

256 Dworschak (2003) The role of succession in reclamation – opportunities and constraints: Experience gained in the Rhenish lignite area, Surface Mining Vol. 55, No. 1

257 Dworschak (2003) The role of succession in reclamation – opportunities and constraints: Experience gained in the Rhenish lignite area, Surface Mining Vol. 55, No. 1

258 Anita Kirmer, Annett Baasch, Sabine Tischew (2011) A reflection of ecological restoration of surface-mined land based on German experiences; Klára Řehounková, Jiří Řehounek & Karel Prach (eds.) (2011) Near-natural restoration vs. technical reclamation of mining sites in the Czech Republic

There are economic limitations to near-natural reclamation as well. Natural succession competes with the creation of economically usable land, such as farmland. This makes it less interesting for German lignite regions, not least due to strong competition over land. However, if done well, it can also become a factor to attract ecotourism, such as in the large nature protection areas of the Lusatian Lake District.

It should also be pointed out that the technical approaches commonly used in the Czech Republic are not well-suited to protect biodiversity. One of the most common procedures is to level the surface of post-mining areas after the spoil substrate has settled, which typically takes eight years. This surface is then covered with organic material, such as bark or milled timber, or a humus layer stripped from mining sites. Trees are then planted in a grid-like fashion with approximately one tree per square meter, alternating between indigenous and exotic tree species. In the following years, the areas surrounding the seedlings are mowed regularly to suppress competition for nutrients from the herb layer. Chemical deer repellents and rodenticides are often used without proper determination of whether they are really needed. This produces forests that tend towards monocultures, have generally lower ecological value and are more vulnerable to diseases. To create agricultural land, the surface is similarly levelled, covered with humus and then sown with a commercial grass mixture, which produces a monotonous, species-poor grassland.[259]

In Germany, the technical methods used for forest and agricultural reclamation are more developed as they lead to more varied landscapes with more amenities and deliberately support biodiversity. For instance, RWE long ago abandoned the practice of levelling the land before planting forests, recognising that geodiversity helps promote biodiversity and focussing on the potential natural vegetation of the region. Tree species are introduced in a carefully managed succession, designed to produce a sustainable and biodiverse forest quickly. Exotic tree species are only used as pioneer species.[260] In contrast to the common practice in the Czech Republic, sufficient gaps are ensured when planting trees in new forests to allow the natural migration of local species.[261] On agricultural land, which typically has low biodiversity, fallow strips are used to provide for more variegated vegetation.[262]

Another issue with land reclamation in the Czech Republic is that it typically only starts eight years after mining has ceased. After initial wildlife and plant cover has been allowed to develop, the area is then typically bulldozed to start the technical reclamation process.[263] In Germany, reclamation is conducted as an integral process of mining, where possible. This reduces the delay before areas become useable again. In the Rhenish lignite area, for instance, RWE transports topsoil stripped from mining areas directly to areas that are being reclaimed to provide a humus layer. Reclamation starts as mining is ongoing in adjacent areas.

In general, one advantage of the Rhenish lignite mining technology is that the different soil strata are kept on the original level to the extent possible and are directly disposed to their final site. Most important for land reclamation is the upper layer, which is pure silt in the case of future agricultural use, or so-called "forest gravel", a mixture of 30% silt with 70% gravel

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259 Klára Řehounková, Jiří Řehounek & Karel Prach (eds.) (2011) Near-natural restoration vs. technical reclamation of mining sites in the Czech Republic

260 Albrecht & Esser (2010) Biodiversity in Recultivation – Examples from the Rhenish lignite mining area, World of Mining – Surface & Underground Vol. 62, No. 5

261 RWE Rekultivierung im Rheinland

262 Albrecht & Esser (2010) Biodiversity in Recultivation – Examples from the Rhenish lignite mining area, World of Mining – Surface & Underground Vol. 62, No. 5

263 Klára Řehounková, Jiří Řehounek & Karel Prach (eds.) (2011) Near-natural restoration vs. technical reclamation of mining sites in the Czech Republic

in the case of future forestry use. Forest gravel itself offers highly beneficiary properties to planted trees and all other vegetation due to its balanced nutrient content and its high water retention capability in combination with a large pore volume.

In the Czech Republic, the strict application of technical reclamation often destroys valuable habitats for rare and endangered species, running counter to biodiversity policy objectives. In Germany, there are a variety of nature protection laws at the federal and Länder levels in addition to EU laws.[264] Permission to commence mining is only granted when the proposed plans comply with these laws, and in the event of breaches they are typically strictly enforced. This is especially critical in the case of species that depend on old forests, such as certain bats and woodpeckers in the Rhineland. To protect these species, RWE was required to take special measures to allow them to find new habitats, such as using "insect corridors" to guide the animals and constructing a bridge over the A 40 highway, for example.

This is not to say that there are no ecological problems connected to lignite mining in Germany. Many environmental organisations criticise the lignite mining practice itself as a massive intervention into nature and landscapes, even while conceding that reclamation practice has improved considerably.[265] Environmental organisations also routinely clash with mining companies over water issues, such as iron and sulphate pollution and water table drawdown. While both RWE and Vattenfall (now LEAG) have installed infiltration systems to counteract the lowering of groundwater and drying-up of wetlands, environmental groups are calling for more determined action.[266] There are a range of legal disputes regarding lignite companies' liability in this area and the attributability of water pollution to mining. It has long been Vattenfall's/LEAG's position that the iron pollution in the Spree River is unrelated to lignite mining, for instance.[267]

3.3.3 Financing land reclamation

Reclamation is generally financed by the profits generated in the mining industry. In both countries, mining companies are required to clean up and restore the land they use for mining, but the provisions on how to accumulate financial reserves for reclamation and where to hold them differ significantly. A particular concern for local stakeholders and environmental groups is that mining companies fulfil their responsibilities vis-à-vis local communities and the environment. Especially with regard to lignite power plants' future prospects and the potential for political decisions to disrupt their businesses, it is important that the reserves accumulated for reclamation be secure.

In the Czech Republic, mining companies are obliged to accumulate financial reserves in a bank account which is protected from seizure and bankruptcy claims. In addition, they pay mining fees which go into a state fund for reclamation, based on the amount mined. Most of the reserves are accumulated by the companies themselves, while the fund is there to help fill gaps, e.g. regarding unforeseen circumstances. This has the effect of extracting the necessary funds for reclamation and putting them under public control while mining operations are ongoing. In the event of bankruptcy, these funds are secure.

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264 See LANUV (2017) Gesetze, Regelwerke und mehr for an overview of applicable legislation.
265 See e.g. BUND Kunstlandschaften statt Natur
266 Aktionsbündnis Klare Spree e.V. Allgemeine Informationen
267 LMBV (2017) LEAG: Kein Zusammenhang zwischen Tagebau Welzow-Süd und BUND-Arsenwerten

Regulations in the Czech Republic were noticeably tightened after several high-profile cases of theft from the state fund in the 1990s. Today, the District Mining Authority and the Ministry of the Environment must approve any use of these reserves.[268] Thus, the Czech framework seems to provide for more security for affected regions than the German model. In Germany, by contrast, reserves only have to be indicated as balance sheet provisions. The reserves are entirely "in the assets", meaning that they are tied to the economic fate of the plants and mines in question. To make matters worse, there is no legal recourse if a mining company goes bankrupt. In that case, taxpayers have to cover the costs.[269] In the case of EPH subsidiaries LEAG and MIBRAG in Eastern Germany this is seen as a key risk.[270] Concerns over the security of the reserves have prompted opposition parties and environmental organisations in Brandenburg and Saxony to call for Länder governments to use a Mining Law provision to require LEAG to provide collateral securities (*Sicherheitsleistungen*).[271]

In the aftermath of the German decision to phase out nuclear power before the end of the power plants' life cycle is reached, a commission convened to resolve the questions around nuclear clean-up and decommissioning costs recommended that a state fund, similar to the Czech example, be established to finance nuclear clean-up efforts in Germany.[272] No such plans currently exist to secure reserves from lignite mining companies.

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268 Government of the Czech Republic (2017) Czech Republic, National Reporting for CSD-18/19, Thematic Profile: Mining

269 Forum Ökologisch-Soziale Marktwirtschaft (2014) Kostenrisiken für die Gesellschaft durch den deutschen Braunkohletagebau

270 Heinrich Böll Stiftung (2016) EPH and the prospective Vattenfall deal

271 Tagesspiegel (2017) Irritationen um Verkauf der Lausitzer Tagebausparte

272 Tagesspiegel (2016) So viel kostet der Atomausstieg

Chapter 4: Political Recommendations

The Expert Group has thoroughly worked on the principles outlined below that should help governments, regions and municipalities in designing their climate, energy and regional development policies and programmes. In the coming years, these decision-makers will have a chance to shape regional transformation processes in lignite mining regions. This historic opportunity should not be missed.

- Lignite regions need to be proactive in developing a common vision for the future of their regional economies and societies. Early planning is a key factor in avoiding social turmoil and fostering economic diversification; regional stakeholders, civil society and social partners, should be encouraged to participate in designing their own future.

- Special support to lignite regions is necessary, as climate policy will affect them disproportionately. Such support should build on their endogenous potential and focus on environmentally and economically sustainable activities.

- Regulatory certainty will be essential in making this transition a success. Regions and businesses need a clear perspective on how climate policy will affect them. Coherence in decision-making across all levels of government and all relevant ministries must be ensured.

- Decision-makers need to be aware of the competing needs and constraints arising from climate, environmental, public health, social and economic considerations in the short term. The design of climate policies must therefore take social and economic interests into account.

- Stimulating economic development in regional economic centres with spill-over effects in neighbouring municipalities is often very effective, but the quality of life in rural areas must not be neglected – especially where municipal budgets are heavily dependent on revenues from lignite.

- Cross-border initiatives should be promoted to share knowledge and good practices, and to strengthen cross-border cooperation, for example in the business and education sectors. The Czech-German context is particularly promising, as the two countries are economically interdependent and face similar challenges arising from their reliance on lignite.

- Lignite mining and power companies should exercise social responsibility and proactively assist in managing structural change in lignite regions beyond simply complying with the letter of the law. There are examples in Germany of good practices to be followed in the areas of land reclamation and regional economic development.

- Due to the technical complexities of lignite mining, a quantity-based restriction on lignite mining or power production could be an alternative to a strict phase-out timeline as the sole guideline when reconciling climate and economic necessities.

- Sustainable land reclamation and purpose-driven landscape development constitute the foundations of any successful post-mining development project. The land needs to be developed in a way that meets human needs for a liveable landscape while allowing space for biodiversity to develop.

- Land reclamation should be carried out at a high technical standard, financial reserves must be secure and local stakeholders should have a voice in designing the landscape they will live and work in.

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With offices in London, Berlin, Brussels and Washington, the independent Think Tank E3G serves public interest and focuses on topics such as climate diplomacy, decarbonisation of the European and international economy as well as sustainable financing.

This report examines the examines lignite mining regions in the Czech Republic and Germany. The report explores how these regions' current development models can be transformed in an economically sustainable and socially just manner. The report is based on discussions by an expert group comprised of members with experience in government, public administration, the energy industry, labour unions, science and civil society in both countries. Lignite is by far the most polluting fossil fuel. Moreover, lignite strip mining incurs lasting damage to the environment, cultural landscapes, and whole regional hydrological systems. Regenerating these landscapes, however, offers multiple opportunities for economic and community development. A number of best practice examples are identified in our report, all of which rely on active citizen participation and inclusive management of change processes.

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