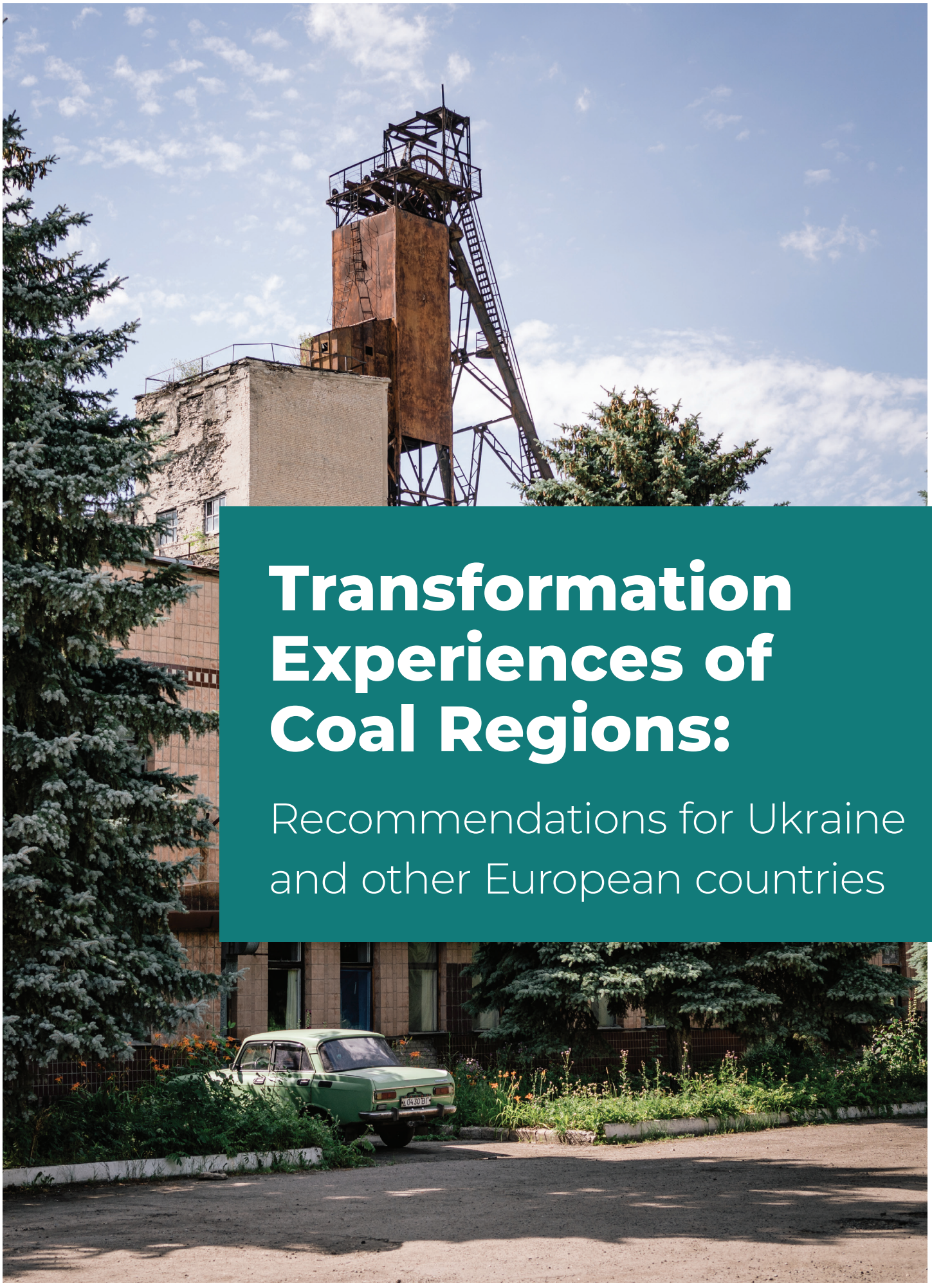

Transformation Experiences of Coal Regions:

Recommendations for Ukraine and other European countries

COMPLETE STUDY


#JUSTTRANSITION4UA

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MORE AND MORE COUNTRIES ARE CHOOSING TO DECARBONIZE THEIR ECONOMIES AND MOVE AWAY FROM FOSSIL FUELS TOWARD RENEWABLE ENERGY SOURCES. JUST SEVERAL YEARS AGO, ENERGY FROM COAL WAS CONSIDERED MORE ECONOMICALLY FEASIBLE, DEPENDING ON WHAT IS COUNTED IN FULL COST.

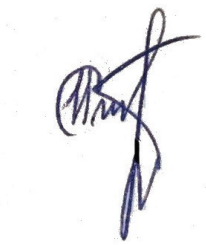
Iryna Stavchuk,
Executive Director,
Ecoaction

But with the rapid development of renewable energy technologies and strengthened climate goals, investments in coal have become less attractive all over the world.

Since the collapse of the Soviet Union and its transition to a market economy, the Ukrainian coal sector has been in a state of decline. The only thing that keeps state coal mines from collapsing entirely are enormous subsidies provided by the state every year. Since the 1990s, n closures of coal mining enterprises have negatively impacted local municipalities, as no comprehensive socio-economic strategies to support these regions were developed. Nowadays, despite the need to close the remaining unprofitable state mines, no politician has dared to take on the responsibility of making tough decisions and managing the inevitable social consequences.

Even though our organization is an environmental one, with its main focus on climate change and other ecological issues, we are deeply concerned about social problems that can arise after the closure of coal mines. First and foremost, there is a concern that miners will be laid off in the affected territories. Without proper planning, reskilling programs, diversification of the economy and creation of new job opportunities, such actions will create great social and economic instability in these regions. The task of the national and local authorities, together with representatives of other stakeholders (civil society, business, and science), is to do everything in their power to mitigate such risks.

The main objective of this study is to provide Ukrainian authorities with concrete recommendations for the impending coal phase-out. Both the positive and negative experiences of other countries are invaluable in its preparation. We hope that in the end, it will be helpful for the creation of a just and comprehensive transition strategy. The sooner our country and affected regions start preparing for the coming changes, the less negative social and economic consequences there will be.



NOWADAYS, THE BROADER PUBLIC IN EUROPEAN COUNTRIES BECOMES INCREASINGLY AWARE OF THE GLOBAL CLIMATE CRISIS. THE WEATHER CATACLYSMS IN UKRAINE IN APRIL 2019 AND THE EXTREMELY DRY SUMMER ACROSS WESTERN EUROPE IN 2018 HAVE RAISED AWARENESS.

Christoph Bals,
Policy Director,
Germanwatch

Meanwhile, especially poor people in the Global South are hit even harder: crops are devastated and housing is destroyed. The climate crisis is increasingly a risk amplifier for uprisings and wars, and the subsequent migration processes might also affect Europe.

These trends have led to a shift in international politics with the signing of the Paris Agreement in 2015 as a milestone. But even more quickly, these trends are being identified by international business actors First, big investors, such as AXA or Allianz, are shifting out of fossil fuels. Second, industrial companies are investing primarily in low-carbon technologies or are trying to reduce their carbon trace to zero, such as Bosch AG or ThyssenKrupp. A well below 2° or 1,5 °C development pathway is a chance for all industrialized countries. It enables innovation, new economic development options, better health, higher quality of life, and fair development opportunities around the world.

The European Union has now generally understood this chance, as observed in the Clean Energy for All Europeans package. The package lays out more ambitious goals for the share of renewables and improving energy efficiency. The EU also made low-carbon energy policies part of its Association Agreements with neighboring countries such as Ukraine.

Decarbonization will speed up. Prosperity in Europe has been built on the back of the people and regions that provide fossil fuels and are home to energy intensive industries. Governments and the EU must now assist them in transforming their society. Non-profit and incorruptible civil society organisations such as Germanwatch can help governments and assist the affected regions directly. This is what Germanwatch, Ecoaction and Alternativa are offering to Ukraine-controlled Donbas, one of the biggest remaining coal and steel regions in Europe.

Today, it is common sense in Germany that power, transport and heating sectors must be carbon-neutral by 2050. Germany recently decided to phase out coal mining and combustion no later than 2035–2038. While the coal phase-out decision is a big success for political dialogue, the phase-out date is not ambitious enough to meet Paris Climate Goals, and a revision will be discussed in 2023.

The European and German coal phase-out experiences send a clear message: an early start and a clear framework are key to ensuring that the affected areas have an opportunity to develop. Delay brings a high risk of economic and social disruptions. Germany experienced this when hard coal mining phase-out was delayed, but it was driven out of the energy sector through pure economic competition. Now, the end of lignite mining was explicitly agreed upon at an early stage, and together with support packages, this prepares the affected regions for the transition.

In this context, the study at hand can provide useful insights for not only Ukrainian, but also other European coal regions by summing up the experience of coal mine closure in four European countries.

Facing this great transition to come, political decision makers need courage. They have to name the social and economic challenges honestly and address them as soon as possible. But they have the unique chance of bringing together different stakeholders for shaping their path to a more sustainable, healthy and resilient society.

1. Introduction:

The Study and the Project «New Energy — New Opportunities for Sustainable Development of Donbas»

THIS STUDY PROVIDES AN OVERVIEW OF THE MAIN TAKEAWAYS FROM THE ANALYSIS OF FOUR EUROPEAN COUNTRIES AND LAYS OUT A SET OF RECOMMENDATIONS ESSENTIAL FOR A JUST ENERGY TRANSITION FROM COAL COMBUSTION TOWARD SUSTAINABLE ECONOMIC DEVELOPMENT.

The analytical study was commissioned and realized as part of the project "New Energy — New Opportunities for Sustainable Development of Donbas." This project has been developed and implemented by the NGOs Ecoaction (Kyiv, Ukraine), Luhansk Regional Human Rights Centre "Alternativa" (Donbas/Kyiv, Ukraine) and Germanwatch (Berlin/Bonn, Germany).

The project supports regional stakeholders to develop concepts, recommendations and actions for a sustainable energy transition. It is based on the specific needs and strengths of the Donbas region, its stakeholders and inhabitants. At the same time, it takes into account worldwide trends towards low-emission development, technological innovations and the industrial potential of the region. Its overall aim is to establish a dialogue between local and regional representatives to jointly define needs and elaborate solutions for a sustainable energy transformation of Donbas. According to state-of-the-art concepts in regional development, such a transition and its results have to be socially just, economically sound and climate-friendly.

This study was conducted in order to define more precisely what this means for Ukraine and Donbas specifically. The current publication is a study of a comprehensive analysis focused on positive and negative experiences of the closure of coal mines in Ukraine and selected EU countries (Germany, Romania and the Czech Republic).

This study consists of research on the national policies of the transformation of the energy sector, on the one hand - and research focused on the specific regions that were affected the most. Different authors studied their respective fields in each of the four countries, gathered all the necessary information and made a set of conclusions.

The publishers summed up the country studies in a list of concrete recommendations on how to manage the closure of coal mines with a sound economic perspective and minimal negative social consequences for Ukrainian authorities on the national, regional and local levels.

Structurally, the study opens with a set of recommendations and visual material, illustrating the main points of successful structural transformations and is followed by the four country studies, and a list of references for each text. The document ends with information about the researchers.

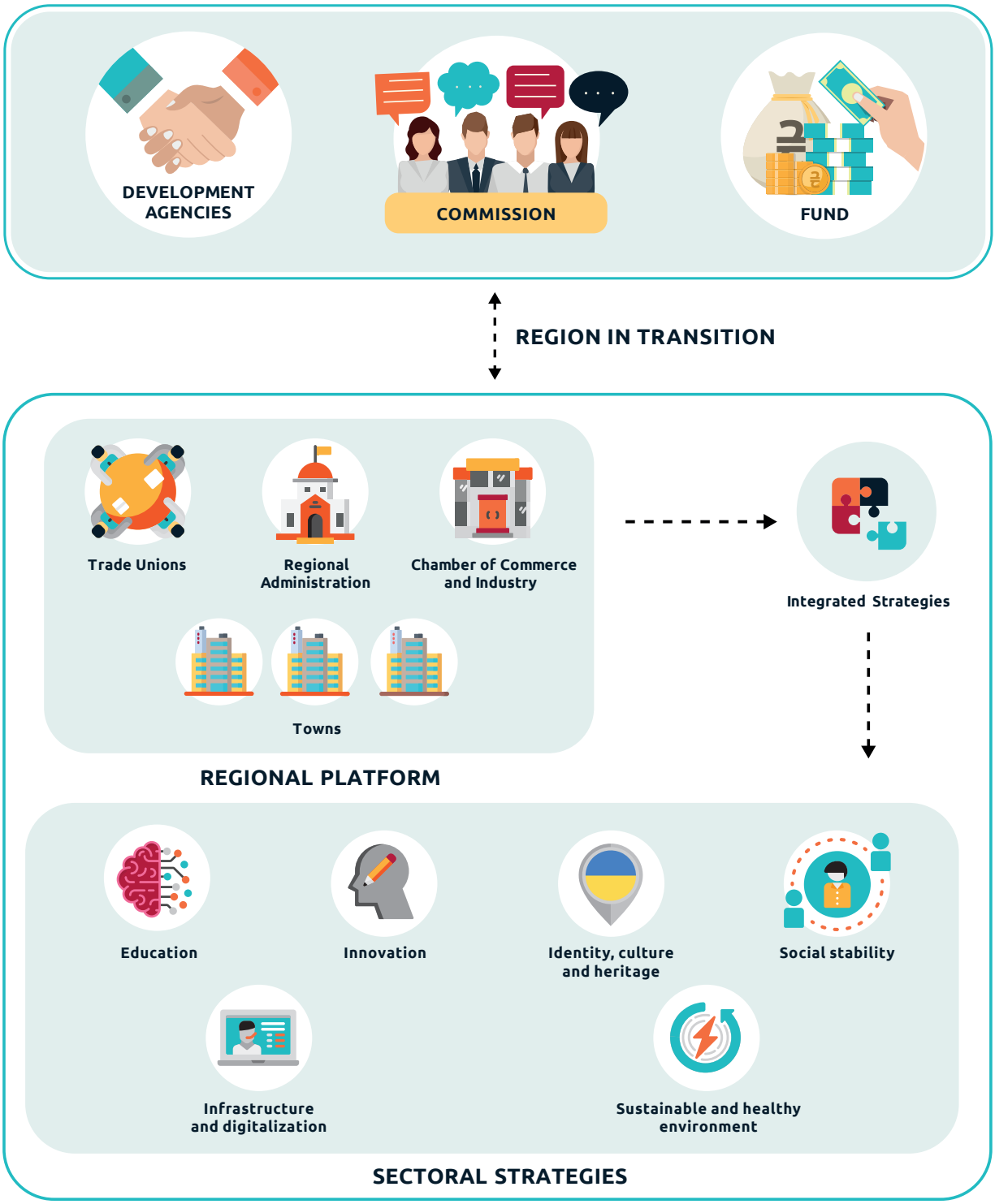
The project and study were supported by the Federal Ministry for Economic Cooperation and Development of Germany (BMZ) through bengo / Engagement Global.

german cooperation
DEUTSCHE ZUSAMMENARBEIT

With funding from the
Federal Ministry for Economic Cooperation and Development

ENGAGEMENT GLOBAL
Service für Entwicklungsinitiativen

SUCCESSFUL STRUCTURAL TRANSFORMATION. OVERVIEW OF THE PROCESS



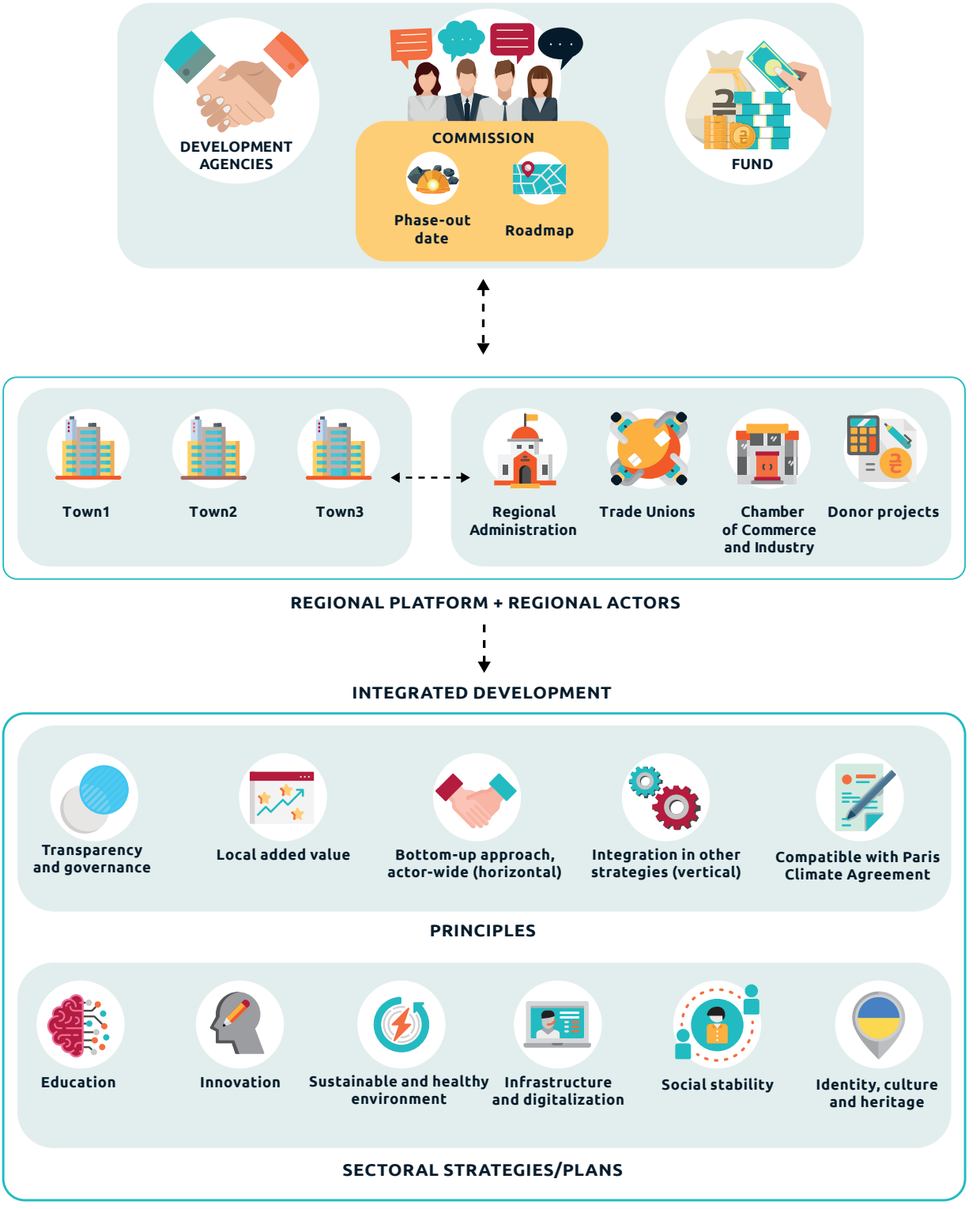
2. Recommendations for Coal Regions: how to manage a proactive transition process?

NATIONAL LEVEL:

- Establishment of a Commission for Structural Changes, consisting of representatives of the main stakeholders (national and local authorities, trade unions, science, NGOs, business), which will provide recommendations to the national government
- Setting a coal phase-out date for the energy sector
- Creation of a Restructuring plan based on the Commission's recommendations
- Early cooperation with the affected regions - put local needs, interests and ownership first
- Creation of a strategic supervision and cooperation body with international institutions and donor organizations for coordinated support and ownership
- Creation of various Restructuring Funds (Economic diversification, Infrastructure development, Pension, Education etc.) aimed at innovative solutions
- Terminating allocation of direct and indirect subsidies to the coal industry, clear plan for reallocation into regional development of coal regions
- Check possibility of merger of all coal mines into one company and early planning for the phase-out
- Creation of national employment and requalification programs, employment agencies, public programs for job creation in other economic sectors
- Overhaul of the existing pension system, finance early retirement of coal miners
- Establishment of one entity/foundation covering environmental damage issues and perpetual mine management obligations
- Creation of new research and innovative centers, adapting (upper) secondary and higher education to new business, innovation and job opportunities.

Novovolynsk, Ukraine

FOCUS ON THE REGIONAL AND LOCAL LEVEL



Novovolynsk, Ukraine

REGIONAL AND LOCAL IN COOPERATION WITH THE NATIONAL LEVEL:

- Creation of local and regional programs for economic and social development
- Diversification of economic activities (creation of industrial and technological parks etc.)
- Shifting to sustainable energy generation (installation of RES capacities, energy efficiency etc.)
- Creation of new local and regional educational institutions, research and innovative centers
- Improvement of local infrastructure (transport, digital etc.)
- Creation of a regional planning agency, which has a mandate for the specific mining area
- Establishment of regional participation events (workshops, conferences) for municipal actors
- Development of a unique marketing campaign for the area, relying on the potential for innovation, economic development and cultural heritage/tourism
- Early recultivation and revitalization of the lands located in the areas that have been affected by mining activities, management of waste, water etc.
- Creation of business-friendly economic environment (through local legislation etc.), promotion of the region as such.

COAL REGIONS RESTRUCTURING FUNDS FOR EACH COAL REGION

ADVISORY BOARD

Regional Development Agency, Civil society, labour unions, business associations etc.

BOARD OF DIRECTORS

Coal Regions Restructuring Funds

SUPERVISORY BOARD

Ukrainian Government and donor community

PENSION FUND

1. TOP-UP EXISTING PENSIONS SO PEOPLE AT AGE OF RETIREMENT DO NOT NEED TO WORK ANYMORE
2. ATTRACT WORKERS 55+ TO START EARLY-RETIREMENT

EDUCATION FUND

3. INVEST IN UNIVERSITIES AND VOCATIONAL SCHOOLS
4. SET UP EFFICIENT EMPLOYMENT AGENCIES TO PROMOTE TRAINING AND RE-EMPLOYMENT

STRUCTURAL DEVELOPMENT FUND

5. INCENTIVIZE BUSINESS INVESTMENTS AND SUPPORT COMPETETIVENESS OF EXISTING ENTERPRISES
6. INVEST IN INFRASTRUCTURE (TRANSPORT, DIGITAL INFRASTRUCTURE, RELIABLE ELECTRICITY SUPPLY, RESEARCH)
7. FINANCE THE CLOSURE OF MINES AND ENSURE A SAFE DECOMMISSIONING
8. REGIONAL FUTURE FOUNDATION

* The fund should be funded mainly by re-purposing the extensive coal-mining subsidies
* Additional funds should be requested from the Donor Community in exchange for a role in the governance process

Supported by:

Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

Low Carbon Ukraine

Country Analysis

3. Germany

National Policies and trends in coal mining and socio-economic development

and

Regional study: Ruhr, Rhine and Lusatia Area

Timon Wehnert, Head of Berlin Office of Wuppertal Institute

Pao-Yu Oei, Research Fellow at German Institute for Economic Research

Part I: Description of status quo and historic development

Political debates on the phase-out of coal in Germany and globally

Impending climate change requires the end of unabated coal combustion, the most greenhouse gas emissions-intensive energy industry (UNEP Gap Report 2017, 2018). With the Paris climate agreement, the world community committed to keeping the global temperature rise to well below 2°C, aiming at 1.5°C, compared to preindustrial levels. Even a global warming of 1.5°C would likely have dangerous implications (IPCC, 2018). Consequently, in 2017, at the COP 23 (23rd Conference of the Parties) in Bonn, several countries founded the "Powering Past Coal Alliance". The alliance pledges to end coal consumption by 2030 for OECD countries and by 2050 for all other countries. As of December 2018, 30 countries have joined this alliance (Powering Past Coal Alliance, 2019). In 2018 at the COP 24, additional treaties regarding the need for a "Just Transition" of coal workers were emphasized (COP24, 2018; Climate Strategies, 2019).

Germany did not participate in this new alliance against coal as it is still one of the countries with many active coal mines and a large coal-fired power plant fleet. Despite being seen as an ambitious country in climate protection negotiations, Germany is set to miss its 2020 climate target of -40% compared to 1990 emissions. Public debate surrounding a coal phase-out largely deals with the challenge of structuring the upcoming transition for the affected regions. The government, however, acknowledged the need for climate action and has agreed on a phase-out pathway by 2035 to 2038. This decision was proposed by a commission consisting of members from industry, civil society, scientists and unions. Polls revealed that 73% of the German population would have even supported a faster coal phase-out (Zeit, 2019).

Status quo of coal use in Germany

Germany profits from the fact that a large share of its coal decline has already been managed within the last decades. Germany therefore provides a case study to analyze the history of the phase-out of hard coal mining in the Ruhr area, and the reduction of lignite

mining in East Germany as a result of Germany's reunification. To enable a Just Transition for coal extracting and burning countries, previous experiences can help to design better policies to structure the decline of the coal industry. Despite having specific regional characteristics, Germany's experience provides valuable lessons for other regions with a phase-out ahead. Learning from the past could help to prevent the repetition of mistakes, and ensure that previously successful policies might be implemented in a similar fashion. (Herpich et al., 2018).

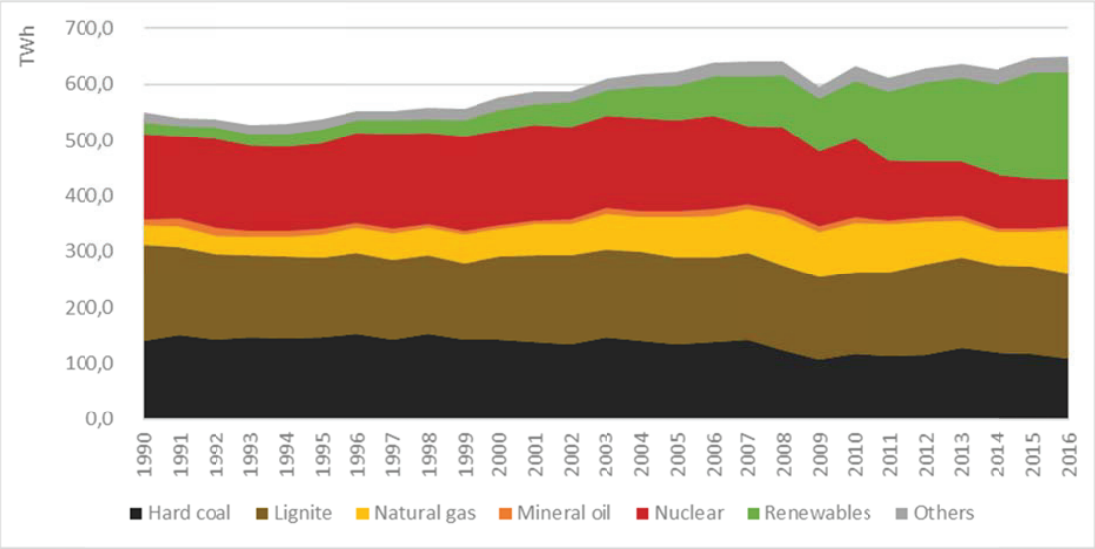
The German lignite-fired power plants and lignite open-cast mines (see **Figure 1**) are concentrated in the Rhineland, Lusatian and Central German coal regions. By contrast, hard coal-fired power plants are widespread throughout Germany, but most are situated in the Federal States of the former Western Germany. The remaining economically inefficient hard coal mines were closed in December 2018 as former subsidies were prohibited by European regulation. Rising hard coal imports since the 1950s mostly originate from Russia, the USA, Colombia, and South Africa (DIW, WI, Ecologic, 2019).

Figure 1: Remaining coal power plants in Germany in 2018

Source: DIW / WI / Ecologic (2019)

In 2019, hard coal as well as lignite in Germany is mostly used in the electricity sector. In overall primary energy consumption, the share of coal has been declining over the last decades, which is due to coal being replaced by gas in heat sector. Coal consumption for electricity generation, however, has increased until the 1990s and has been fairly constant despite climate mitigation actions since the 1990s (see **Figure 2**). In August 2018, roughly 21 GW of net nominal capacity from lignite and approx. 24 GW from hard coal-fired power plants were still in operation. In 2017, lignite accounted for 23% and hard coal for 14% of gross power generation.

Figure 2: Gross electricity generation in Germany 1990 – 2016



Source: Statistik der Kohlenwirtschaft e.V. 2017a

Environmental impact from coal extraction and combustion:

In Germany, 80% of current CO_2 emissions from electricity come from coal burning, necessitating a coal phase-out to meet agreed-on climate targets. In addition to CO_2 emissions, coal is responsible for further emissions of other pollutants such as Mercury, NO_x, and SO_2. This harms especially the health of children, sick and elderly people and causes additional overall public health costs (see **Figure 3**). As a consequence, air pollution from lignite and hard coal fired power plants in Germany is responsible for 4,350 premature deaths per year (CAN Europe, et al., 2016). Coal mining leads to big changes for surrounding water sources. In some cases, pumps still have to run to reduce the level of pit water even after coal is no longer mined (RAG, 2019).

Figure 3: How air pollution from coal power plants may harm your health

Source: Heal (2018)

Key messages / Synopsis

- → **80% of current CO_2 emissions from electricity come from coal burning. Therefore, to meet its GHG emission reduction targets, Germany has to phase out coal generation**
- → Besides climate, coal also has negative effects on the environment and health
- → **Germany will phase-out coal by 2035-2038**

A historic view on coal mining

For more than two centuries, coal has been very important for Germany's economic and industrial development. Today's challenges of phasing-out coal for climate reasons and especially today's political debates on the issue can only be understood against the background of the historic importance of coal and its decline over the last decades. Therefore, this section analyzes the historic development of coal mining in Germany after world war two. It highlights differences between East and West Germany, and between hard coal and lignite.

After the Second World War, Germany was divided into West and East Germany. The main mining sites of underground hard coal were based in West Germany, whereas in East Germany, hard coal mining was conducted on a much smaller scale and ended already in 1978 (see below). For West Germany, the domestic hard coal reserves were more than just an energy carrier, since they helped to rebuild its industry and enabled its “economic miracle”. Their importance - well beyond Germany - can be illustrated by the fact that the European Coal and Steel Community (ECSC) was founded in 1951 together with Italy, Belgium, France, Luxemburg and the Netherlands. The ECSC eventually became the predecessor of the European Union (Herpich, et al., 2018).

Lignite has been mined in both West and East Germany. But especially for East Germany it was the major energy carrier, as the socialist country could rely less on the import of fuels.

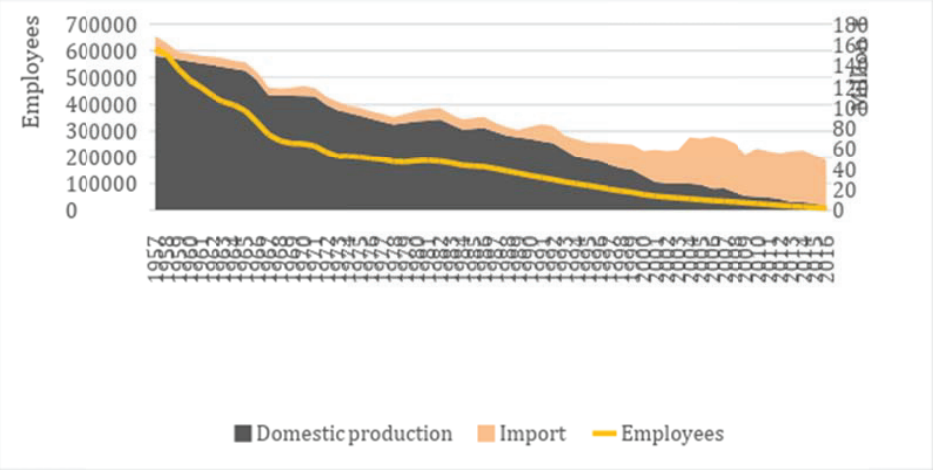
Hard coal mining in West Germany

By the middle of the last century, Germany was the second largest coal producer in Europe (second to the UK). Mining was concentrated in the Ruhr area where more than 80% of Germany's hard coal was mined. In 1957 employment peaked at more than 600.000. About 500.000 of these direct jobs in coal mining were in the Ruhr area. Coal was not only used for power generation and heating, but also for steel production. As a result, the Ruhr area remained the industrial heart of Germany (Herpich, et al., 2018).

After 1957, jobs in hard coal mining rapidly declined: Within ten years, 320,000 people had lost their jobs (see **Figure 4**) (Statistik der Kohlenwirtschaft 2017b, 2017c). Reasons were of

technological and economic nature: mechanization of mining led to higher efficiency in mining - with lower employment rates; coal production decreased because of higher shares of other energy carriers (oil, gas and nuclear) and in later years an increasing share of imported coal. While hard coal mining in Germany became more and more expensive as mining companies had to dig ever deeper shafts, the production costs in competitor countries remained lower due to more accessible mine fields, lower wage levels in some countries and reduced costs for global shipping of coal.

Figure 4: Domestic hard coal production, imports and employees of West Germany



Source: Herpich, et al. (2018) based on Statistik der Kohlenwirtschaft (2017b, 2017c) and Verein der Kohleimporteure (2017)

Apart from the Ruhr area, hard coal was also mined in the Saarland (see Table 1). But the process of phasing out coal mining showed quite different dynamics - largely due to very different framework conditions. In the Saarland, the number of miners was about one tenth of those in the Ruhr area. Furthermore, mines were largely owned by the public, granting the federal government important influence on the transformation process. Consequently, the transition process was smoother in the Saarland. Part II of this article, which deals with structural policy and regional support actions consequently describes the more demanding transition in the Ruhr area.

Table 1: Differences between the Ruhr area and Saarland

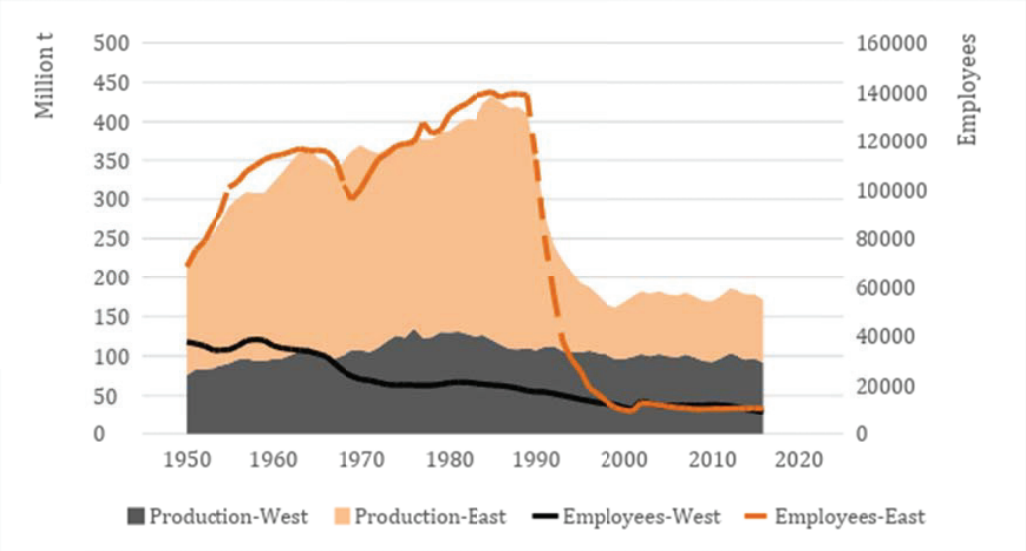
	Ruhr area	**Saarland**
Population	Most densely populated area in Germany, >5 million people	~1 million people
Employment in mining	1957: ~500,000 1967: ~230,000 1977: ~150,000 2017: ~4,500	1957: ~65,000 1967: ~32,500 1977: ~22,000 2017: ~139
Phase-out date	2018	2012
Ownership of the coal production	Private	Public
Regional resistance against transition	Protests against coal reduction in the mining regions; strong connection and identification with jobs in hard coal production; resistance of coal corporations to give land to new businesses	Less resistance; measures to provide land for new corporations; security concerns due to earthquakes
Competition in the region	Strong intra-regional competition of the cities in the Ruhr area	Early realization to connect with other cities across the border in France and Luxemburg to overcome the fringe status

Source: Own illustration based on Herpich, et al. (2018)

The importance of lignite for East Germany

Both East and West Germany possess large lignite reserves. The production of lignite continuously increased in both parts of the country after the war. However, the economic importance of lignite mining in East Germany was much higher, as the capacity of the socialist state to import energy fuels was very limited. Lignite became the primary energy source which was domestically available. Production peaked in 1985 when around 160,000 direct employees produced 430 million tons of lignite. About 90% of the employees worked in the mines of East Germany. In East Germany, lignite production was characterized by high overcapacities and inefficiencies (Kahlert 1988, p.15). Right before the reunification in 1991, the average production in tons per worker in West Germany was three times higher than in East Germany. Reunification caused major changes for the Eastern German energy industry since it was not able to compete with Western standards, which produced at lower costs and had higher efficiencies. As a result, demand for East German Coal was drastically reduced. Also, remaining mines had to optimize their production cycles to stay profitable, resulting in additional lay-offs. As a consequence, between 1989 and 1994 over 100,000 employees lost their jobs and production decreased by about 200 million tons (Statistik der Kohlenwirtschaft (2017b, 2017c) . Unlike the hard coal decline, lignite broke down within just a few years, leading to a structural disruption. Since the mid-90s, lignite production and employment has stayed almost constant, however, at only a fraction of the pre-reunification time. Despite this, Germany is still the largest lignite producing country in the world. **Figure 5** displays the lignite production and employees in Germany from 1950 – 2016. Table 2 highlights the key figures of the three remaining lignite regions in Germany.

Figure 5: Lignite production and employees in Germany 1950 – 2016



Source: Herpich, et al. (2018) based on (Statistik der Kohlenwirtschaft e.V. 2017d)

Note: The values for lignite production are displayed as stacked areas for East and West Germany, while employment figures are depicted as individual lines. Since 2002, the employees of lignite-fired power plants are included.

Table 2: Comparison of key figures of the German lignite regions (base year 2014, unless stated otherwise)

	Rhineland	Lusatia	Central Germany	Germany
Labour force [inhabitants]	3,261,791	518,072	1,602,561	4,560,388
Share of people over age of 50	43%	55%	48%	43%
Population density*	700 inh./km²	106 inh./km²	222 inh./km²	230 inh./km²
Unemployment rate	7.3%	11.0%	9.2%	5.7%
Gross value added	204,602 Mln. €	22,606 Mln. €	71,090 Mln. €	2,624,437 Mln. €
Share of mining, energy, water of overall industry	4%	13%	5%	3%
Employees in lignite according to own calculation**	8,873	7,763	1,895	18,531
Installed lignite capacity**	10,370 MW	7,000 MW	3,330 MW	21,000 MW
Lignite production **	95 Mln. t	63 Mln. t	19 Mln. t	178 Mln. t
Generated electricity by lignite (gross) **	79 TWh_{el}	49 TWh_{el}	17 TWh_{el}	150 TWh_{el}
Lignite reserves**	2,479 Mln. t	1,291 Mln. t	395 Mln. t	4,165 Mln. t
CO_2-emissions of lignite-fired power plants **	95.2 Mln. t	56.7 Mln. t	18.7 Mln. t	170.6 Mln. t

Sources: DIW, et al. (2019) and Holtemöller and Schult (2019)

*Note: *The cities Chemnitz und Halle in Central Germany and Görlitz and Cottbus in Lusatia are responsible for a higher density; ** Status at the end of 2017*

Key messages / Synopsis

- ➔ The importance of coal mining in Germany has decreased significantly in the last decades. Employment peaked with 750.000 miners in 1957 (80% of which were in hard coal mining). Today there are only 20.000 jobs left in lignite mining. Hard coal mining was phased out in 2018.
- ➔ **This historic reduction of hard coal mining was due to economic and technological developments (mechanization, globalization, cheaper coal imports, re-unification) and not due to environmental / climate concerns.**

Beyond the hard facts - narratives of coal mining and use

The transition away from coal is not only a question of structural change in the sense of a technological and economic transition. It is a cultural, and for many people an emotional issue as well. In most coal regions around the world, mining is an important part of the regional identity. This may be even more true for underground hard coal mining compared to open pit lignite mining, because the risks of working underground have formed a strong sense of comradeship in mining communities. But in general, miners have their very own tradition, starting with clothes, a patron saint (St. Barbara), songs and rituals.

In Germany, coal mining has been a fundamental element of the regional identity in mining regions like the Ruhr Area or Lusatia. But even beyond that, coal became an important element in the national narratives of both post-war German states. After the second world war, Germany was in ruins and its economy was very weak. But West Germany recovered very quickly in the 1950s. The coal and steel industry of the Ruhr Area was an important driver for the tremendous economic growth the west was experiencing. The Ruhr Area was called the "fly-wheel of the economic miracle" ("Schwungrad des Wirtschaftswunders") and thus became a key element of a national *phoenix from the ashes* narrative. Political choices in the late 50s until the late 80s can only be understood against the background of this narrative, mixed with cold-war paradigms, which mutually enforced each other.

Although the political system and the use of coal in East Germany was very different compared to West Germany, the importance of coal for the national narrative was just as high. In 1948, the young socialist government started what would today be called a motivation campaign. The activists movement was supposed to be a leading example of hard working people who overperform and help to build the socialist state. Adolf

Hennecke, a hard coal miner, was iconised as an "activist of the first hour" ("Aktivist der ersten Stunde"). He was given a well prepared shift, where he was able to dig 387% of the daily norm of coal - "proving" of what a committed individual could do for his country. The activist movement extended into all economic sectors, but the hard working coal miner remained a symbol for the movement. As late as 1988 medals to be given to people who did well in their job showed the iconic picture of the miner Adolf Hennecke. This is irrespective of the fact that hard coal mining had ceased a decade earlier in East Germany. But the iconisation of the coal miner continued and was seamlessly passed on to lignite mining, which at this time constituted for 83% of the East-German energy supply (Jänicke, et al., 1987).

Also today, where the economic importance of coal mining has diminished, the heritage of coal mining is kept alive in (former) mining regions. Both Lusatia and North Rhine Westphalia call themselves "energy regions" (Energieregion). In the Ruhr area, many of the big football clubs were initially founded as clubs of the workers in the collieries. Consequently, when hard coal mining was stopped finally in 2018, the famous club "Schalke 04" played in tricots displaying the names of the former collieries in the region - and not their prime sponsor Gazprom.

Noteworthy is also the high lobbying power of the miner's trade unions, which cannot be explained alone by the current economic significance of coal mining. The image of the miner is, on the one hand, that of honest, working class people. On the other hand, German miners received above average income, with good social benefits, not only contributing to taxes and income for the region but also being a symbol for the success of the worker’s struggle in the capitalistic economy. Miners have high membership rates in the trade unions (much higher than those in the "young" renewable industries). Thus miners are an asset for the industry trade unions who have generally been losing power and influence over the last decades. Likewise, the political party of the social democrats (SPD), the second largest party in Germany, is in recent years facing a dramatic loss of importance. This is partly because it has strong ties to the unions in the industrial sector and the SPD’s traditional strength in NRW and Brandenburg (the two states with major coal mining activities).

So in many ways, strong narratives exist which link coal mining to the "good old times”. Whether that be when the Ruhr Area was the economic heart of West Germany or when lignite from Lusatia was fuelling the East-German economy, when industry trade unions were the powerful attorneys of the common worker or when hard manual labor could pay you above average wages. After decades of decline, the final phase-out of coal mining is a threatening symbol that these good old times may never come back.

Key messages / Synopsis

➔ beyond the importance for the economy and the energy supply system, coal mining is deeply entrenched in national narratives and regional identities, which makes a transition away from coal even more difficult.

Part II: Description of structural policy and regional support actions

Overview of structural policy in the Ruhr Area

The downturn of hard coal mining in Germany began in the late 1950s (see also above) as German coal became less and less competitive. The predominant perception was that the coal and steel industry in the Ruhr Valley was “too big to fail” and, consequently, politics stepped in with public support programs following a two track approach:

- restoration and modernization of the coal (and steel) sector, which included heavy subsidies for German coal and support schemes for workers who were facing income losses;
- diversification of the economic base of the region and fostering innovation in economic sectors other than the coal and steel sector.

Although both tracks were addressed in parallel, a clear shift in priorities is visible over the 60 year of structural policy in the Ruhr area: In the beginning, the emphasis was clearly on supporting the coal sector and workers. Meanwhile, in later years, the diversification of the economy became more and more important. In this article we briefly describe key structural policy measures of Germany's largest hard coal mining area and give an overview of funding figures over the last 60 years. For more detailed descriptions and assessments of priorities in the various phases we recommend the following papers in English: Dahlbeck and Gärtner, 2019; Herpich, et al., 2018; Taylor, 2015.

Modernizing the coal sector, subsidies and support schemes for workers

In the late 1950s and early 1960s the coal crisis was perceived by many as a temporary phenomenon. Accordingly, many countermeasures were not addressing structural change: surplus coal was put on stock in gigantic heaps (13 mt in 1958), miners were put on reduced hours, import taxes were introduced on coal and oil to protect German coal mining (Spiegel, 1958). Additionally, early retirement in the mining industry was financially supported by the state (Farrenkopf 2009, p.81, p.94). In the short-term, these measures were able to alleviate negative consequences for the industry and affected workers,

however, the measures did not succeed in addressing the structural problems of the hard coal sector.

In parallel efforts were undertaken to make the German hard coal sector more competitive. On the one hand this included innovation and technology development (e.g. in mechanization of mining gear). On the other hand, a massive restructuring of the whole industry took place - largely driven by governmental interventions. In retrospect, this process is only understandable against the political situation of post-war Germany and Cold War Europe. Without going into detail, it needs to be noted that the European Coal and Steel Community (ECSC), which was established in 1951, was seen as a way to prevent further war between France and Germany. The treaty created a common market for coal and steel among its member states - and eventually led to the formation of the European Union.

In 1958 the first mine was closed in the Ruhr valley - provoking massive protest by the labor unions. But in order to make German coal generally more competitive, it was necessary to close down the least competitive mines. The political struggle was solved by a quite unique institutional set-up. In 1968 about 80% of all hard coal mines in Germany, which were previously owned by independent private companies, were merged into one company the "Ruhrkohle AG" (later including mines from the Saar region and renamed into RAG). The federal government of Germany covered for outstanding debts of companies joining the Ruhrkohle AG. The labor unions secured massive influence within the company, up to the level of specific rights for workers in the coal and steel sector, which were even enshrined in federal law ("Montanmitbestimmungsgesetz"). Through this institutional set-up, the labor unions reached an agreement that workers from a closed mine could either continue working in another mine or enter an early retirement scheme.

The Ruhrkohle AG/RAG also served as a vehicle to channel the massive public subsidies into the sector. To name two examples: in 1968 most of Germany's steel mills signed a contract to buy coal only from RAG, whereas the German government covered the gap between the German coal and the cheaper imported coal (Klute, 2015). Likewise for electricity production, since 1965 a series of laws were implemented, which provided the framework for the German electricity utilities to predominantly use German coal and to levy a surplus charge (so called "Kohlepfennig") from their customers in order to cover price differences to cheaper international coal.

By 2008, the institutional set-up was extended by implementing a foundation ("RAG Stiftung") which also covers environmental damage issues and perpetual mine management obligations (see below).

Proactive structural policy: diversifying the economy of the region

Right from the beginning of the coal crisis, the regional government of North-Rhine Westphalia (NRW) made efforts to diversify the economic base of the region. First steps

were to attract new companies. One example: as early as 1959 the regional government had started negotiations with General Motors on the installation of a car factory in the city of Bochum. As the decline in domestic coal production and related employment accelerated, the government of NRW started to address the need for an economic reorientation in a more strategic way: it launched its first structural policy program called "Development Program Ruhr" in 1968 with a volume of 17 billion Deutsche Mark (equals 32 billion € real) (Goch, 2009, p.146), which bundled hitherto individual and isolated measures.

One key obstacle to attracting new businesses to the region was the availability of suitable land. Large areas, also in the cities, were in the hands of coal mining companies. But even if they were not using the land anymore, they were unwilling to sell it as they feared that new companies in the region could increase the competition for cheap and/or qualified labor. This behavior of the mining companies was later even coined with a new term: "ground lock" ("Bodensperre"). Over the decades the public sector tried to address this issue with a series of interventions, ranging from buying individual pieces of land and reselling them (e.g. in the case of the above mentioned car factory) down to establishing frameworks and institutions responsible for site conversion (see below).

In the late 1970s the effort was made to coordinate structural policy actions even better. The oil crisis (1973 and 1979) had a negative effect on the steel sector and consequently on the prospects of coal mining in the Ruhr. As an answer in 1979, the "Action Program Ruhr" combined several individual measures for technology and innovation support, ecology, culture and the labor market. One goal of the program was the better coordination of the various measures by the federal government, the state and municipalities. Although a majority of the measures were still implemented in an isolated way, the result was a more dialogue-oriented approach to policy making. The program improved the Ruhr area's situation in terms of soft location factors (e.g. improving the regional image, more cultural activities, etc.). Although it led to the creation of several new technology centers, it was not able to substantially diversify the economy, as large part of subsidies still went to the coal and steel industry.

Since the mid of the 1980s a paradigm shift in regional structural policy occurred: Policy makers had realized that there was no single industry likely to replace the steel and coal sector in a way so that it could stabilize the Ruhr area's economy. The new approach regionalized the structural policy, mainly via regionally planned development strategies including individual strength and weakness analyses (Goch, 2009, p.156). In later years, regional development approaches were increasingly aligned with EU structural policy approaches, which also aim at specific profiles of regions, like the cluster policy and the EU smart specialisation strategy (European Commission, 2018).

It is important to note that the above named explicit structural policy interventions were accompanied by other public programs. These programs were to some degree independent. Nevertheless, they showed great synergies in terms of regional development. Two examples are transport infrastructure and research & education.

The cities within the Ruhr area were originally not sufficiently interconnected by transport routes. Coal miners often lived in quarters close to the mines and therefore the need for an infrastructural connection between the cities was neglected (Bogumil, et al., 2012, p.15). The economic reorientation needed a higher mobility of workers since the distances between their homes and jobs were likely to increase. Over the last decades strong investments were made into transport infrastructure. However, it is hard to assess which amount of funding should be attributed to structural change policy or the usual transport policy efforts.

As a result, public transport and transport infrastructure funding is generally not accounted for in the figures of regional structural funds (see below),despite the fact that improving the regional transport capacities can strongly support the economic development of the region.

Another important prerequisite for successful structural change is the availability of a skilled labor force. Up until the 1950s, coal mining was dominated by manual labor - and the Ruhr valley (with more than 5 million inhabitants) did not have a single university. Only in 1965 the Ruhr-university Bochum started operation. Today there are five universities, 15 technical colleges and 49 research institutes in the region, employing over 31.000 people providing education and knowledge for innovation, thereby increasing the attractiveness of the region (Prognos, et al., 2015). Some of the first technology parks in Europe were founded in the Ruhr valley, which provided a fertile soil for the cooperation of research institutes, companies and business start-ups. For example Technologiepark Dortmund, founded 1984, today hosts about 300 companies with 8.500 employees (TZDO, 2019). As much as the development of a vital research and education landscape had aided the structural change process, it is hard to attribute exactly which activities were specifically related to structural policy and which to general increase of academic training and research activities, which took place in Germany in general over the last decades.

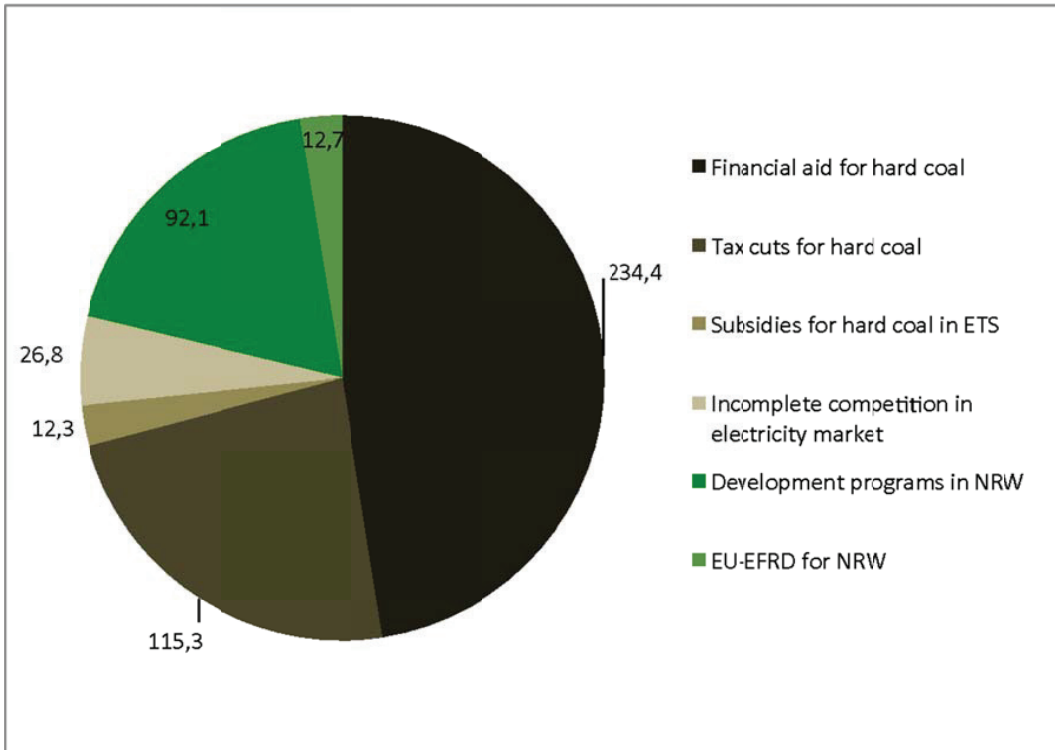
Budget volumes of structural policy measures

It is very difficult to pin down the amount of money spent on structural support for the German coal mining regions / the Ruhr area, because it is impossible to clearly define what is structural policy and what is sector policy (e.g. transport, research, education). Many publicly supported activities in Germany's coal regions may have happened regardless (e.g. construction of roads, establishment of universities etc.) and thus cannot not be labelled structural policy due to coal phase-out. But undeniably they did have a strong impact on the transition process. Furthermore, the very specific features of the German policy framework has provided support, which may not be available in the same way in other countries (e.g. social security, unemployment support and retirement schemes etc.). In contrast, costs may have been higher in Germany than what can be expected in other countries due to specific framework conditions (e.g. the power balance in Germany's federal system - see below). Despite these methodological difficulties, an assessment of budgets spent on structural support is obviously of high interest. Thus, in

this section we give an overview and briefly assess the budgets for explicit structural policy for the Ruhr area, which can directly be linked to support due to the economic downturn of coal mining.

The majority of costs were linked to structural and social policies to slow down the economically driven phase-out as depicted in **Figure 6**. Germany conserved a shrinking share of its hard coal production for more than 60 years with subsidies. These subsidies consist of various elements, e.g. direct subsidies, infrastructure investments or labor market interventions. Germany spent close to €390 billion on direct and indirect hard coal subsidies, dwarfing the roughly €100 billion spent on regional development (some of which also included support for the coal industry, e.g. in the form of research and innovation support for the mining sector). This massive and long-term subsidization slowed down the speed of structural change. On the positive side, this ensured against a harsh structural break and secured a socially accepted phase-out of many hundreds of thousands of mining jobs. But this approach came at very high costs: not only did the German population at large have to pay for the subsidies, but it also acted as a barrier against the necessary diversification of the economy. There are certainly many reasons why German politicians agreed to support coal mining as long as they did. One might be the federal structure of Germany, which enabled the states to externalize the costs of transition and did not incentivize them sufficiently to accelerate the reduction process (Feld, et al., 2012, p.581). Also, the subsidies in the Ruhr area supported a German company that was interconnected on the regional level, since politicians were holding positions within the firm and cities were shareholders of the company. The acceptance of change among the citizens of the Ruhr area (and Germany) might therefore have been different if it would have been foreign mining companies, especially if the resources were exported.

Figure 6: Real values in billion € for measures implemented for conservation of hard coal and economic reorientation in North Rhine-Westphalia



Source: Own depiction, based on Meyer, et al. (2010)

The case of structural policy in the Ruhr area is certainly unusual and cannot as such serve as a blueprint for other coal phase-outs which will become necessary because of climate concerns. Retrospectively, a faster and more organized hard coal mining phase-out in Germany could have been much cheaper and resulted in a higher likelihood of the development of new industries. The challenge for other regions will be to find a more appropriate balance between softening hardships for companies and workers by the use of subsidies and social support programs on the one hand - and a much more proactive and future-oriented support for mining regions, fostering innovation and diversification. Key actions and policies which could be used or adapted for other coal mining regions are described in the next section.

Key messages / Synopsis

- ➔ The decline of hard coal mining has been going on for more than 60 years and has been accompanied by a massive, ongoing structural change process in the Ruhr area
- ➔ This transition process was deliberately slowed down by massive public subsidies for coal. Together with social support programs it was possible to avoid economic hardship for miners.
- ➔ **A stronger and earlier shift towards a more future-oriented support could have fostered more innovation and strengthened the regional economy - at lower costs for German taxpayers and energy consumers.**

Flashlights on key actions and policies

RAG - an example for a run-off company, to govern the phase-out of coal

In the case of hard coal mining, the RAG was a key institution which helped to govern the phasedown, and eventually phase-out of coal mining. With the formation of the RAG, all separate coal mining companies merged into one (private) corporation. In doing so, it was possible to manage the transition more efficiently (close down those mines first, which were economically least competitive), and at the same time provide solutions for laid-off workers (they could more easily transfer to another mine as it was now one big company).

In 2007 the assets of the RAG corporation were brought into a foundation. In this year, the German federal government had reached an agreement with the governments of the coal-mining states North Rhine-Westphalia (NRW) and Saarland, the RAG Corporation, and the Mining, Chemical and Energy Industrial Union (IG BCE) to discontinue government subsidies for coal mining in Germany by 2018. The goal of the new foundation was to ensure three key objectives (RAG, 2019):

- **Ensuring that coal mining is discontinued in a socially acceptable manner:** The foundation is providing qualification training to the employees promptly so that they can reenter the job market, and it is also informing them about new employment opportunities.
- **Financing perpetual mine management:** Even after the closure of mines many duties remain to be undertaken: securing the shafts and tunnels, eliminating mining-related damage, measures for the permanent management of pit water and groundwater etc.
- **Supporting education, science, and culture:** The foundation supports education, research and culture in the region. It specifically supports institutions that used to be regularly funded by RAG AG and whose survival would be at stake with the

closure of coal mining (i.a. German Mining Museum, the miners' choirs and orchestras).

The foundation's assets were made up not only of the old mines. During their profitable times, the mining companies had invested in other industrial sectors, namely real estate (including housing for their workers) and the chemical industry. Those assets, the companies Vivawest GmbH and Evonik Industries AG, have (partly) been included in the foundation's capital. This set-up reduces the risk that the long-term obligations have to be borne by the public, and takes the burden off the public budget.

Public frameworks and institutions to support industrial site conversion

The conversion of old coal mining and industrial sites and their re-use for new economic activities can be challenging for various reasons: For one, remains of previous use (pollution of soil and water, mining shafts, outdated infrastructure) require high investments for site conversion. As a result, the incumbents (like mining companies) are often not interested in selling land, even if they are not using it anymore, to postpone or avoid restoration costs. Furthermore, they have no interest in providing land as they fear that new companies in the region could increase the competition for cheap and/or qualified labor. In the Ruhr valley, these factors proved to be a major barrier. Despite massive public support programs for economic diversification, initially only a few new enterprises were able to settle in the Ruhr area (also due to the "ground lock").

As an answer to these challenges, new public institutions were set up. A property fund Ruhr and the "State development society" ("Landesentwicklungsgesellschaft"), which bought and restored former industrial sites, led to an end of the so-called "ground lock" (Metropoleruhr, 2010). This was only possible through a high level of engagement of local and regional governments with the private sector. Besides political will to support new industries, regional coordination of efforts was crucial to their success.

International Building Exhibition Emscher Park - an example for environmental revitalization and improvement of local quality of life

In the 1980s, the river Emscher was among the most polluted rivers in Europe. At this time, the core of industrial activity in the Ruhr area had already moved north (following the availability of coal), leaving the Emscher Region with high shares of very unattractive post-industrial sites. Against this background a new program was launched: the so-called "International Building Exhibition Emscher Park". In some way, the program marks a paradigm shift in structural policy. The focus was on improving the quality of life in the region. Over 120 projects were implemented between 1989 and 1999, supported by investments with a volume of DM5 billion (€4.4 billion real) – two thirds from the public budget. Projects included measures to implement an underground sewage system, improving water quality and opening up new living spaces for citizens and nature. The cultural and touristic attractiveness of the region was increased by transforming former

industrial sites into touristic landmarks, preserving the region's coal history. Furthermore, 17 technology centers were created and mining damages as far as possible were remediated. (Goch, 2009; Scheck, et al., 2013).

The approach proved successful to improve the quality of life in the region and thus supported "soft" location factors. With a short-term view, the program itself managed to create only a few new jobs. But it is generally acknowledged that it did increase the attractiveness of the region - both for companies and qualified workers. Some of the cultural landmarks have become major tourist attractions, drawing both national and international visitors to the region.

Enabling conditions which were critical to the success of the program were 1) an appropriate timeframe for program execution (10 years) and 2) a development agency, which was created specifically to execute the program and which was liquidated at the end of the program.

Research and education - a key success factor for regional transitions

At the peak of their mining activities all of the German mining regions had either very few academic facilities (e.g. first university in the Ruhr area only opened in the 1960s) or a research and education system that was predominantly geared towards energy and mining-related expertise, offering very little capacity for a more diversified economy. Improving the knowledge base in the regions has been one key success factor to prepare the transition away from coal. However, the strategic approaches taken differ strongly from region to region - which also corresponds to the very different framework conditions in the German coal mining regions: the very urban Ruhr area in contrast to rather rural Lusatia.

In the Ruhr area a wide variety of scientific institutions have been established very successfully over the last decades. However, it must be noted that developing a future oriented and effective innovation system is not an easy task. Over the last decades many different approaches have been tried and some have proven to be less successful. For example the technology transfer initiative in North Rhine Westphalia in the 1980s and 90s aimed at bringing science, industry and trade unions together in a huge networking effort - but it turned out too academic and lacked practical relevance (Heinze, et al. 1996). One interesting example is the Fraunhofer UMSICHT. It started in the 1980s based on engineering knowledge related to coal, but from the beginning explored options to use this knowledge in more future oriented fields. Environmental engineering (e.g. water and soil treatment) became one approach, which bridged the existing capacities to future business models. Today, the Institute is active in many industry sectors including material science, chemistry and energy.

Zukunftsagentur Rheinisches Revier - an example for a regional economic development agency in Germany's largest lignite mining area

The Rhenish lignite mining region in the west of Germany is a rural area but close to many urban centers. Compared to its 2.2 million inhabitants the number of 10,000 jobs in coal mining and power plants may sound small. But the availability of cheap lignite attracted many energy intensive industries, which today provide more than 90,000 jobs - more than 10% of all employees in the region work in the sector (IRR, 2018). Against the background of a foreseeable end of coal mining, the question "Which future for the region?" emerged well before Germany's recent coal phase-out plans.

Municipalities, business associations of the region and the trade union for the industrial sectors mining, chemical industry and energy (IG BCE) joined forces and became shareholders in a newly funded regional development agency. In the beginning it struggled with a weak mandate and inadequate funding. However today, the Zukunftsagentur Rheinisches Revier (http://rheinisches-revier.de/) has become an important promoter of regional development. Since 2014 the agency has been active in developing a shared vision and a development strategy for the region. It has organised idea contests, networking events and conducted studies on the future prospects of specific industry branches. All of this should be standard routine for a development agency. Important to note, however, are two points: 1) the towns of the region organised in the Zukunftsagentur have joined forces - and reduced competition among each other, and 2) the agency promotes a future-oriented thinking of a proactive structural change. One small example is that a process has been started to develop ideas for site conversion for the big power plants. Although their shut-down date was well into the future, various stakeholders in the region started developing ideas of how the existing infrastructure could be used for other uses. A prerequisite for the success of the Agency was that it has been receiving reliable support through EU structural funds.

LMBV as project executor for restoration and reclamation of the decommissioned lignite mining facilities in the eastern part of Germany

The Lausitzer und Mitteldeutsche Bergbau-Verwaltungsgesellschaft (LMBV) has restored and reclaimed decommissioned lignite mining facilities left behind by former East Germany in the Lusatian and Central German mining regions for over 20 years. This happened on behalf of and was financed by the German federal government and its states. The achieved reclamation and remediation of former lignite mining facilities has been a success story. Their activities have created safe landscapes that offer new perspectives – not only for the people who live and work there, but also for the landscapes themselves as they offer new possibilities for usage. In 2014 GVV (Gesellschaft zur Verwahrung und Verwertung von stillgelegten Bergwerksbetrieben mbH) merged with LMBV and now performs backfilling and securing of decommissioned potassium, spar, and ore mines as a business unit within LMBV. (LMBV, 2017)

Importance of participatory stakeholder processes

Participatory elements have been a key factor in various processes relating to phasing out coal and defining regional structural support actions in Germany.

Inclusion of stakeholders in defining regional support action in the Ruhr area

Over the last decades of structural policy in the Ruhr area, many different formats to manage and govern the process have been tried. While in the beginning, support programs were defined by the state government (consulting only a few stakeholders, mainly industry and labor unions), in later years much more participatory processes have been set-up. One challenge has been the polycentric structure of the region: the Ruhr area consists of many mid-sized cities, which partially are in competition to each other. On the other hand, they know their challenges and potentials better than the regional government could. Therefore, later regional development strategies encompassed both: 1) a regional planning agency (Metropoleruhr, 2019), which has a mandate specifically for the Ruhr area (which is unequal to administrative boundaries), and 2) delegating planning mandates to municipal actors or including them in strategic planning processes (e.g. so called "Ruhrkonferenz") (Klute, 2015). For specific programs, like the IBA Emscher Park (see above), citizens were able to participate in workshops which developed and discussed ideas for local development projects. It was generally acknowledged that elements of participatory design increased the acceptance of measures and improved their usefulness to the inhabitants of the region (Scheck, et al., 2013).

Reaching a compromise to phase-out coal within a commission of stakeholders in 2019

In the last years, the public perception of coal has shifted from being the former backbone of Germany's economy towards resembling the Achilles' heel of its energy transition. As a consequence from rising pressure of civil society as well as from the coal regions demanding financial support, the government started tackling the coal issue by introducing a **"Commission on Growth, Structural Change and Employment"** – often also referred to as "coal commission". The commission consisted of four chairs and 24 representatives of industry, labor unions, environmental NGOs, climate scientists, and the regions. Around one third of the commission's members can be grouped into a "pro coal" alliance, consisting of the trade union, industry, and local representatives of the lignite regions whose priority is to secure sufficient funds for the ongoing structural change. Another third forms a "pro climate" alliance of NGOs, climate scientists and local representatives pushing for a rapid coal phase-out. During the first meetings, external experts were invited to provide input on various topics to allow for sufficiently fact-based decision making. Critics hereby point out that the choice of experts did not include any representative from other affected countries of climate change, younger generations and less than 10% women. Also, the government refrained from setting clear guidelines for the

commission's work which might have eased consensus talks, e.g. through setting an indisputable CO_2 budget for the coal sector. The results of the commission - the coal phase-out by 2035-2038 - were celebrated by some as a unique settlement between all involved actors, and criticized heavily by others stressing that an earlier phase-out by 2030 would have been needed.

Part III: Conclusions

Conclusion on which of these learning can be relevant for other coal mining regions

Many framework conditions in Germany are and were certainly very different from those in other countries in general and in Ukraine specifically. This includes regulation, ownership structure of coal mines, economic structures within and outside the mining sector, political as well as socio-cultural frameworks. Nevertheless, we consider many lessons from more than 60 years of structural change due to reduced coal mining in Germany pertinent to learn from.

- A faster and more organized hard coal mining phase-out in Germany would have been much cheaper and resulted in a higher likelihood of new industries.
- It is not only necessary to have policies addressing unemployment, the economy and the energy system, but also measures to improve former coal regions' infrastructure, universities and research facilities as well as soft location factors like culture and environmental health.
- Implementing a fair and realistic transition from a fossil fuel-based economy can be managed when city, regional, national and supranational governments work together on designing a phase-out and a multi-level polycentric structural policy mix.
- The transition needs tailor-made institutions supporting their governance. Even if institutional set-ups should not be copied, but would need to be adapted, the challenges these institutions need to address are likely to exist in many mining regions: supporting workers when mines close, supporting the regional economic development (beyond energy and mining), perpetual mine management, industrial site conversion.
- One big challenge in the transition is capacity development. This is not only about the individual miner who may need training to be able to find another job. It is even more important to develop and transform the research and education institutions in coal mining regions. The challenge is that those institutes work more effectively if they link up to existing knowledge and industry in the region, but on the other hand they need to constitute a future-oriented innovation system providing knowledge outside coal and mining.

A final conclusion is that structural regional development processes take a very long time - even decades! In consequence, we see the necessity to start thinking about the

transition as early as possible. Coal mining regions will face the need to transition sooner or later - may that be because of increasing climate mitigation targets or because of depleted coal fields. The sooner strategies for the time beyond coal are being developed, the smoother the transition can become.

In our view, examples of historic coal transitions in Germany (and other countries) can provide valuable information for other regions. Firstly, are full of mistakes, dead ends, and failed experiments, which other regions should attempt to avoid. But they also show the potentials for Just Transitions, better and more sustainable jobs and transforming highly industrial and polluted areas into attractive and modern regions.

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4. Czech Republic

National Policies and trends in coal mining and socio-economic development

Klara Sutlovičová, Policy Officer, Czech Forum for Development Cooperation (FoRS)

Introduction

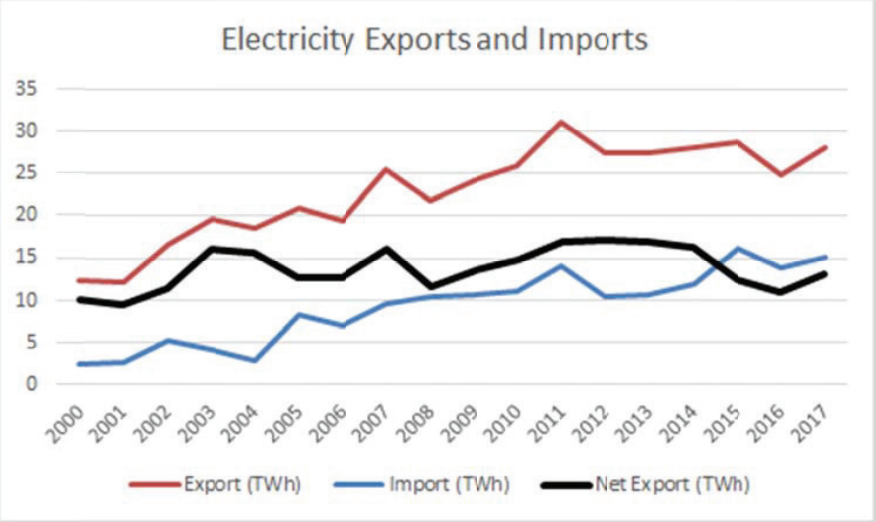
It was in the age of steam that the largely agriculture-based region in the centre of the European continent transformed into one of its fastest growing and most successful parts. Much of this growth until the First World War was driven by the exploration of local coal resources and by the expansion of the energy-intensive industries that formed the backbone of the Czech economy (Nielsen, 2017, p.11). This form of industrial use of coal to a substantial extent persists until the present day.

However, a combination of surface lignite mining, the concentration of related power and heavy industrial production and rather wasteful practices of the planned economy resulted in one of the most damaged environments in Europe in the 1980s (Moldan, 1990, cited in Fagin and Jehlička, 1998, p.113). People who criticised the communist government for being responsible for the situation were also among the chief proponents of democracy (Fagin and Jehlička, 1998, p.113). Protests against massive air pollution were an important part of the broader uprising that led to the collapse of the communist regime in 1989.

At present, the Czech Republic still has the third highest share (after Estonia and Poland) of coal in total primary energy supply: almost 37% in 2017, while lignite provides roughly 27% and hard coal 10% (Ministry of Industry and Trade, 2018a, p.30).

Given the availability of rather low quality lignite, it may come as a surprise that the country is a net electricity exporter. Since 2000 it has been one of the three largest net electricity exporters in the European Union next to France and Germany.

Figure 1: Electricity Exports and Imports



Source: Energy Regulatory Office, http://www.eru.cz/cs/

Only in 2012 excessive exports from Sweden and Norway shifted the Czech Republic into the fifth place. The energy import dependency of around 50% of primary energy consumption is among the lowest in the EU. However, the role of coal in the national energy mix is set to decrease. As lignite reserves become less available, new environmental requirements will be set in place and hard coal mining will face economic difficulties. The energy policy adopted in 2015 envisages by 2040 a partial replacement of domestic coal by nuclear and renewables in the electricity sector and by biomass, gas and imported hard coal in the heating sector.

Overview - statistical information about the coal sector

The largest lignite mining area is the Northern Bohemian basin, located along the border with Germany (Saxony). In addition, there is a smaller lignite deposit near the town Sokolov in the Northwest of the country. Hard coal mines are located in Northern Moravia, bordering with the Silesian coal mining region in Poland. The mining industry is concentrated in three regions: Ústecký, Karlovarský and Moravskoslezský regions.

a) Coal mining companies and their mines

There are four lignite mining companies in the Czech Republic:

- Severočeské doly (100% owned by ČEZ, the majority state-owned energy producer) with mines Nástup Tušimice and Bílina.
- Vršanská uhelná (private, up to 2013 a subsidiary of the Czech Coal, private) with mine Vršany.
- Severní energetická (private) with mine ČSA.

- Sokolovská uhelná (private) with mine Jiří.

There is one hard coal mining company: OKD (private) with three mines: Karviná, ČSM, Darkov. The company is in bankruptcy since May 2016.

b) Annual coal production

Lignite production was 39.3 Mt in 2017, so 21% lower compared with ten years prior; it correlates with domestic demand, mainly in the energy sector, which consumes 90% of supply.

Hard coal production was 5.5 Mt in 2017, the production decreased from the previous year by about one fifth, mainly due to the negative economic situation of the only domestic hard coal mining company (Ministry of Industry and Trade, 19.02.2018, online).

c) Annual coal consumption (by sector)

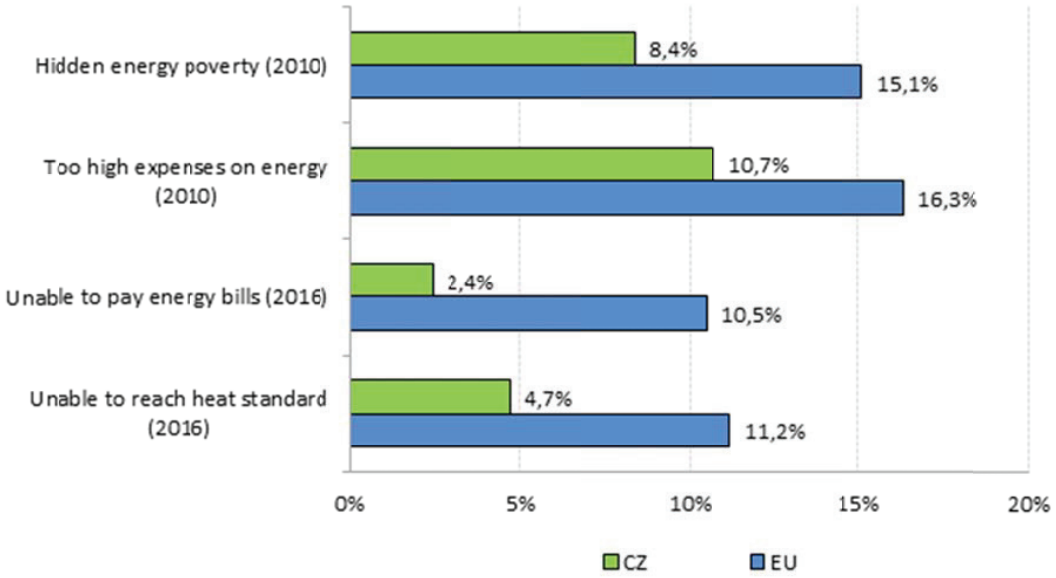
Hard coal is mostly used in the metallurgical and steel industry, but about 40% of the supply is consumed in the energy sector. Given the diminishing production of hard coal from local mines and expected further decline of its role in the Czech energy mix, the following analysis will focus on lignite. The implications of the needed phase-out of lignite are expected to be far more significant than in the case of hard coal.

Lignite is primarily used in electricity and heat generation (87.8% of supply), and the rest is used in industry (chemicals, paper, pulp and printing products) and households.

The heating sector is especially dependent on coal. Lignite is responsible for 44% of heat production. The situation in heat generation remains almost unchanged since 1990 (50% lignite, 24% hard coal, 14% gas). About 1.8 million households are supplied with thermal energy via centralized district heating (this equals to 37.1% of the inhabitants in the Czech Republic). There are almost 2,000 thermal plants registered in the Czech Republic engaged in heat generation, while also generating some 13% of gross electricity production in the cogeneration mode with an efficiency of about 60%. The State Energy Strategy adopted in 2015 aims for a 60% share of the combined heat and power production within the centralized heating system by 2040.

A significant part of coal use in the country is the large proportion of coal consumed by individual households, which accounts for almost 20% of final coal consumption. Coal provides an inexpensive heating option for about 330,000 Czech households, particularly in smaller settlements and villages. The estimates of energy poverty rates are therefore lower than the EU average: in 2016, less than 5% of households were not able to keep sufficient heat comfort and only about 2.4% of households encountered problems with covering their energy bills. Furthermore, about a relatively low 10.7% of households spend more than twice the median for energy (see **Figure 2**; Ministry of Industry and Trade, 2018b, pp.56-57). However, as the country neither has the necessary methodology to systematically monitor energy poverty, nor the legislation in place, the numbers above should be considered preliminary.

Figure 2: Energy poverty in Czech Republic compared to the EU average



Source: Draft National Energy and Climate Plan, Ministry of Industry, December 2018, https://www.mpo.cz/assets/cz/energetika/strategicke-a-koncepcni-dokumenty/2018/12/Navrh-vnitrostatniho-planu-v-oblasti-energetiky-a-klimatu-_prosinec-2018_.docx

Apart from domestic coal production, the country is also importing coal. In 2015, lignite imports were marginal at 1.0 Mt. However, the Czech Republic was for the first time in the last decade a net importer of lignite as a result of a surge in imports from Germany in 2013-14. Lignite was imported from Germany (91%) and Poland (8.9%). The Czech Republic started importing lignite from Germany following its acquisition of German lignite mining sites in 2009 to facilitate trans-border lignite deliveries (iuhli.cz, online).

d) Percentage of coal in electricity generation

In 2017, 43.8% of electricity was generated from lignite and 5.4% from hard coal (OTE, online).

e) Employment in coal sector

In the coal industry, the number of employees has been steadily decreasing. The number of jobs in the mining and quarrying sector decreased from almost 160,000 full-time equivalents (FTE) in 1990 to about 33,000 in 2005, about 21,000 in 2013 and 16,400 in 2016. The corresponding contribution of mining and quarrying to the total employment in the country is less than 1%. However, the situation differs in the regions directly affected by mining: in the Ústecký region, the mining industry contributes 2.35% to employment; while in neighboring Karlovarský region it is 3.91%. Given the fact that unemployment

rates in both regions are higher than the country average (4.7 % in Ústecký and 3.2 % in Karlovarský regions versus 3.1% overall in 2018), the impact of further decreases in coal mining jobs is not to be underestimated. The projected shift in energy policy envisages a reduction of jobs in the coal mining sector over the coming decades. It assumes a halving of employment in mining from 20,000 to 10,000 between 2015 and 2035 (Ministry of Industry and Trade, 2014, p.245).

f) Role of coal in the national economy

Coal mining in the Czech Republic is strongly influenced by global factors. This is above all global overproduction of coal, connected with price cuts, as well as tightening legislation in connection with air pollution and climate policies. Mining and quarrying have been contributing to the structure of gross value added by approximately 1% for several years (Ministry of the Environment, 2017a, p.31).

g) Environmental impact of coal extraction and combustion

Current annual external costs of the Czech mining industry, namely due to air pollution, amount to €2.4 billion (Melichar, Máca, Ščasný, 2012, p.21). According to a study by Stuttgart University, the air pollution caused by coal combustion is annually responsible for at least 18,000 years of life lost in the Czech Republic (Preiss, Roos, Friedrich, 2013, p.61).

A particularly pressing issue is the persistent high concentration of PM 10 and PM 2.5 particles in the air: excessive concentrations of PM 10 affected 23.1% of inhabitants in 2017 (7.3% in 2016). The dominant source of both the PM 10 and PM 2.5 is heating of households, including coal. Furthermore, over 60% of inhabitants are affected by excessive concentrations of benzo(a)pyrene, with 98.4% of the pollution being traced to household heating (Ministry of the Environment, 2017b, p.17). With regard to new European pollution standards (starting in 2021) for large combustion sources, 8 out of 12 Czech coal power plants will comply, while the remaining 4 plants would have to invest in modernisation, limit their operation to an economically problematic 60 days per year or shut down completely (Hnutí Duha, Greenpeace, 2018, p.2).

Political Aspects

a) Existence of a national plan and its implementation

The Czech Republic has no phase-out plan for coal. However, as a result of a 1991 government resolution on territorial environmental limits, significant amounts of economically extractable coal reserves are non-accessible. As of January 1st, 2016, there were 737 Mt within the lignite mining limits, but also more than 900 Mt economically recoverable reserves that could be made available by extending/removing the limits. If current rates of extraction and current mining limits continue to be applied, lignite would be available for roughly another 20 years.

The territorial limits affect the coal mines and related power plants very differently, with some mines set to be exhausted by 2024 and others currently having license to operate

into the 2050s and even beyond. It is therefore not possible to name a clear exhaustion year under present circumstances.

According to a government energy policy adopted in 2015, electricity generation should transform by moving away from coal in favour of nuclear power, natural gas and renewables by 2040. The share of lignite in electricity production should fall as a result of energy modernization up to the year 2025, and then as a result of decreasing lignite mining. In 2040 the lignite share should be 15.2% while nuclear should increase to 48.8% and renewables to 22.8%.

As for the heating sector, the above mentioned policy envisages a decreasing role of coal due to efficiency measures by final consumers, more efficient heat distribution systems and replacement of coal mostly by renewable energy (biomass), waste incineration and gas in smaller installations. The share of lignite in the centralized heating systems should decrease from 47 PJ in 2015 to 18 PJ in 2040

b) Legal form

In 1991, the government imposed the so-called environmental territorial limits in six mining locations in the North Bohemian Lignite Basin.[1] It also set air pollution limit values in basins in the regions of Chomutov, Most, Teplice, Ustí nad Labem and Louny. The affected area covers 591 km2 with 34 villages (including 8 towns). Territorial limits were also imposed in 1991 on the smaller Sokolov coal basin, but were removed relatively soon afterwards in 1993.

The territorial limits concern five mining localities: ČSA, Jan Šverma, Vršany, Bílina and Nástup - Tušimice.

The limits were established as a guarantee for 34 towns and villages situated on coal deposits that they would not be demolished and relocated to make way for further mining activity, and also in order to improve the environment in these regions. This was in part a result of strengthening environmental protection policies and the fight against air pollution through mining and industry, which has been a traditionally strong factor in politics and was one of the drivers of the Velvet Revolution which led to the end of the communist regime in 1989.

On 26 September 2012, the Czech parliament passed an amendment to the Mining Act which removed the right to expropriate private property for mining purposes, following intense campaigning by Greenpeace, NGOs and local governments from regions affected by coal mining. It has therefore become very difficult for mining operators to expand their activities on “occupied” lands, unless the owners voluntarily give up their rights.

In 2015, following lobbying by the mining companies and their trade unions, the government reevaluated the environmental territorial limits set in 1991 for two mines, ČSA

[1] Territorial environmental limits on lignite mining are guided by Government Resolution No. 444/1991 on territorial environmental limits on lignite mining in the North Bohemian Basin of October 30, 1991. The limits were set by Czech Government Resolutions 166, 443, and 490 of 1991.

and Bílina. Inhabitants of the town Horní Jiřetín, which was under threat of being destroyed if the limits to ČSA mine had been cancelled, conducted a major campaign with the help of environmentalists to resist these efforts.[2] In the end, a compromise was reached: the limits to ČSA mine were maintained, while mining in the Bílina mine was allowed to continue past the original limit.

The government justified the extension of the limits (100 – 120 Mt of lignite) in the Bílina mine with the claim that they were securing the supply of coal to the heating industry in the Czech Republic and preserving jobs for the miners. Therefore, the anticipated end of mining in Bílina was shifted from 2038 to 2055. As the mining company is owned by ČEZ, the majority state-owned company, it has been ordered to primarily use the mined coal to cover the needs of the heating industry.

c) Most important stakeholders

Supporters of the preservation of the territorial environmental limits are elected municipal representatives (mayors, deputies) from villages and towns affected or endangered by mining activities, non-governmental environmental organisations such as Greenpeace, Limity jsme my and others, as well as experts specializing on health issues (medics, environmental scientists etc.).

Opponents of the preservation of the territorial environmental limits are the mining companies directly affected by the territorial limits, Severočeské doly and Severní Energetická, and to some extent also the electricity power company ČEZ. Trade unions representing coal miners have a strong influence on climate and energy policy and are strongly opposed to any measure that might impact coal.

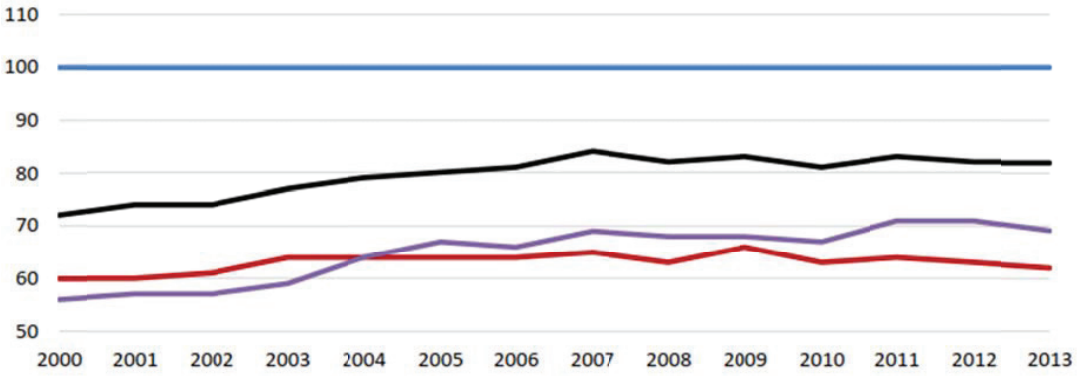
In terms of general public opinion, 66% of Czechs are against the expansion of mines outside the territorial limits according to a survey by Ipsos from 2014. Concerning the Ústecký region only (i.e. the region to be most affected if mines are expanded), the public support for preservation of the mining limits is stable: 70% in 2014, 66% in 2010 (Eurozprávy.cz, 25.02.2014, online).

d) International support and funding

A common problem of all the three mining regions is that the GDP is lower than the country average and the rate of economic growth is slower than in other regions. The mining regions are also less attractive for living and do not offer enough work opportunities for young people and qualified workers. While the country's GDP per capita reached over 80% of the EU-28 average in 2013, it was only 70% in the North Moravia region and about 60% in Northern Bohemia.

[2] More information about the campaign available online at https://limityjsmemy.cz/en/about/

Figure 3: GDP per capita comparison in %, EU 28 average = 100 % (in blue), Czech Republic (black), Northern Bohemia mining regions (red) and North Moravia mining region (purple)



Source: Ministry for Regional Development (2016): Vstupní analýza Strategického rámce hospodářské restrukturalizace Ústeckého, Moravskoslezského a Karlovarského kraje, https://restartregionu.cz/content/uploads/2016/10/39509_ma_ST-RES_priloha1.pdf

The mining industry accounted for 0,9% of the national GDP in 2015 (down from 3,7% in 1990). The role of energy, gas, heat and air-condition production and distribution accounted for 3,4% in 2015. In comparison, in 1990 this number was 2,5% (Czech Statistical Office, 2017). For example, in 2015, the Ústí region accounted for 6% of the national GDP with 7.7% of the Czech population living there (Schulz S., Schwartzkopff J., 2018).

The unemployment rates are among the highest, especially in the already mentioned Ústecký region where the unemployment rate remained 3-5% higher than the country average, until only recently when record low levels of unemployment were reached across the country (Ministry for Regional Development, 2016, p.11).

Under the previous, Social-Democratic government, based on the resolution from October 2015, the Czech Republic kicked off a strategy for the economic restructuring of the country's main mining regions, Ústecký region and Karlovarský region in the northwest, and Ostrava in the northeast. Dubbed Re:Start, the strategy is nominally meant to help the development of the country's poorest regions.

The first Action Plan plan under Re:Start allocated 42 billion CZK (€1.5 billion) over the first three years to development activities in the three regions.

e) Transition strategies/typology

The initiative for the creation of a strategic framework came from the three concerned regions themselves. They asked the government for financial support in order to restart their economies. As a result, the position of a Government Plenipotentiary was established to develop a common strategy for economic and social restructuring.

A general Strategic Framework was then developed, which forms the basis for the further Action Plans proposing concrete measures to deal with the structural problems of coal mining regions.

The Strategic Framework entails seven pillars, which are common for all the involved regions. Re:Start recognizes business, innovation and social stabilization as central elements of the transition. Among its pillars are research and development, increased benefits for the economy, a well-educated workforce, high-quality infrastructure and public authorities as well as an environment that is attractive for people to live and work in.

The creation of the Strategic Framework and the subsequent Action Plans is overall a step in the right direction in order to prepare the regions for the phase-out of coal.

However, there are some significant shortcomings:

- The government never mentions an explicit deadline for the coal phase-out. Thus, the incentives to restructure the regional economy and make it less coal-dependent are not as strong.
- The current Action Plan includes many projects that would have been complete regardless. The Strategic Framework being in place does not provide a comprehensive scheme for supporting renewable energy sources, and misses some important topics entirely, such as air pollution.
- There were no public hearings or structured public participation planning process, and while some of the stakeholders were consulted, others were left out.

Economic perspectives/regional development

Mining companies, their trade unions, industry representatives, as well as some politicians often claim that if coal mining could not continue beyond the territorial limits and would therefore decline in the Northern Bohemia region, thousands of jobs would be lost. The range of lost jobs is estimated between 3,400 and 4,800 for the mine ČSA and between 5,250 and 7,500 for the mine Bílina (Mládek, 2015, online). However, another view on the problem shows a completely different picture: preservation of the territorial mining limits would actually have a positive impact on employment while further mining would lead to the opposite.

For example, the mining company Severní energetická, operating in the mine ČSA, employs about 900 people, and aims to mine in an area where several other important employers have their facilities, such as the chemical factory Unipetrol, Czech Refineries and dozens of smaller companies. Altogether, they employ over 4000 people. Therefore, if the company Severní energetická would be allowed to mine beyond the territorial limits, more jobs in non-mining sectors would be lost than preserved in the mining sector. It remains a question if the concerned companies would be able to relocate their business and related jobs within the same region, especially in the case of the dominant employer, the Unipetrol chemical factory.

It is also worth noting that the above-average unemployment rates in the three mining regions are a result of their inherited dependence on coal and related heavy industry that

limited their possibilities to transform after the collapse of the communist regime in 1989 (Ministry for Regional Development, 2016, p.5).

A precedent from Chabařovice provides hope. It shows that if mining is continuously phased-out, the region would get a chance to develop other sectors and services and provide enough jobs. The open cast mine on the edge of Chabařovice, a town of then 2000 inhabitants, was closed in 1996. The very similar arguments about impending massive unemployment were used by opponents of the closure. Following the closure, in 1996-1998, the unemployment in Chabařovice increased. However, about half of the unemployed came from businesses other than mining. About 90 out of 150 ex-miners registered with the employment agency. According to data from the municipal office in Chabařovice, in 1998, two years after the closure of the mine, there was no officially registered unemployed ex-miner. Some found a job with the recultivation company, some established businesses on their own, and the town's socio-economic situation was stabilized (Štolfa, 1998).

After years of public debate about the extension of the mining limits, the Strategic Framework may help to move the debate on coal phase-out forward by shifting the discussion to more constructive themes such as economic and ecological revitalization of the region. A driver for such a transformation could be the technology and innovation capability of the Czech Republic, which is among the strongest in Central and Eastern Europe according to the Global Innovation Index: The country ranks 27th out of 126 countries (Cornell University, INSEAD, WIPO, 2018, p.27).

There are various initiatives and newly founded institutes in the Ústecký region that might play a role in catalysing the region's transition. The Palivový Kombinát Ústí, the state

company in charge of remedying the destruction caused by mining during the communist era, helps with the ecological restoration of the region. Lately, the company started getting involved in more complex projects, for example working together with research universities on creating large heat-pumps using mining water in the location of a former coal mine.

The region's University of Jan Evangelista Purkyně in Ústí nad Labem (UJEP) has a relatively diverse range of fields of study and its research activities focus on materials and technologies for the environment, as well as on the role of the city and region in addressing current societal and economic challenges. The private Unipetrol Centre of Research & Education carries out research and development for, among others, renewable and environmental technologies, and is involved in a number of international research projects among which are also projects funded by the Horizon 2020 programme.

Finally, the Innovation Centre was established by the Ústecký region, UJEP and the Regional Chamber of Commerce of the Ústecký region in 2015 and aims to encourage innovation, entrepreneurship and the transfer of knowledge between corporations and

research. For example, the Centre supported the incubation of 32 startup projects or helped to create 150 new jobs in the region.[3]

Municipalities also have an interest in finding innovative solutions for the economic restructuring of the region. For instance, the mayor of Horní Jiřetín in the Ústecký region has attempted to restore occupations that were once traditional in the town, inviting architecture students to create a plan for locations of various small businesses (Popp, de Pous, Reitzenstein, 2018, p.24).

Next to the national budget, EU structural and cohesion funds play a major role in financing the transition as they are one of the most important sources for public investments in the Czech Republic. From 2007-2013 they made up 34.3% of all public investment, and their share is even higher in Ústecký region as the region is a major recipient of the EU funds. Due to previous instances of misuse of EU funds through corruption, the Regional Operational Programme for the period 2014-2020 is managed at the national level instead of each region managing its own programme (Schulz, Schwartzkopff, 2018. p.48). With more competent management of funds, the region has good chances of building up new economic perspectives and ameliorating the social costs of the transition.

[3] More information available online: https://icuk.cz/en

Summary

The enormous availability of coal in the region provided a cheap and secure source of energy for centuries. However, it led to major environmental and social destruction of the mining regions. The driving force behind the first regulation or limitation on the coal mining business was the concern over the poor quality of life of inhabitants in the mining regions. With the so-called territorial environmental limits set in 1991, the government aimed to protect remaining towns and villages from an exacerbation of their situation. Since 1991, this policy has been consistently challenged, and in 2015 the government adjusted the territorial limits for one mine in order to secure a supply of coal for the heating sector.

Nevertheless, lignite reserves will become less available in the future, new environmental requirements are in place and hard coal mining faces economic difficulties. So the role of coal in the national energy mix will decreaseю This is recognized in the State Energy Strategy adopted in 2015. This document envisages gradual replacement of coal by nuclear and renewables in the electricity sector and by biomass, gas and imported hard coal in the heating sector.

The feasibility of this strategy, namely the construction of new nuclear facilities under present (economic) conditions, is a hot issue in the country with many stakeholders calling for a “plan B” - i.e., an energy strategy without new nuclear power units.

Another challenge is the significant coal use by individual households for heating. Although there is a funding scheme for households enabling replacement of coal boilers with cleaner alternatives, some consumers, especially from socially disadvantaged communities, require a more targeted approach to move away from coal.

After years of pressure to revoke the decision about mining limits, a strategy for the economic restructuring of the country’s main mining regions, Ústecký region and Karlovarský region in the northwest and Ostrava in the northeast, was adopted. The strategy may help to move the debate on coal phase-out forward by shifting the discussion to more constructive areas such as economic and ecological revitalization. An explicit decision regarding a coal phase-out date would provide an impetus for the Just Transition of the affected regions. The establishment, work and recent decision of the so-called “Coal Commission” in neighboring Germany is an inspirational process for the public debate in the Czech Republic.

Regional study: Ustecky region

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Political aspect in the Czech Republic

At the current moment, the Czech Republic is the only Central and Eastern European country that has a governmental strategy for transformation of coal regions. The so-called Re:Start program – is a long-term plan of government and regional approaches to the transformation of coal regions. It was launched in January 2017 as a result of the adoption of a Government Resolution.

The initiative to create the restructuring strategy started in 2015. It is the first attempt on a national level of this kind and scale. The implementation fell under the responsibility of the government plenipotentiary for the three affected regions. The plenipotentiary, as a key operational structure, has been equipped with the Regional Economic, Social Agreement and Restructuring Councils. Made up of representatives from the main stakeholders (i. e. local governments, industries, universities), these bodies were supposed to play an important role in this social dialogue. The main principle – according to the German inspiration – was that all the deciding actors were to be represented and treated at the same level.

Re:Start, formally known as a strategic framework for economic restructuring, defines the principles of transformation in seven pillars (Ministry of Regional Development of the Czech Republic, 2016b):

- Business and innovation
- Direct investments
- Research and development
- Human resources
- Social stabilization
- Environment
- Infrastructure and public authorities
- Implementation

The specific measures and future steps follow the strategic framework and are defined in the so-called Action Plans (AP). The AP is an annually updated and evaluated document which focuses governmental support in the aforementioned regions. It includes a detailed description of specific activities and actions for restructuring. The AP for the period of 2017-2018 was the first document for the process of economic restructuring, the second AP (current one) defines activities for 2018-2019.

The persistent problem, however, is the lack of public participation and mistrust of locals. The current strategic framework does not contain any efforts to enhance participation. It

seems that there is a concern regarding the public's reaction and its negative impact on the long-term expert opinions.

In 2020 the strategic framework is going to be updated for the next three years and it is considered to change the periodicity of the Action plan confirmation from the annual model, as it currently stands, to an update once in 2 years.

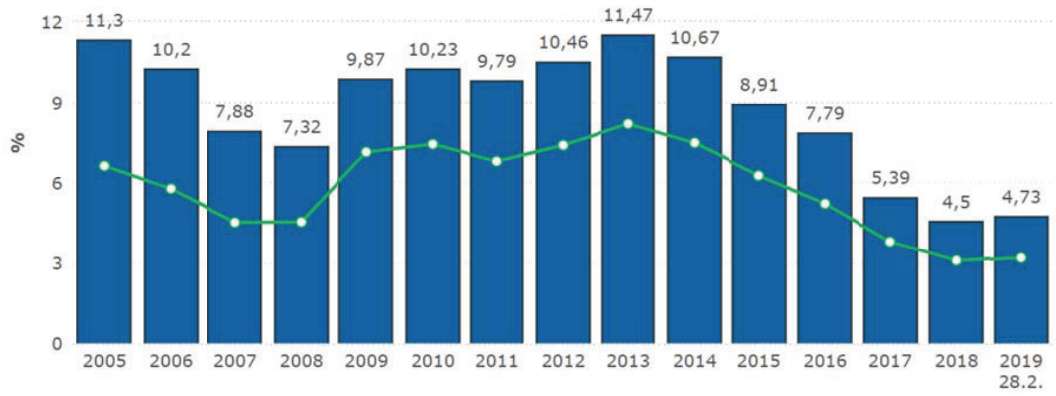
Recently, all three regions of the Re:Start strategy have become pilot region within the Coal Regions in Transition Platform. The platform is part of the Coal and Carbon-Intensive Initiative, included in the Clean Energy for All Europeans Package and was established by the European Commission in 2017.

Social aspect in Ustecky region

Due to the fact that Ustecky region faces the biggest struggles in terms of transition, the region has been chosen as a focal point of the Just Transition process in the Czech Republic.

The most important social problem of Ustecky region is unemployment (see **Figure 1**). The current unemployment rate in Ustecky region is 4.74%, compared to the nationwide 3.3% (Czech Statistical Office, 2019). However, the current unemployment rate in the Czech Republic is the lowest compared to all other member states of the EU (Statista, 2019).

Figure 1: Average unemployment rate for persons aged 15 - 64 from 2005 – 2019



Source: Czech Statistical Office, 2019

Note: The blue diagram represents the Ustecky region, while the green line depicts national average rate.

The largest contributor to the insufficient quality of labor is the concentration of socially disadvantaged persons and marginalized communities. Because of this, a huge percentage of Ustecky households live under the limit of subsistence income, and the rate of distraints is higher than anywhere else in the country. About 18.08% of the population from the region were in enforcement proceedings in 2017. In comparison, the Czech national percentage was 9.7%. In Ustecky, the average number of enforcement proceedings per person was 5.2 (Otevřená společnost, 2019).

The social situation and composition of the population has caused a premature withdrawal of students from elementary schools (Ministry of Regional Development of the Czech Republic, 2016a). There is also a persistent lack of interest in higher education. Locals are often not willing or ready to change their lifestyles.

The social situation in all the Czech coal regions is further exacerbated by internal migration patterns. The Czech region where population decreased the most in the period of 2005-2017 was the Moravia-Silesia region (-39,090 persons) followed by the Ustecky region (-19,863 persons) (Czech Statistical Office, 2018a). Similar findings are stated in another study, which monitored internal migration by region between 1993-2014. Ustecky region lost 18,210 persons, while the Moravia-Silesia region lose 51,727 persons (Fiala, T., Langhamrová, J., 2016). A low level of local identity and poor regional identification contribute to these numbers.

Local enthusiasts and NGOs have created several initiatives that brought optimistic and realistic solutions to the region.

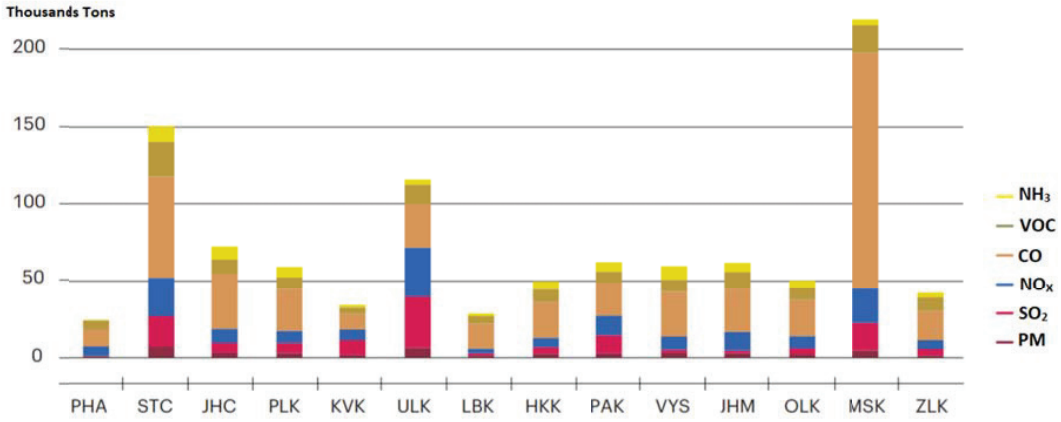
The “Innovation Centre of the Usti Region” has been established in 2015 to promote positive change and increased competitiveness throughout the Usti Region by advancing enterprise and innovation. The Centre became a partner of Re:Start program. A student platform UL debaty where students moderate interviews and panel discussions with politicians from the Ustecky region was also created.

In 2017 and 2018 the platform “Re-vize Ústí” has organized a series of public lectures, panel discussions with experts and published publications with concrete solutions for specific problem areas (transportation, unemployment, environment etc.). Another interesting project is “Místa zblízka”, which supports regional development. The project enables consultation services and education for stakeholders, and provides subsidies assistance.

Environmental impact from coal extraction and combustion

Air pollution in the Ustecky region is among the highest in the Czech Republic, exceeding official pollution limits (see **Figure 2**). However, according to the Czech Hydrometeorological Institute the air quality in Ustecky region from 2000–2015 has increased (CENIA, 2015a). The highest emissions contributing to air pollution in 2015 were SO_2 and NO_X emissions, coming mostly from the energy and heat production (SO_2 95,6%, NO_X 85,2%).

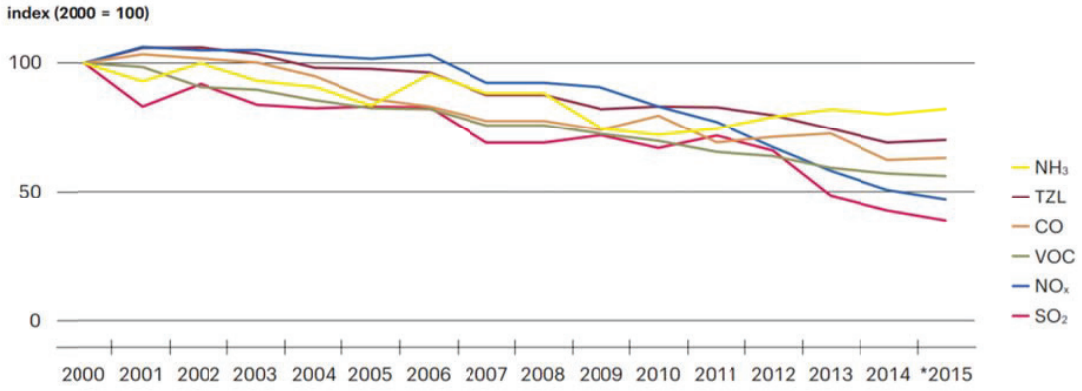
Figure 2: Emissions of the main air pollutant in the Czech Republic by regions in 2015



Source: Czech Meteorological Institute, 2015 cited in CENIA, 2015b

Note: PHA = Prague, STC=Stredocesky region, JHC=Jihocesky region, PLK=Plzensky region, KVK=Kralovehradecky region, ULK=Ustecky region, LBK=Liberecky region, HKK=Kralovehradecky region, PAK=Pardubicky region, VYS=Vysocina region, JHM=Jihomoravsky region, OLK=Olomoucky region, MSK=Moravia-Silesia region, ZLK=Zlinsky region

Figure 3: The trend of selected pollutant emissions in the Czech Republic [index 2000=100], 2000-2015



Source: Czech Meteorological Institute, 2014 cited in CENIA, 2015a

Note: TZL = particulate matter, PM

Economic perspectives and regional development in Ustecky region

From an economic point of view, the most challenging issue is the dominance of economic activities with low added value and unskilled labor. Because of the focus on sectors linked to production and mining, in addition to a few similarly-oriented large companies, the economic structure is not very progressive.

Also, the economic problems are mainly the result of the unfair distribution of financial prosperity. Only a small portion of the wealth coming from the region actually remains there. Either the money goes to private mining companies or it gets dissolved in the national budget. This problem could be solved through a transformational fund with its budget made up by the revenues from the EU ETS and a national compensation program that could pay off the damages caused by mining and air pollution.

The quality of the workforce does not correspond to the current labor market situation, which lowers the attractiveness of the region to investors (Ministry of Regional Development of the Czech Republic, 2016a). A successful example from an economic perspective may be the activity of CzechInvest agency, which assists firms that are interested in bringing their investments to the region and provides consulting services with representatives of companies regarding possibilities for business support. As an example, CzechInvest helped to establish a new factory for the company SII Technologies s.r.o.

A development plan for Ustecky must address the roots of the region's social and economic problems, while also taking a realistic approach. The region can capitalize on this opportunity by drawing from its current advantages, such as expertise in the field of energy, cheap accommodation and possibilities for investments, or beautiful nature. The development potential could be:

- improvement of the region’s image, making it more attractive to investors;
- coal phase-out;
- revitalization and potential to house new industries (f. ex. through new education programs);
- progress of the tourist industry;
- improvement of transportation.

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5. Romania

National Policies and trends in coal mining and socio-economic development

Radu Dudău, Co-founder & Director, Energy Policy Group (EPG)

Coal is an important fuel in the Romanian economy, although its relative significance has been dwindling over the past two decades. Especially since 2007 when Romania joined the EU, with its restrictive state aid policies and increasingly ambitious climate goals, the coal industry has steadily lost market share, employees, and has reduced the number of mines in operation.

Lacking a substantive coal exit strategy, the country's state-owned coal companies are struggling to survive, pressured by the high cost of EU ETS certificates. Meanwhile, the government's sole idea seems to be the continuation of coal mining and subsidizing coal-fired power generation. As shown below, several coal power generation plants are functioning without the mandatory integrated environmental authorizations (IEAs).

Eurostat (2018) indicates that Romanian primary energy production in 2016 was 25 million tons of oil equivalent (Mtoe) – down from 28.2 Mtoe in 2006 – with the following break-down: natural gas, 31.1%; renewable energy (including hydro), solid fuels, 16.9%; oil, 15.7%; and nuclear energy, 11.6%.

According to data from the Transmission System Operator (TSO) Transelectrica (2018), out of the total electricity production of 59.8 TWh in 2017, coal-fueled capacities covered 25%, behind hydropower (28%) and followed by nuclear (17%), natural gas (15%), wind (11%), solar (3%), and biomass (1%). The coal-fueled power generation was split between lignite, with the dominant share of 14 TWh, and hard coal, with 1.1 TWh.

The two sorts of coal used in Romania are mined in the country's two main coal basins: hard coal in the Jiu Valley (Hunedoara county), and lignite in the Oltenia region – mostly in Gorj county, but also in Mehedinți and Vâlcea counties. As noted by Euracoal (2019), "total hard coal resources are estimated to be 2,446 million tons (Mt), of which 252.5 Mt are exploitable within the currently leased areas, although as little as 11 Mt might be actually recoverable. Proven reserves of lignite total 280 Mt, with a further 9,640 Mt of resources. Of these deposits, 95% are situated in the Oltenia mining basin where more than 80% can be surface mined. The remaining lignite deposits have low economic potential, explaining why extraction in most other areas has stopped. Figures 1 and 2 below, based on data from the National Institute of Statistics (INS, 2019), show the evolution of production and consumption of hard coal in Romania over the past 25 years.

Figure 1. Romanian hard coal production and consumption, including anthracite, 1992-2017[4]

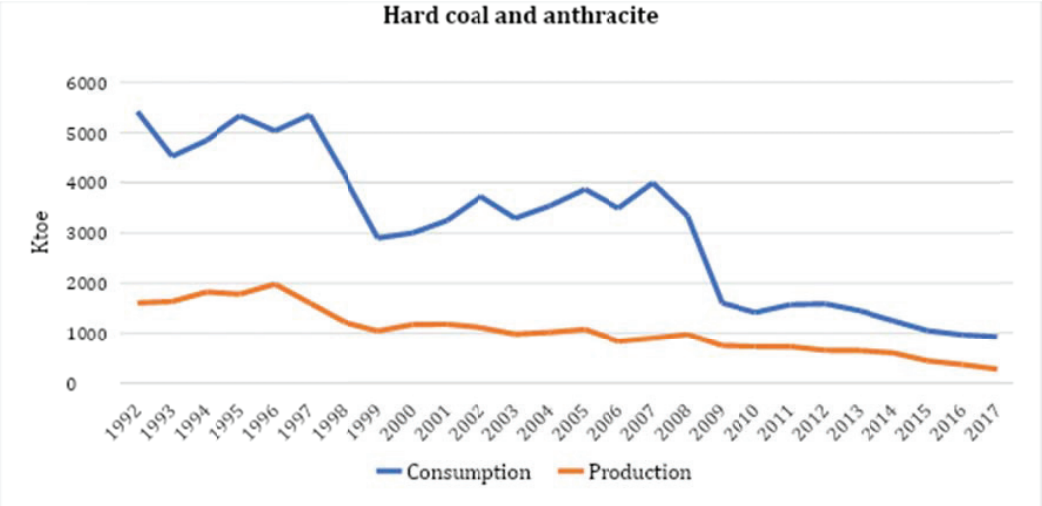
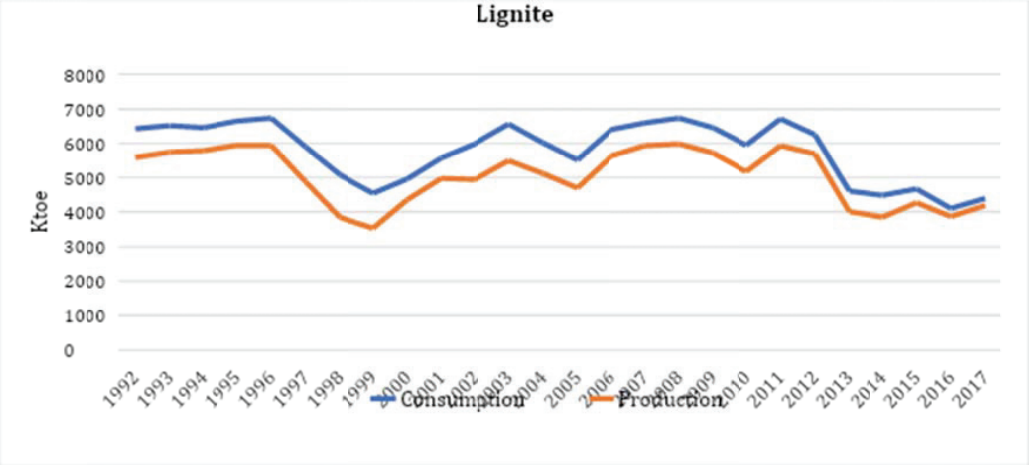


Figure 2. Romanian lignite production and consumption, 1992-2017



Source: EPG, based on INS (2019) data

The demise of Romanian hard coal

Hard coal was, next to oil, the fuel of the Romanian industrial revolution, which started only in the middle of the 19th century. The Jiu Valley saw the opening of an increasing number of mines, along with the development of supporting railway infrastructure. Subsequently, it grew into a critical source of primary energy for the Romanian industry. With the addition of thermal power plants in the 1970s and 1980s, the Valley became a

[4] Anthracite, which is a superior, high calorific power type of coal, has become practically depleted in Romania. The remaining resources, estimated at 3 Mt, at Schela mine in Gorj county, lie too deep in the ground to be extracted economically.

hub of electricity production, too. Starting in the 1980s, the coal-fired units also cogenerated heat, which has been distributed through the district heating systems of Deva (Hunedoara county) and the towns of the Jiu Valley.

Then, in the 1980s, against the background of the Ceaușescu regime's flawed policies of economic autarchy, heavy industrialization, state control and centralized planning, access to new technologies and know-how was cut, leaving coal mining to become increasingly inefficient. In the early 1990s, after the political change of 1989, the difficulties were compounded by plummeting energy demand on account of the closing of old industrial capacities and economic restructuring.

As noted by Dani, et al. (2006, pp.339-340),

> In the early 1990s, Romania had an estimated 464 mines for coal and other minerals. By 2004, production has ceased in 344 of the most uneconomic mines; 82 have been completely closed and the physical closure of 191 mines contracted out. … At the beginning of 2004, an estimated 120 mines were still operating, but many remained uneconomical and dependent on budget subsidies and debt write-offs, generating quasi-fiscal deficits estimated to be 0.5 percent of GDP.
>
> The workforce dropped from 171,000 in 1997 to 50,000 in 2004; significant downsizing occurred in 1997 through a process of voluntary redundancies induced by a generous severance package of 12-20 months' wages. Layoffs have continued since then, with 5,000-10,000 workers leaving the industry annually.

The constant threat of job insecurity was not dealt with in a socially and economically responsible manner. Instead, it was used politically from the outset of the new Romanian democracy. Thus, the Jiu Valley miners got regimented into battalions that stormed Bucharest several times in 1990 and 1991, at the behest of the FSN[5] government, and then unsuccessfully attempted to do so again in 1999. They were to intimidate and silence the opposition forces perceived as hostile to their requests for state subsidies and job guarantees. Hundreds of millions of dollars were pumped into supporting hard coal mining.

In 1998, the Hard Coal National Company (CNH) was founded. It continued for years to receive direct and indirect subsidies. Already in its first three years of activity, CNH registered $350 million in losses. Meanwhile, though, subsidies continued to flow in. In 2012, CNH became insolvent and started the procedure for liquidation. The debt to the state budget that it left behind was nearly €1 billion.

In 2004, the Romanian state approved a strategy for the mining sector which addressed its cost inefficiency and unsustainable debt. The strategy also took into account the EU pre-accession requirements of eliminating subsidies to all minerals other than coal by 2007 and to coal by 2010. Even so, as it joined the EU in 2007, Romania was granted an

[5] National Salvation Front (FSN), the ancestor of today's Romanian Social Democratic Party (PSD).

exemption until 2011 for the hard coal sector to subsidize production costs – a term that was thereafter extended up to 2018.

As of 2012, there were six companies active in the coal sector: Oltenia National Lignite Company (SNLO), National Coal Company of Ploiești (SNC), National Hard Coal Company of Petroșani (CNH), and the three lignite-based energy complexes of Rovinari, Turceni and Craiova, dependent in various degrees on purchases from SNLO.

In 2012, as agreed with the IMF, coal mining companies and power generation plants were merged into new vertically integrated entities. Thus, lignite mines and lignite-fired power plants of Turceni (1,980 MW), Rovinari (1,320 MW), Craiova (300 MW) and Ișalnița (630 MW) were put under the unified management of Oltenia Energy Complex (OEC).

A new hard coal company was also established: Hunedoara Energy Complex (HEC), a merger of the mines deemed viable from CNH (Lonea, Livezeni, Lupeni and Vulcan) and the thermal power plants of Mintia and Paroșeni into a vertically integrated structure. The Mintia thermoelectric plant consisted of six hard coal-based units of 210 MW each, totaling 1,260 MW, while the Paroșeni plant had one 150 MW unit. They all run on hard coal with an average calorific power of 3,650 kcal/kg. Mintia is the only source of district heating for the nearby city of Deva. Likewise, the Paroșeni plant is the sole source of centralized heating for the towns of Petroșani, Vulcan and Lupeni. As of 2018, 2,300 apartments in the Jiu Valley and 5,500 apartments in Deva depended on heating provided by HEC, according to the Energy Ministry (2018b).

There has been a stark drop in the Jiu Valley's number of coal-related workers, from about 20,000 in 2000 to about 4,800 in 2017.[6] Unemployment has strongly impacted the Valley's demographics, since no long-term economic and social programs were effectively put in place. The region's mono-industrial character has remained largely unchanged, with little job opportunities in other types of economic activity.

In January 2016, HEC declared insolvency, following numerous filings by businesses whose services and goods the energy complex was unable to pay. Yet, in November 2016, the Hunedoara Tribunal annulled the previous decision by the lower court to claim insolvency. Subsequent insolvency filings by the company have been turned down. Currently, the company's assets are under the sequester of the National Agency for Fiscal Administration (ANAF), or serve as collateral for the state guarantees given by the Finance Ministry (for the state aid which the EC deemed illegal in June 2015).

In November 2018, the European Commission (EC) found that HEC "received around €60 million of incompatible State aid from Romania through four publicly financed loans. Romania now needs to recover the illegal aid plus interest." (European Commission, 2018).

The history of those loans started in April 2015 with the EC's approval of state aid to HEC under the EU's rules for temporary rescue, in sum of €37.7 million (Lei 167 million), which was supposed to be paid back in six months. The government submitted a restructuring

[6] By a governmental decision passed in November 2018, another 920 miners were to be laid off from the Hunedoara Energy Complex (HEC) until December 31, 2018.

plan to ensure the company's long-term viability. Yet, HEC was unable to repay the loan. Regardless the EC concluded that the restructuring plan submitted in October 2015 and revised in January 2016 could not ensure the energy complex's long-term economic viability without continued state aid.

Indeed, a statement by the Energy Ministry in February 2018 noticed that HEC's Development plan of mining and energy production activities for 2018-2024, effectively 2018-2030 depends on continued state subsidies: "To continue activities in safety conditions, investment of Lei 168,213,000 from the state budget is necessary for 2014-2024" (Energy Ministry, 2018a).

According to the Energy Ministry's new Energy Strategy 2019-2030, with an Outlook to 2050 (2018c) the country's total hard coal reserves add up to 2.2 billion tons, of which 592 million tons (Mt) are currently in exploitation. Out of the 15 mines that were active in the Jiu Valley in 1990, only two were still operating in 2018: Lonea and Lupeni. The deadline for these last two hard coal mines to cease the exploitation activities was December 31, 2018.[7] Then, the closing of underground mines is to take place until July 1, 2021, followed by the closing of open cast mines until December 31, 2022, and environmental cleaning and reforestation by December 31, 2024.

Romania modified the state aid for closing down uncompetitive coal mines due to a notification from the EC in November 2017. Thereby, the Lupeni mine demanded a deadline extension of 15 months until December 31, 2018, along with a corresponding extension of state aid. This was approved by the Commission in February 2018.

The Energy Ministry and the Competition Council also asked for an opinion from the EC concerning the possible continuation of exploitation activities in the Lonea and Lupeni mines. The answer was adamant: if those mines continued coal extraction, the entire state aid package would have to be repaid by HEC. Under these circumstances, hard coal mining ought to have stopped in Romania by the end of 2018. Otherwise, no state aid can be extended to HEC under the EU legislation.

Lignite

Lignite extraction in Romania takes place in three counties: Gorj, Mehedinți and Vâlcea; in five geological basins: Rovinari, Motru, Jilț, Berbești and Mehedinți. These basins contain 17 mining perimeters, 16 of which are open cast and one which is underground. Mining started in 1957 and the lignite-fueled thermal power plants were built between 1964 and 1987. Deposits currently in exploitation go up to 986 million tons (mt), distributed as follows: 88% in Gorj county, 22% in Mehedinți, and 10% in Vâlcea.

The calorific power of Romanian lignite is 1,650-1,950 kcal/t, with a sulfur content of 0.5%-1.5%, making it a low-grade variety of coal. The value is less than half of Czech Republic's lignite, and about 80% of the German lignite. The main consumers are the thermoelectric

[7] As of March 2019, the situation of the Lonea and Lupeni mines is still unclear, as the government seems to be trying to extend the deadlines, yet it appears to be at a loss for the legal means of doing so.

plants in Rovinari, Turceni, Craiova, and Işalnița, as well as the cogeneration plants of Halânga, Govora, Oradea, Arad, COLTERM Timișoara, UATA Motru, along with public institutions and households in the region.

In 2012, the Oltenia Energy Complex (OEC) was founded as a vertically integrated structure of lignite mining and lignite-fired power and heat generation. The shareholders are the Energy Ministry (77.15%), the Proprietatea Fund (21,56%), Electrocentrale Grup S.A. (0.84%), and state-owned Mine Closure and Conservation (0.44%). However, at about the same time, lignite demand started to decline on account of limited consumption of electricity nationally, but also due to a gradual number of traditional large lignite buyers either going insolvent (e.g. RAAN Drobeta Turnu Severin), switching from coal to gas (e.g. CET Arad and CET Oradea) or turning to local lignite suppliers (e.g. COLTEARM Timișoara). In 2016, lignite production hit a low point of only 19.6 Mt, compared to 29.7 Mt in 2012 (OEC, 2016). This led to downsized lignite mining capacities at OEC.

Based on the existing concession agreements, OEC can keep exploiting its resources until 2027, after which the licenses can be extended five years at a time, until reserves deplete. This, in fact, is the situation at the following mines: Pinoasa, Jilț Sud, Jilț Nord, Roșiuța and Roșia de Jiu. Others were closed on account of depletion, starting in 2016 (Husnicioara, Gârla, and Peșteana Nord). Husnicioara and Lupoaia were supposed to shut down in 2016, because of unfavorable technical-economic conditions. Yet, Husnicioara continued to produce 690,000 tons in 2017. The Seciuri mine was shut down in 2017 and Rovinari is expected to close in 2019.

As calculated in a comprehensive Bankwatch report on the coal sector in southeast Europe,

> The productivity figure for lignite stands at 3190 tonnes/worker in 2017, a substantial increase from 1,778 tonnes/worker in 2013, but nowhere near the productivity levels of other EU members states such as Poland or the Czech Republic, that Romania likes to compare itself with. If it achieved the average EU productivity of 6111 per worker, it would have needed 3,671 workers in 2017. (Bankwatch 2018, p.36).

The production cost decreased from Lei 61.5/t (€13/t) in 2012 to Lei 52.6/t (€11.2/t) in 2015 and Lei 44.99/t (€9.57/t) in 2016, according to data from OEC (2016). 50% of costs were personnel spending and 15% were energy costs.

The company planned to countervail the anticipated price increase of CO_2 emissions through an ambitious reduction of fixed costs (salaries, water, oils, chemicals, etc.) to Lei 44.14/MWh (€9.4/MWh) in 2030, and variable costs (coal, lime stone for desulfurization, etc.) to Lei 41.82/MWh (€8.9/MWh) in 2030. However, the OEC (2016) report vastly underestimated the growth of EU ETS prices. In 2016, OEC envisaged an EUA price of €6.5 for 2018, 2019 and 2020. In reality, the price had gone beyond €20 by 2018, strongly favoring the coal-switching in power generation.

Thus, the company's planned reduction of operational expenditures has not been able to keep up with the swift rise of ETS prices over the past two years, which has put its operation under great financial pressure.

After losses of more than €200 million in 2015 and €31 million in 2016, OEC registered a €41 million profit in 2017, on account of favorable electricity market conditions. However, the abrupt increase in the EU ETS price since early 2018 has drastically eroded the company's profit (Invest Energy, 2018).

The number of workers in mining and energy production continues to decrease. From 12,816 in 2013, the number went down to 7,053 in 2017. The figures anticipated in the OEC (2016) report were 6,001 in 2019 and 5,027 in 2030. The total number of employees currently stands at "about 13.300 employees", according to the company's website (OEC, 2019), which makes the company the Romania's third largest employer, after the National Post and the Romanian Railways. The government's downsizing plan for 2017-2018 initially foresaw 1,000 dismissals in 2017 and 740 in 2018, starting on May 1. However, based on improved electricity sales in 2017 and corresponding higher profits, plusan increase in lignite production to 22 Mt, the government decided to reduce the number of dismissals to 200 in 2018.[8]

Meanwhile, the government maintains that OEC operates with a workforce deficit of about 3,100 miners and over 1,100 workers in the energy production industry (Energy Ministry, 2018a). The company's difficult financial situation is compounded by new and burdensome regulations introduced in December 2018 through Governmental Emergency Ordinance (GEO), such as the imposition of a 2% tax on the companies' yearly turnover. Already in January 2019, the Energy Minister contemplated that the government may exempt coal-fired power generators from this obligation. This would only increase the distortion of fair competition on the energy market and deepen the discriminatory support of the coal sector.

The commitment of the current government to a long-term continuation of the Romanian lignite industry is reflected in its actions to expropriate land for open-cast mine expansions. Thus, in 2018 alone the government issued several decisions to expropriate land for new open-cast mining and expanded ash storage. Governmental Decision (HG) 339/2018 approved expropriations for the expansion of the Roșia mine, along with €1.68 million for compensation. Two months later, the government approved the expropriation procedures in the Jilț Sud mine expansion corridor, for a capacity of 8.5 Mt/year, along with the equivalent of about €910,000 to be paid for compensations. Likewise, the government approved an expropriation for the expansion of the Roșiuța quarry in Gorj County for a capacity of 3 Mt/year, along with some €817,000 for compensations. All in all, millions of euros have been recently invested by the Romanian state to facilitate and expand the mining activities of OEC.

[8] A strike involving more than 10,000 workers took place in January 2019 at OEC. The main demands regarded improved working conditions and salary increases. The HEC unions joined the protests, denouncing the state's disregard for the value of their work, which they see reflected in the fact that Romania imports electricity from Hungary, instead of directing those funds toward Romanian coal-fueled electricity production.

Although this has been an obvious form of public support for OEC's mining activity, it does not qualify as illegal state aid, as some critics claim. It is true that the European Council Decision 2010/787 only allows state aid for the coal industry if it is for legal closure or conservation works. However, through the aforementioned governmental decisions, the Romanian Government has taken practical measures to facilitate the exploitation of state-owned coal resources in exchange for royalties. For other natural resources, such as oil and gas, the government extends exploration and production grants, while concessions granted to utility companies are typically paid for tariffs.

Nonetheless, it is deeply questionable that the government is pursuing an expansion of lignite mining with a phase-out strategy for the entire coal sector with a clear deadline. On the contrary, based on the recently published Energy Strategy and draft National Integrated Energy-Climate Plan (NECP) shown below, , Romania sees a substantive role for coal in the national economy through the 2030s and even the 2040s.

Coal-based thermal power plants

As noted above, both HEC and OEC were founded by the Romanian Government as vertically integrated companies, operating in both coal mining and power generation capacities, with units that cogenerate electricity and heat. The table below lists all 28 coal-fueled power plants certified in 2017 by the national electricity dispatcher (Transelectrica, 2018), down from 31 in 2016 after the units of CET Oradea were shut down. The table's column to the right, presented by Greenpeace Romania (Rădulescu, 2017), shows that 15 coal-fired units cannot operate legally since they do not have the prerequisite integrated environmental authorizations (IEAs) and therefore cannot comply with the emission limits of SO_2, NO_x and particulate emissions. In other words, these power plants are operated illegally.

Table 1: Status of dispatchable coal-based thermal power plants in 2017, including environmental authorization

No.	Thermal power plant	Unit	Owner	Available power	Can operate legally
1	CET Bacău	Bacău 1	Thermoenergy S.A.	0	no
2	CET Craiova II	Craiova 1	OEC	143	yes
3	CET Craiova II	Craiova 2	OEC	143	yes

4	CET Drobeta	Drobeta 1	RAAN-Romag Termo	60	no
5	CET Drobeta	Drobeta 4	RAAN-Romag Termo	60	no
6	CET Drobeta	Drobeta 5	RAAN-Romag Termo	60	no
7	CET Drobeta	Drobeta 6	RAAN-Romag Termo	25	no
8	CET Govora	Govora 3	Vâlcea county	50	no
9	CET Govora	Govora 4	Vâlcea county	50	no
10	CTEIșalnița	Ișalnița 7	OEC	312	yes
11	CTE Ișalnița	Ișalnița 8	OEC	300	yes
12	CTE Rovinari	Rovinari 3	OEC	320	yes
13	CTE Rovinari	Rovinari 4	OEC	320	yes
14	CTE Rovinari	Rovinari 5	OEC	0	yes
15	CTE Rovinari	Rovinari 6	OEC	320	yes
16	CTE Turceni	Turceni 1	OEC	0	no
17	CTE Turceni	Turceni 3	OEC	315	yes
18	CTE Turceni	Turceni 4	OEC	315	yes
19	CTE Turceni	Turceni 5	OEC	315	yes
20	CTE Turceni	Turceni 6	OEC	0	yes
21	CTE Turceni	Turceni 7	OEC	315	no
22	CET Iași II	IASC	City of Iași	59	yes

23	CTE Mintia	Mintia 2	HEC	195	no
24	CTE Mintia	Mintia 3	HEC	225	no
25	CTE Mintia	Mintia 4	HEC	195	no
26	CTE Mintia	Mintia 5	HEC	195	no
27	CTE Mintia	Mintia 6	HEC	195	no
29	CET Paroșeni	Paroșeni	HEC	150	no

Source: Transelectrica 2017, Greenpeace Romania 2017, EPG

The coal-fired power plants are major polluters of SO_2, NO_x and particulate emissions. Apart from that, coal mining (especially open pit lignite extraction) has a massive environmental impact: deforestation, destruction of agricultural land and villages, air pollution with particulate matter and water pollution.

Directive 2010/75/EU on industrial emissions was enacted in Romanian legislation through Law No. 278/2013, which allowed exemptions for the coal-fueled units to operate within a limit of 20,000 hours. The law stipulated that either the mines had to be closed until December 31, 2015, or they would be refurbished so as to comply with the emission limits applicable to newly built units (150 mg/m^3 for NOx, 150 mg/m^3 for SO_2, and 10 mg/m^3 for particulate emissions). For comparison, the minimal monthly values registered by Turceni 7 in 2013 were the following: 486 mg/m^3 for NOx, 4,898 mg/m^3 for SO_2, and 168 mg/m^3 for particulate emissions – all substantially higher than the BAT/BREF limits.

Then, the Transitional National Plan (TNP), put in place according to Law 278/2013 and approved by the EC in March 2016, allowed for the units included in it to be exempted from the emission limits until June 30, 2020. Yet other exemptions have been granted based on Romania's Adhesion Treaty to the EU. Thus, some coal-fired power plants were exempted under the Treaty with respect to the NOx emission limits until December 31, 2017.

In April 2017, the EC adopted new norms on the best available techniques (BAT/BREF) regarding the burning of fossil fuels. Member states are obligated to make sure that the large burning installations are duly refurbished, and that the IEAs issued according to Law 278/2013 are properly reviewed so that by the end of 2020, all the installations comply with the new emission limits.

These new emission limits are much more restrictive and difficult to follow for coal-fueled thermal power plants, some of which were not able to comply with the earlier Law 278/2013. Rădulescu notes that (2017, p.4),

> The Romanian Government has tolerated for years the illegal operation of coal-based thermal power plants that do not comply with the emission limits set in Law 278/2013. Consequently, numerous such units do not have integrated environmental permits, without which functioning is illegal. [...] Art. 4, par. 1 of Law 278/2013 states that 'It is forbidden to operate without integrated environmental authorization any burning installation, waste incineration or co-incineration.' Such an authorization cannot be issued, in spite of the requests by coal-fueled operators, as long as the needed investment in technology to ensure compliance has not been made. These installations will not be able to comply with the new BAT requirements, which are to be implemented within the next three years.

Some coal-fueled plants were included in TNP, hence exempted until June 30, 2020, despite the fact that they operated with emissions considerably above the set limits. While they ought to have been compliant by December 31, 2015, they had in fact not even been issued IEAs.

Table 1 above summarizes the legal status of those units' operations with respect to the environmental authorizations and emission limits. To offer some illustrative detail, units 2 and 3 of CET Govora have been functioning without an IEA for the last five years, as the old one expired in December 2013. The operator failed to secure enough finances for refurbishment. Through the TNP, the plant is exempted from emission limits for SO_2, NOx and particulates until mid-2020.

To put it in numbers, out of the total dispatchable coal-fired power generation capacity of 4,637 MW in 2017, 2,862 MW could operate in compliance with the environmental legislation, while 1,775 MW could operate only by infringing such legal requirements.

To conclude, the thermal power plants of Mintia, Turceni, Paroșeni, and Govora, which lack IEAs and whose pollutant emissions greatly exceed the legal limits, have kept functioning for years regardless of fines imposed by the Environmental Guard. Based on a rather lax interpretation of the law, the imparted fines were contested in court as if they were minor transgressions. Hence, the delinquent installations could not be closed down so far and were even provided with a way to keep working within the law.

The future of Romanian coal, according to current energy and climate policy planning

In spite of the dire economic future of the Romanian coal industry, the PSD-ALDE ruling coalition that has been in power since early 2017 has taken a firm stance in favor of maintaining and extending the coal mining activities, preserving the current coal-fired capacity pool, and investing in new coal mining capacities.

The Energy Strategy 2019-2030, with an Outlook to 2050 (Energy Ministry, 2018c) emphasized the role of lignite in ensuring grid stability and energy security in 2030 and beyond. The document projects about 1,600 MW of lignite-fueled power generation in 2030. One of the strategy's main investment objectives is a new 600 MW supercritical,

CCS-ready lignite-fueled plant in Rovinari. While the document clearly states the economic inviability of hard-coal mining, it nevertheless envisages a long-term operation of Mintia's unit 3, based on hard coal imports. Moreover, the Energy Strategy envisages the construction of a new gas-fueled CCGT unit at Mintia.

More recently, the draft National Energy-Climate Plan published by the Energy Ministry (2018d) has a more conservative estimate of the size of coal-fueled electricity production capacities that would have been withdrawn by 2030. From a 3,700 MW coal-based capacity in 2020, the draft NECP expects a slow decrease to 3,400 MW in 2024 and to 3,200 MW in 2030. It is not clear by which means such a high level of the coal-fueled capacity pool can be maintained in 2030 and beyond, given that no less than 2,400 MW will have to be retired as their technical lifetimes expire. The country has no coal phase-out strategy in place, and neither does it have a Just Transition strategy.

Moreover, at the EU level, coal-fired power generation is facing an evermore constraining environment: increasing EU ETS prices, the recently set limit of 550g CO_2/kWh for power generation units admissible on the capacity markets, and the aforementioned BAT/BREF limits. A recent Carbon Tracker Initiative report (2018) projects that by 2025 new wind and solar capacities will be cheaper than new coal-fueled units from the viewpoint of capital and operational costs on each and every market of the world, and that by 2030 new renewable capacities will be cheaper than operational costs at coal-fueled plants. Together, these laws and predictions paint a grim picture for the future of the coal mining industry.

All in all, the economics of the clean energy transition is making the long-term survival of the coal industry virtually impossible. In Romania, however, as in other Eastern European countries, maintenance of the coal industry is defended by invoking grid safety, stability and security of energy supply. With this reasoning, the government continues to channel subsidies to the ailing coal energy complexes. This was illustrated most recently in the Emergency Governmental Decision (OUG) 26/2018 concerning "the adoption of measures for the safety of electricity supply."

The OUG mandates the TSO to set the monthly capacity of technological system services and, specifically, the slow tertiary reserve. Out of that capacity, 400 MW are allocated to Hunedoara Energy Complex in the timeframe April 15, 2018 - June 30, 2020. Such mandates, which are effectively lifelines for a moribund industry, have been periodically renewed over the course of the last few years.

In an effort to ensure that none of the EU regions affected by the decline of the coal sector are left behind, in December 2017 the EC launched the Platform on Coal Regions in Transition. The aim is to enable EU regions to exchange and to develop projects that can generate modern and sustainable economic activity in those regions. Also, "it is facilitating the development of long-term strategies to boost clean energy transition by bringing more focus on social fairness, new skills and financing for the real economy." (European Commission, 2019). The Platform can also support measures for renewable energy source

development, digitization and data centers, e-mobility, sustainable tourism and agriculture.

Pilot projects are currently under development in 14 coal regions of the EU. For Romania in particular, the one concrete action taken as of 2018 is a "request to the Structural Reform Support Service to assist with the development of a transition strategy" (Colucci, 2018, p.5).

Against this background, the potential of converting coal mines into renewable energy production is significant and already well illustrated by successful projects, such as the 16 MW PV power plant in Visonta, Hungary, which was placed on the top of a lignite mine dump site; or the five wind parks of Klettwitz, Germany, summing up 145.5 MW (Tzimas, 2018, p.7). The same study indicates that Romania's coal regions have significant solar potential of 2,000 to 5,000 GWh/year, and also sizeable wind energy potential of 5,000 to 10,000 GWh/year.

The management of the Oltenia Energy Complex has announced publicly in recent conferences that the company plans to invest in renewable energy sources. The region's available workforce (which can be reskilled), land reclamation after mine closure and vicinity to high-voltage lines pose opportunities to develop renewable projects. The funds for such investments can come in part from the EU's Modernization Fund, which is part of the post-2020 phase of the EU ETS scheme. As shown in a recent joint policy paper by Centre for European Policy Studies (CEPS), Energy Policy Group (EPG) and Romianian Energy Centre (CRE) (2019), the Fund:

> is an instrument for enabling investments in small-scale energy projects, improvements in energy efficiency, and the modernization of energy systems in lower income member states, with a GDP per capita of less than 60% of the EU average. [...] The fund will be financed through the auction of up to 2% of the total EU ETS allowances for the period 2021-2030 (approx. 310 million, estimated to be worth between €6.2 billion and €9.3 billion) [Estimation based on prices of €20/EUA and €30/EUA]. Each individual member state will have a fixed allocated share from which projects can be financed (the share of Romania represents 11.98% of the fund, i.e. €928.45 million) [calculated at €25/EUA]. The fund can be used for coal power plants only in the case of refurbishments of existing coal power plants for district heating in countries with a GDP per capita lower than 30% of the EU average (i.e. Bulgaria and Romania).

Thus, the Modernization Fund is a valuable source of funds for investments in sustainable energy projects and aspects of the Just Transition starting with 2021, including redeployment, reskilling and upskilling of workers. Indeed, the Fund is being envisaged by the General Director of the Oltenia Energy Complex as a source of funding as it allows for the refurbishment of cogeneration coal-fired thermal power plants in Bulgaria and Romania (Financial Intelligence, 2018).

The question for OEC is: given the manifold challenges to its operations depicted above, can it see an economic turnaround and transform itself by attracting investments in clean energy projects? Or will it continue to be moribund? Right now, the latter seems much more likely.

Annex 1: Timeline of important events in Romania's coal sector

Date	Name of the event	Comments
1990 1991	*Mineriads*	Violent demonstrations by Valea Jiului coal miners in Bucharest against the democratic and pro-market opposition parties of the time.
1997	20,000 hard coal miners laid off	Program of voluntary dismissals induced by generous severance packages. Dismissals continued in the following years at a rate of about 5,000/year.
1998	Hard Coal National Company (CNH) was founded	In less than three years of activity, CNH amassed debt of $350 million.
2004	National strategy for the mining sector	EU demanded that all subsidies to coal-related activities be eliminated by 2010. Number of employees in the hard coal industry dropped from 171,000 in the early '90s to 50,000.
2007	Romania joined the EU	Exemption was granted until 2011 for the hard coal sector to subsidize production costs. It was later extended until 2018.
2012	Six companies were active in the coal mining sector	Oltenia National Lignite Company (SNLO), National Coal Company of Ploiești (SNC), National Hard Coal Company of Petroșani (CNH), and the three lignite-based energy complexes of Rovinari, Turceni and Craiova, depended in various degrees on purchases from SNLO.
2012	Founding of Oltenia Energy Complex (OEC) and Hunedoara Energy Complex (HEC)	Vertically integrated structured that merged the coal mining and coal-fired power and heat generation, respectively for lignite and hard coal.
2013	Law No. 278/2013 adopted	Directive 2010/75/EU on industrial emissions

		enacted in Romanian legislation allowing exemptions for the coal-fueled units to operate within a limit of 20,000 hours.
2015	European Commission approved state aid to HEC	Government loan of €37.7 million approved under the rules of temporary rescue, which was supposed to be paid back within six months. Yet HEC was unable to repay the loan. Besides, the EC concluded that the restructuring plan submitted in October 2015 and revised in January 2016 could not ensure the energy complex's long-term economic viability without continued state aid.
2016	Lay-off plan for 2017-2018 adopted by the Energy Ministry	The plan initially foresaw 1,000 layoffs in 2017 and 740 in 2018, starting on May 1. However, based on improved electricity sales in 2017, with an increase in lignite production to 22 Mt, the government decided to reduce the number of discharges to 200 in 2018.
2016	Low point of lignite production	Lignite production reached a low of 19.6 Mt, compared to 29.7 Mt in 2012. The Husnicioara, Gârla, and Pește̦ana Nord lignite mines were shut down..
2016	EC approval of the Transitional National Plan (TNP)	The TNP was adopted according to Law 278/2013. It allowed for the units it included to be exempted from emission limits until June 30, 2020. Other exemptions have been granted based on Romania's Adhesion Treaty with the EU. Thus, some coal-fired power plants were exempted under the Treaty with respect to the NOx emission limits until December 31, 2017.
2017	EC adopted new norms on the best available	Member states have to make sure that the Large Burning Installations are duly

	techniques (BAT/BREF) regarding the burning of fossil fuels.	refurbished, and that the IEAs issued according to Law 278/2013 are properly reviewed so that by the end of 2020, all the installations will comply with the new emission limits.
2017	15 out of 29 dispatchable coal-fired power plants operate without mandatory IEAs.	15 coal-fired power generation units have no integrated environmental authorizations (IEAs), and cannot comply with the emission limits for SO2, NOx, and PM.
2018	Several government decisions issued to expropriate land for lignite mining expansion	The government decisions also allocated state budget money to compensate for land expropriations.
2018	Energy Strategy of Romania for 2019-2030, with an outlook to 2050	The strategy does not include a phase-out plan for the coal sector. On the contrary, it foresees a long-term role for the coal sector in the Romanian economy, well into the 2040s. No Just Transition considerations are made.
2018	First draft of the National Energy and Climate Plan was published by the Energy Ministry.	The document makes a conservative estimate and anticipates only a slow decrease of coal capacities to 3,400 MW in 2024 and 3,200 MW in 2030.
2018	The hard coal mines of Lonea and Lupeni are closed	By December 31, 2018, these last two hard coal mines of the Jiu Valley were shut down.
2018	GEO 114/December 2018	The Government Emergency Decision 114/2018 introduced a 2% tax on the yearly turnover of energy companies licensed to produce, trade, distribute and/or supply electricity and natural gas. Therefore, both OEC and HEC are hard hit. This situation compounds the struggles of coal complexes dealing with t record high EU ETS prices.
2019	OEC considers investments	OEC sees the Modernization Fund of the EU ETS scheme as a source of finance for clean

	in renewable energy sources	energy projects, and for refurbishing its cogeneration lignite-fired electricity production.
2019	Strike of more than 10,000 miners of OEC and HEC	The main demands were improved working conditions and salary increases. The HEC unions denounced the state's disregard for the value of their work, which they see reflected in the fact that Romania imports electricity from Hungary instead of directing those funds toward Romanian coal-fueled electricity production. As a concession, the Energy Ministry announced it will propose that the coal-fired power generation be exempt from the newly imposed 2% turnover tax (GEO 114/2018).

Regional study: Jiu Valley

Gabriel Ghinea, Waste Management Consultant

Romania has a long coal mining tradition and substantial coal resources. According to the latest research of V. Popovic and A.J. Vasile (2015), "hard coal resources are estimated at 2,446 million tons, of which 252.5 million tons are commercially exploitable within the currently leased perimeters, although less than 11 million tons might be economically recoverable". Most hard coal deposits are located in the Jiu Valley coal basin. Mining activities are dispersed over six of the eight regions in Romania, but are concentrated in the west and northwest where historically mining was the dominant economic activity. According to the Romanian National Agency for Mineral Resources, prior to 1989, mining employed some 350,000 people directly and generated another 700,000 jobs indirectly.

During 2012, the coal industry underwent major restructuring. The lignite mines and power plants were combined into the vertically integrated Oltenia Energy Complex. Restructuring the hard coal sector was more challenging and was completed only at the end of 2012 with the creation of two separate operating units. One (National Society for Mine Closure Jiu Valley) will oversee the closure of three coal mines in the Jiu Valley that are not viable (Uricani, Paroşeni and Petrila) by 2019, following the Council Decision 2010/787/EU on state aid to the coal industry. According to a Market Report of Euracoal (2014), "job losses will total 2,400, leaving 5,200 employees". The other unit (Mining Division of Hunedoara Energy Complex) will continue to operate the remaining four coal mines (Lonea, Livezeni, Vulcan and Lupeni) without state aid and at an annual production capacity of 1.5 million tonnes. The unit will supply two thermoelectric power plants that are part of the Hunedoara Energy Complex. By 2019, the Mining Division of Hunedoara Energy Complex will be the only hard coal producer in Romania.

Romanian Mining Law No. 85/2003 (the "Mining Law") governs the performance of mining activities in Romania by stimulating the capitalization of mineral resources, which are property of the State. Mining activities comprise the reconnaissance, exploration, development, exploitation, preparation and conservation of mines; trade in mining products; and the conservation and closing of mines, including the relevant works for environment recovery. The Mining Law also ensures maximum transparency in relation to mining activities, as well as fair competition between operators, irrespective of the type of property (i.e. private or public), the origin of the capital or the nationality of the operators. The National Agency for Mineral Resources (the "NAMR") is the main institution with supervisory and regulatory authority in the mining sector.

S. Ilie (2007, pp.10-11) states that "the Romanian society is not a traditionally poor one, but the process of massive industrialization and fast deindustrialization, caused by economic and social changes, depleted it". The most affected regions were those where industrial activities were once central. One example is Jiu Valley in the county of Hunedoara. Mining in Jiu Valley was at its peak during the communist period and started to decline after 1990

with Romania's transition to a market economy. Over the last 25 years, the restructuring process meant that assets and staff were transferred or some units were liquidated, while others were stopped and some were transformed into independent companies.

The structures still working today to extract, prepare and produce electrical and thermal energy are:

- Jiu Valley Mining Liquidation National Society, including Petrila, Paroşeni and Uricani mines;
- Hunedoara Energetic Complex, including Lonea, Livezeni, Vulcan, Lupeni mines, The Mining Salvation Station and the Coal preparation station Jiu Valley.

Recent research (S. Irimie, L. Zeininger and M. Mihai, 2016, p.3) suggests "that the number of staff working in Jiu Valley mining sector in the period 1990-2015 has decreased to a dramatic downsize in 1997 (from 55,000 employees in 1990 to 45,647 employees in 1996 and down to 24,258 employees in 1997). Ever since, the decrease continues but at a slower pace of several hundred of employees per year".

Today, there are only 7,034 employees for both the two entities still operational in Jiu Valley, but a new lot of 489 workers is expected to be laid out.

Ever since 1945, mining in Jiu Valley faced specific technical issues that turned hard coal mining into a difficult, inefficient, and high risk activity with very specific hazards: thin and inclined coal layers, many layers' faults, hard steril, methane, water. In addition to these natural hazards, there are also work hazards: explosion risk, various health hazards, instability of the mines. Miners were forced to perform extremely hard work under conditions of increased responsibilities, more complex tasks due to less staffing, higher physical stress, job volatility and less money to cover their family needs.

This drop had a huge impact on the Romanian regional deficit. Studying the numbers regarding the drop of employes, we can see that mine closure has affected and still affects a large number of communities, families and individuals. Regardless where it may be situated, at a former mining industrial site there are some common elements that have an impact on the population and on the environment such as: lack of higher education, lack of transportation infrastructure, problems with water and soil treatment. All these factors exacerbate poverty and environmental degradation.

According to G. Pascu and T. Gheorghiu (2012, p.91) "the history of coal fields in Jiu Valley starts in 1869 with the 'Brasoveana' Mining Industry. Starting with 1920 the industry was formed by four independent enterprises: a state corporation (Campa de Sus, Campa de Jos), 'Petrosani' (Petrila, Petrosani, Dilja, Aninoasa), the 'Jiu Valley de Sus' Society Vulcan and the 'Uricani – Jiu Valley' Society (Lupeni)". In 1948, all the mines were nationalized. This "nationalization law" represented the transition from the capitalist economy to a centralized one. It was declared that all the underground and surface resources that were not the property of the state were to be nationalized. As such, the factories and industrial associations were transferred to the state. From 1945 until 1952, the coal from Jiu Valley was one of the principal sources of energy for the entire industry in Romania. To achieve

this, thousands of people were relocated from Moldova to meet the demand for the working force. In 1979, the number of miners was 179,000. In 1980, when Nicolae Ceausescu, leader of Romania at that time, decided to have no debts, the mining sector was even more oversized in order to fulfill the needs of raw materials for national industry. In the beginning of the 1990s the decline of mining in the Jiu Valley was obvious. The absence of any strategy related to the coal industry's decline led to massive job loss and even harder working conditions, with a large percent of workers getting layed off without any employment alternatives or requalification. In 2005, the first mine was closed in Jiu Valley, in the smallest town of Hunedoara County, Aninoasa.

Currently six coal mines are in operation, at least until 2019: Petrosani, Uricani, Lupeni, Petrila, Vulcan and Paroseni.

As C.A. Pana (2009, pp.135-144) states, "Jiu Valley is situated in the central – western part of Romania, in the Petrosani Depression, a total of 954 skm. The altitudes increase from 555 m to more than 1,600 m. The population is 146,750 inhabitants".

G. Pascu and G. Tudor (2012, p.91) claim that "vulnerability is the main feature of the region and it is determined by multiple factors (economic, social, ecological and political)". Of these factors, social and environmental issues play the largest role in keeping inhabitants of the Jiu Valley in poverty.

According to D. Fodor and G. Baican (2001, pp.47-76), "land deterioration caused by anthropogenous activities occur more frequently in waste dumps, but also in natural slopes". Another consequences of underground coal exploitation are landslides and subsidence. These ground movements obviously affect buildings and agricultural land, especially in Lupeni (2538 ha) and Petrila (7715 ha)". A. Costache (2010, p.8) considers that "another problem is land use change caused by deforestation, overgrazing, built areas and development of mining activities ... Floods are one of the most important natural threats to the region. For example, the floods of 1999, 2004, and 2005 caused damage to many households, had a negative impact on transport infrastructure and water supply. Some of the most vulnerable sites are: Lupeni until the confluence of Jiu de Vest with Jiu de Est; the flood plain from Petrila to Petrosani".

Another problem caused by the mining industry is damage from mining water. The main sources of pollution are extraction and processing activity. The polluted water that was pumped into the Jiu River caused the disappearance of aquatic flora and fauna. Such environmental degradation leads to problems in the agricultural sector, urban development, tourism, and the critical deterioration of land and forests.

Social problems are entwined with environmental ones. Reliance on coal has created sensitivity to adapt to the new economic reality especially for young and elder population. As M.M Lupchian writes (2016, p.1), "the most affected social indicators are unemployment and the share of aged people in the population (proxy. 17%)". Communities that depend on agriculture are particularly vulnerable to environmental change. According to A.S. Negulescu (2004, p.17), "the longstanding unemployment rate (41,5%) was caused mainly

by the lack of stable jobs, by the monospecialization of the labor force and by the passive social security actions (for example, minimal social payments provided by the government)". The education level has an important effect on the economic characteristics and on the socio-economic revival of the region. The technical and vocational education and the local university curricula were built around the training requirements of the mining industry, a fact which has become a major contributor to the high unemployment rate. In terms of social factors, the consequences affect the way communities function, the way individuals collaborate and how their purchasing power develops.

The health status of the population in the Jiu Valley deteriorated after 1990. The rate of child mortality and tuberculosis cases increased, and the life expectancy is under national average (Alexandrescu 2001). This leads to a reduction in workforce and family stability. According to A. Mariciuc (2007, p.107), "although there are 34 pharmacies in the entire microregion, from the point of view of the number of healthcare institutions, the situation is relatively stable, but the healthcare structure on the whole is weakly developed, needing investments for rehabilitation, expansion and replacement of the non-efficient and out of date equipment".

Analyzing these factors, we can draw several conclusions:

- In Jiu Valley there are still six extraction points. These will be subsidized until closure by the Romanian Government;
- Even if some of the mining sites are reorganized, they will inevitably face closure;
- Jiu Valley has problems with unemployment caused by the closure of the Aninoasa mining site and by dismissal from the other six centers. The closure of these mines will have a major impact on the entire region, increasing the poverty level. Therefore some important changes must be made by engaging state bodies in the implementation of existing strategies and by applying counter-measures to systematically tackle the problem of poverty;
- The local economy is still dominated by the National Hard Coal Company, where more than 40% of the workforce is concentrated and another large percent of them is working in sectors indirectly connected with mining;
- The industry restructuring has generated new problems, such as: an abrupt drop in the mining regions' economies, exacerbation of social issues, and an increase in poverty. Social problems in the area are mainly the result of decades of specialisation in a single industry, the heterogeneous population, limited resources to sustain further economic progress and slow adaptation to change.
- The biggest problem is poverty, generated by all the economical, environmental and social factors previously stated;
- Another process associated with poverty and vulnerability is social exclusion. The causes are nearly identical: job loss, income depreciation and lack of available social services.

Jiu Valley is a poor region because of its ecological vulnerability (land deterioration, mass movement, land use change, floods and water damage) and social and anthropic characteristics (sensitivity to change, adaptability problems, job losses, mono specialization, passive social security actions). Reducing the vulnerability by constructing infrastructure, natural barriers against floods and earth movement will make the region more resilient and reduce the poverty risks. This type of community can reinvent itself by learning to use alternative sources of energy and “alternative” industry. To have a positive impact, these projects must be guided by certain principles, with transparency being at the core. For example, sustainability in the mining sector can only be achieved by publicizing all planned policies: development, biodiversity action, land recovery, water management and regulation, water recycling etc.

EU Decision 787 clearly states that coal shall not be extracted from the two mining operations as of December 31, 2018. However, a study performed by the National Research and Development Institute for Mining Security and Anti-explosion Protection in Petrosani (INSEMEX) warns that this plan will not come to fruition due to the short timeframe. The mines entered the closure program in 2017 and are set to shut down by the beginning of 2019 (N. Ilias, V. Plesea, 2015). The immediate closure of the Lupeni and Lonea mines, without the depletion of the exploited mine, would turn the two mining operations into time bombs for social and economic dysfunction. These conclusions are drawn from the official study conducted by the INSEMEX specialists at the request of the Hunedoara Energy Complex. The report was submitted to the European Commission after the Romanian government requested to the activity of the two mining capacities.

"Coal Regions in Transition" is an initiative of the European Commission dedicated to the 41 mining regions of the European states. The European Commission expects the governments of the Member States to come up with concrete project proposals to support mining areas in order to receive development funding. By launching this platform specifically for coal mining regions, such as the Jiu Valley, the European Union aims to help by using best practices and relevant EU funds. The initiative to set up this special program for mining areas began in 2017 with 3 states (France, Poland and Greece), joined by Germany later. These 4 states are already included in a pilot project for mining areas and will be the first beneficiaries of funds from the development programs proposed by their governments. The mayor of Petroşani has stated that the activities of the Platform has already begun, but that the European Commission is now waiting for member states to submit concrete proposals to support the transitions. In order to have access to these funds, local authorities, representatives of civil society and the Government of Romania must identify local development needs and present a plan addressing these needs to the European Commission.

Five NGOs from the Jiu Valley have already responded to the request of the Ministry of European Funds and submitted proposals for the valley’s revitalization. Among the proposed projects are:

- Converting closed mining sites into new economic, social and cultural centers;
- Developing sustainable social services for vulnerable people in the Jiu Valley;
- Setting up a tourism promotion office for the Jiu Valley, as well as developing active tourism, capitalizing on the area's potential for mountain biking; the rehabilitation of the railways, including the industrial ones; and the establishment of an intermodal passenger transport system in Petrosani, serving all the cities of the Jiu Valley;
- Establishing community-based medical and social centers in former workers' colonies;
- Developing measures to improve the quality of life in the Jiu Valley, including the rehabilitation of public spaces and heritage sites;
- Establishment of an investment attraction office in the Jiu Valley (continuation of the "Invest in Jiu Valley" Initiative formed at the Valea Town Hall in autumn 2018);
- Setting up a technical assistance unit to support local governments, the private sector and citizens in attracting European funds;
- Considering that civil society in the Jiu Valley is quite young and developed, it has been proposed to set up a hub of local NGOs and to facilitate the active involvement of citizens.

Some of the proposed projects concern the modernization of the mountain road infrastructure (Câmpu lui Neag - Herculane, DN7A Vâlcea - Voineasa - Petrila - Petrosani) and interurban roads (DN 66A) as well as the construction of a tourist and museum complex for recreation called “The gateway to Retezat National Park”. According to the Romanian Government, another €1.5 million will be awarded through an EU funding channel that will be open by the end of February 2019. These funds will support professional development programs for people in the area, including a partnership with the University of Petrosani and grants for those who will decide to open a business in the Jiu Valley. In addition, another €800,000 will be spent by the Romanian Government to produce a new Development Strategy for the Jiu Valley (Economica.net, 2018).

Regardless of politics, the Romanian government will have the final say on the strategic direction of the Jiu Valley. Given the social, economic, and ecological vulnerability of the mining areas, regional and state authorities must consider local conditions and best practices learned from other areas that have transitioned away from coal. It is clear that the Romanian government must move beyond the strategies outlined during EU accession and begin to implement new, concrete plans with the support of international funds and NGOs (A. Mariciuc, et al., 2007). This process is at an early stage and its success will depend on civil society, local and government authorities, businesses, academia and average citizens getting involved by raising awareness and debating complex situations.

Non-governmental organizations have an important role to play in the transition process. NGOs are mobile, real-time problem solvers that come with a host of other advantages:

- A network of volunteers, with solid growth potential in the coming years;
- The availability of financial support from other governments and international institutions for the social development of Romania, through grant and other financing programs;
- Strong competition to attract funds. This competition forces NGOs to innovate, which may lead to better quality projects;
- Awareness of external funding opportunities;
- Collaboration between the private sector and non-profit organizations through sponsorships and Corporate Social Responsibility activities.

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6. Ukraine

National Policies and trends in coal mining and socio-economic development

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Introduction

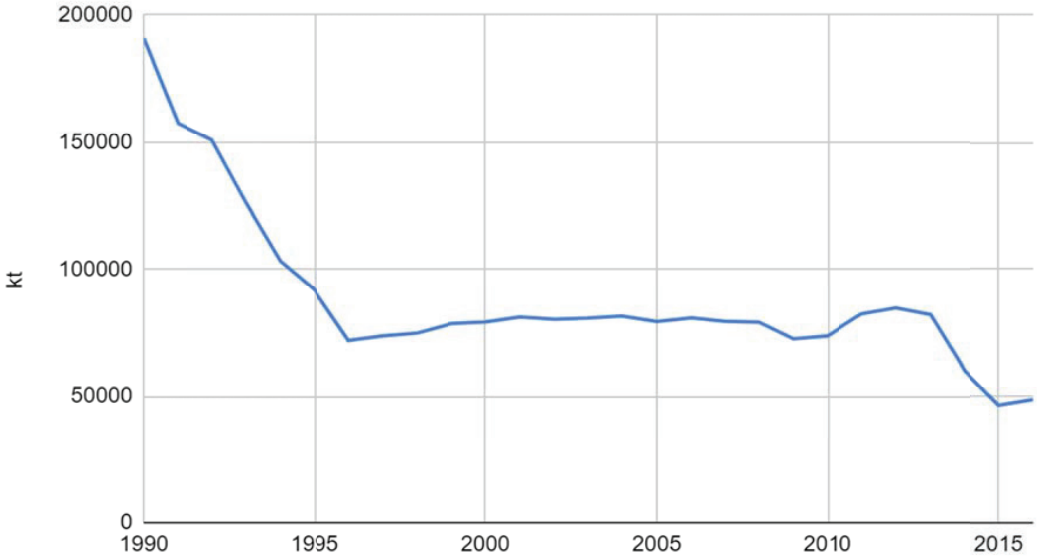
Ukraine ranks 8th in the world in terms of proven coal reserves, estimated at around 34 billion tonnes, or 3.5% of the world's reserves (National Institute for Strategic Studies, 2017). In addition, as of 2017, Ukraine ranks 13th in the world in terms of coal production.

About 70% of the coal produced in Ukraine is gas coal, which is used by thermal power plants to produce heat and electricity.

It should be noted that there are statistical differences in estimated coal production by different state authorities. For example, while the State Statistics Service announced that the amount of coal production in 2016 was 43.18 million tonnes, the Ministry of Energy and Coal Industry calculated 40.86 million tonnes, and the State Research Institute "Geoinform of Ukraine" - 26.85 million tonnes (Extractive Industries Transparency Initiative, 2018). These disparate results persist despite the State Statistics Service and the Ministry of Energy and Coal using the same methodology.

However, for unification purposes in this study we will use the information provided by the Ministry of Energy and Coal Industry, as it is the sole state body responsible for the functioning of the coal sector. According to it, total coal production decreased from 164 million tonnes in 1990 to 33 million tonnes in 2018.

Figure 1: Coal production (1990-2016)



Source: IEA, 2016

In order to evaluate coal as an energy source and to compare it (considering also its substitution potential - in the case of mine closure) with other energy sources, we propose to measure it in tons of oil equivalent (Mtoe).

It should be noted that while coal is one of Ukraine's key energy sources, it is significantly dependent on imports.

According to Ukraine's energy balance for 2017 (State Statistics Agency of Ukraine, 2018), the level of coal dependence is as follows:

- it contributed 29% to the primary energy supply (25.69 million tonnes, 51% of which is imported);
- the share of coal in electricity generation is 51% (2016);
- coal production covers 66.4% of Ukraine's domestic energy demand (anthracite) and coking coal (36.9% in 2017).

Given the unmet demand in the domestic market, there is a net import of coal which has more than quadrupled since 2013, from 2.89 million tonnes up to 12.4 million tonnes in 2017. According to the MIT Atlas of Economic Complexity (2017), Ukrainian coal imports totaled $2.3 billion in 2017. Top coal importing countries were: Russia (49%), US (31%), Australia (4%), South Africa (3.1%), Poland (2.8%), Kazakhstan (2.7%).

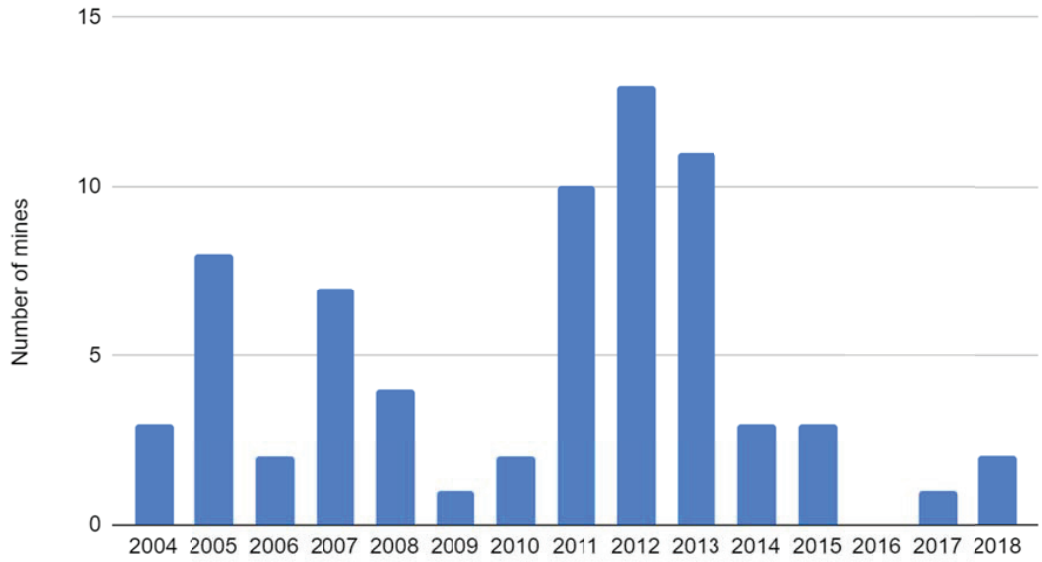
The significant import increase in 2014-2017 is associated with a decrease in coal production in the uncontrolled territories of the Donetsk Coal Basin and in some areas of the Donetsk and Luhansk regions (NGCA). The increase is also caused in part by a substitution of natural gas for energy consumption, which is related to increase of the

import price of the latter by 2.3 times in 2014-2018. By 2014, the net import of coal to Ukraine did not exceed 2.8 million tonnes per year.

Public and private companies both operate in the coal mining industry. According to the Ministry of Energy and Coal Industry of Ukraine, in the spring of 2014 - before the beginning of the armed conflict - coal was mined by 148 mines, 102 of which were state owned and 46 private mines (Extractive Industries Transparency Initiative, 2018).

The war in eastern Ukraine has a significant impact on coal mining opportunities, including state mines. There are 95 mines in the territory of Donetsk and Luhansk which is not under the control of the Ukrainian government as of 2019. Out of 102 mines subordinated to the Ministry of Energy, 67 mines are located in the uncontrolled territory and 33 mines are outside the combat zone.

Figure 2: Closures of coal mines (2004-2018)



Source: Ministry of Energy and Coal Production, 2018

The coal industry needs comprehensive reform. To this end, the Cabinet of Ministers of Ukraine approved the Concept of Reform and Development of the Coal Industry until 2020, the Energy Strategy of Ukraine until 2035 and the Action Plan for the Energy Strategy until 2020. There has been little progress in implementing the latter as of early 2019 in the context of coal reform (Low Carbon Ukraine, 2019).

An analytical study has been prepared to provide recommendations for the restructuring of the Ukrainian coal industry. It provides an overview of the reasons for the start of coal restructuring, the experience of closing coal mines in Ukraine, an overview of state and international technical assistance programs aimed at reforming the coal industry, as well

as a list of recommendations to combat the negative economic, social and environmental consequences of the restructuring process.

General overview

Economic problems in the coal industry

The following are the main economic problems that spurred the decision to restructure the coal industry:

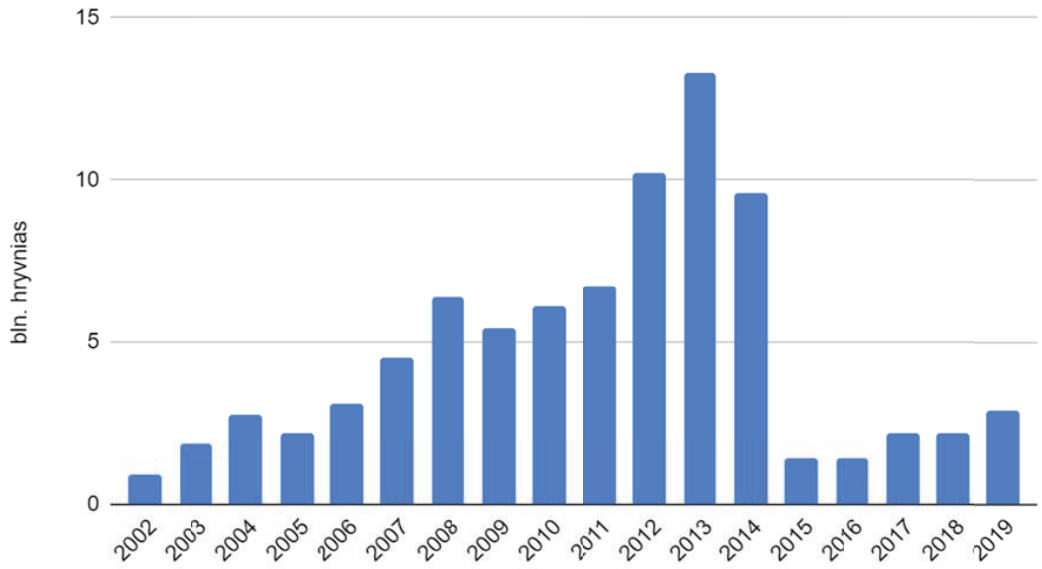
1) Significant subsidies to support coal mines. According to the Ministry of Energy and Coal Industry in Ukraine, 29 out of 33 state-owned mines are not profitable. For example, in 2018, state support for coal mining companies to partially cover the cost of finished coal products amounted to ₴1.4 billion. Another ₴1.3 billion was spent on measures to ensure domestic production of coal products and further reform of state-owned coal mines (Verkhovna Rada of Ukraine, 2017). State-owned mines mainly have complex mining and geological conditions, which significantly affects the cost of production and, accordingly, requires additional financing.

At the same time, such strong government support for the coal sector has not been effective. According to the decision of the Accounting Chamber of Ukraine from May 16th, 2017, the Ministry of Energy did not ensure the "lawful, efficient and effective" use of state budget funds provided for the restructuring of the coal industry in 2014-2016.

2) Corruption component in receiving coal subsidies. The state owns primarily unprofitable mines with complex mining and geology, which require significant subsidies to function. Due to the lack of transparency in the management of state-owned enterprises, the situation of inappropriate and illegal use of allocated funds has arisen, which in the years of independence is estimated at tens of billions of hryvnias. For example, the Audit Department of State Enterprise “Makiyivvuhilia” 2011 report revealed gross violations of financial and budgetary discipline with a loss amounting to ₴1.823 billion (Dzerkalo Tyznia, 2011).

3) Unprofitability of coal-mining enterprises. This situation is created by the discrepancy between the market price for coal products and cost of their production (Cabinet of Ministers of Ukraine, 2017). According to the Ministry of Energy, only 4 state-owned mines were profitable in 2017, with losses from coal production in 2016 amounting to ₴2.5 billion. For example, the Ministry of Energy established a limit price for coal from the state mines in April 2018 amounting to ₴2535 per tonne, while the Ministry's forecast for 2018 is ₴2937.3 per tonne. Further state support for the industry is a heavy burden on the budget, given the current economic situation: 35% fall of GDP in 2014-2017; a 2.3 times increase in the price of natural gas through government subsidies; growth in the share of other social payments.

Figure 3: Coal subsidies (2002-2019)



Source: State Treasury Service of Ukraine, State Budgets of Ukraine, 2002-2019

4) Poor condition of technology in most coal mining companies. Of 7,000 units of basic stationary equipment, 2/3 have fulfilled their standard operating life. In addition, almost 95% of mines have been operating without renovations for over 20 years. Not only does this affect the prime cost of the output, but it also increases risks to the lives and health of the miners (Cabinet of Ministers of Ukraine, 2017).

At the same time, given the global trends in decarbonisation and the fossil fuels phase-out, technological modernization of outdated equipment does not make economic sense in the long run.

5) Difficult geological conditions may preclude the development of new fields. They require complex engineering solutions which are not comparable with the potential economic effect of such investments, as well as a low level of financing for exploration (Cabinet of Ministers of Ukraine, 2017).

6) Competition in the energy market related to the rapid development of renewable energy sources (RES).

The global decarbonisation trend influences and will continue to affect Ukraine in the future (the difficulty of obtaining financing for the construction of new coal mines and power plants, setting the price for CO2, etc.).

Social problems in the coal industry

The main social problems that lead to the decision to restructure the coal industry are:

1) The problem of the monospecialization of the coal regions and most of the mining towns, whose economies are often completely dependent on coal mining activities. Closure of a mine or reduction of production means outward migration until the disappearance of such towns. However, most mines are likely to close due to the aforementioned economic challenges. Generally, the level of production and use of fossil energy sources, coal in particular, is to decline significantly in the coming decades. Ukraine's Energy Strategy until 2035 halves the use of coal in its primary energy supply to 12 million tonnes by 2035 (in comparison to 25 million tonnes in 2017) and increases the share of renewable energy sources by at least 25%.

2) Negative environmental and human health impacts - coal is one of the largest polluting energy sources and is one of the major sources of large-scale greenhouse gas emissions, which should be substantially reduced by the middle of the century in line with the Paris Agreement and Ukraine's Energy Strategy 2035. According to the National Emission Reduction Plan by 2034, harmful emissions from coal plants should be minimized over the next 15 years by installing appropriate wastewater treatment equipment and shutting down parts that are past their service life (Cabinet of Ministers of Ukraine, 2017). In particular, by 31.12.2033, the decommissioning of 17 existing coal-fired large combustion plants with a total rated thermal capacity of 15,118 GW is envisaged; for 32 large coal combustion plants with a total rated thermal input of 45,420 GW, operators were provided with information on planned emission reduction measures. To achieve the goals of the National Emission Reduction Plan, it is also envisaged to switch to co-firing of biomass with solid fuels (coal).

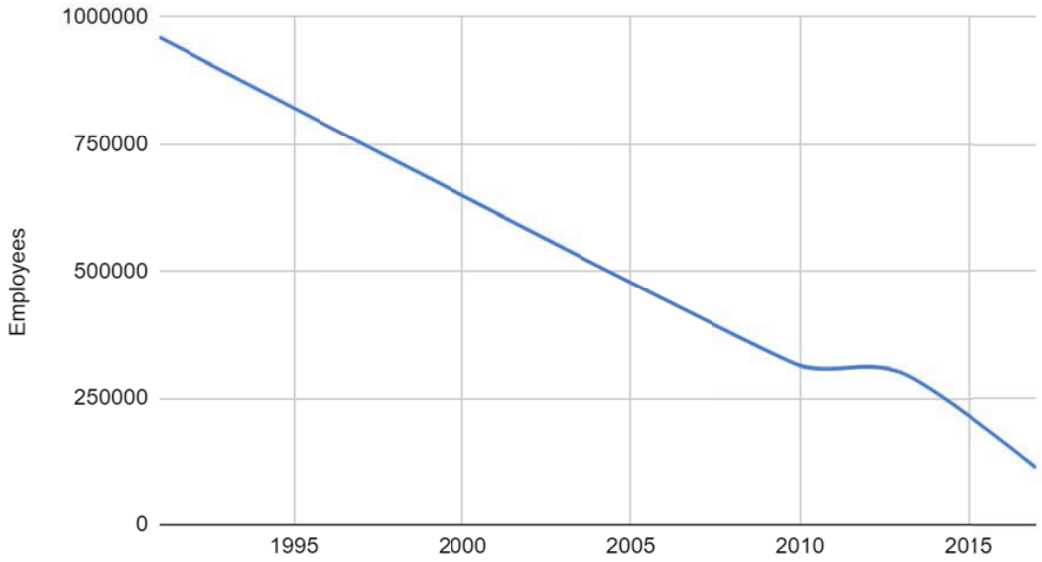
3) Difficult working conditions at mines - low safety level and often non-compliance with health and safety rules pose a high risk of harm to workers.

4) The skill level among personnel in the coal industry - the decline in prestige of mining, the lack of a training base and the level of professional training does not meet the needs of innovative development in coal production (Cabinet of Ministers of Ukraine, 2017).

Consequences of closing coal mines

According to the Ministry of Energy and Coal Industry of Ukraine and the State Statistics Service of Ukraine, the number of employees in the coal sector decreased by 88% over the period 1991-2013, down to around 120,000 in 2013. The beginning of the war in eastern Ukraine has significantly influenced the continuous decrease in the labour force. As of 2018, approximately 42,000 people work at state mines.

Figure 4: Employment in the coal sector



Source: State Statistics Service of Ukraine, 2018

In turn, we can distinguish the following negative effects that may occur after the closure of coal mines:

- Economic: a possible imbalance in the country's energy system due to the reduction of coal production, the need for significant funding for the social and environmental consequences of coal mine closure;
- Social: The dismissal of a large number of workers who lose their livelihoods, which can lead to severe social consequences in the mining regions. This is especially the case in towns that formed due to the coal industry. As a result, there will be a need for employment or retraining of dismissed workers so that they can earn a living. Social facilities may also be closed if people leave their towns after coal mines shut down;
- Ecological: unmanaged flooding of mines, methane entering the earth's surface, fires and landslides occurring in waste heaps.

The government plans to continue the liquidation of unprofitable coal mines. In line with the Energy Strategy until 2035, closure or conservation measures for unprofitable state-owned mines should be completed by 2025 and a social and environmental mitigation plan should be adopted for each site.

However, part of the actions envisaged in the Action Plan for the implementation of the "Energy Sector Reform (2020)" phase have not been implemented.

First and foremost, no programs have been developed to ease the transition of coal mining regions, which is key for a successful transformation. Delaying such programs will delay the alleviation of socio-economic problems and hinder further development of the coal regions. Second, it is not clear which mines are set to be liquidated.A clear understanding of the fate of local mines will allow local authorities and populations to begin the process of responsible planning of the closure and diversification of the economy.

Since its independence, Ukraine has closed down coal mines without adequate socio-economic support, resulting in complex negative consequences. The process of liquidation began without consulting local authorities and populations. In most cases, this resulted in economic decline and outward migration. Some closed mines face constant floods (the average cost of which is ₴3-5 million per month per mine), necessitating systematic shutdowns of water pumps . As a result, untreated water from the mine enters soil and groundwater, flooding nearby homes.

The negative effects of closing coal mines can be offset by early management of the restructuring process, before the predicted economic and social challenges have grown insurmountable. If national, regional and local authorities, with the support of international partners, can develop and implement programs that overcome the economic, social and environmental consequences of coal restructuring, successful diversification of the economy and local society can be achieved.

State and international coal sector restructuring programs

State documents on restructuring of the coal industry: Measures and Results (1991-2018)

Throughout its independence, Ukraine has adopted many programs to restructure the coal industry. Initially they were aimed at making the industry more profitable. Over time, however, government programs in the field of energy began to take into account the development of RES and energy-efficient technologies. As a result, , several strategies now envision a reduction in coal's value within Ukraine's energy supply.

However, it should be noted that a serious problem facing all the strategic documents listed below is that they have not been fully or even partially implemented.

In 1991, there were an estimated 280 mines in Ukraine. The first document outlining the development of the coal industry was the "Coal Mining and Social Development Program for the Mining Regions up to 2005", adopted on March 2, 1994. It planned to introduce

production facilities with a capacity of 28 million tonnes for new and reconstructed mines and to close 48 coal enterprises. The program also envisaged maintaining production volumes at the 1994 level (152 million tonnes). However, due to the mass liberalization of the Ukrainian economy, in 1996 the capacity of state-owned mines dropped sharply, and the volume of production fell by 20% to 129 million tonnes.

As a result, the Cabinet of Ministers' resolution No. 280 "On the course of restructuring of the coal industry" was adopted on March 28, 1997, initiating the restructuring of the industry for the period up to the year 2000, during which 83 mines were closed. However, such measures did not achieve their goal: to adapt the industry to the needs of the economy, to make coal enterprises profitable and to ensure socio-economic stability (payment of salaries and reduction of industrial injuries).

The next document aimed at further reforming the coal industry was the CMU Resolution “On approval of the Ukrainian Coal Program” adopted on September 19, 2001 for the years up to 2010. The program’s goals were“improving the efficiency of the coal industry and achieving the volumes of coal production required to meet the needs of the national economy”. The document envisaged, accelerating the closure of unprofitable mines, bringing the total number of mines down from 275 in 2001 to 159 in 2010; while also planning to increase production (and therefore productivity growth) from 80.8 million tonnes to 110.3 million tonnes, respectively. It is important to note that the Program takes a "conservative" view of the role of fossil fuels ("in the new century, the share of coal in the energy balance will increase"). This indicates the orientation of the then-strategic documents to support the development of the coal industry, despite the significant socio-economic problems of restructuring in the 1990s.

I.M. Kocheshkova, D.D. Cheliakh and D.Y. Cherevatskyi state that the problem with the coal industry lies not only in the large number of closed facilities, but also in the abundance of mines that could potentially face liquidation (Forum of Miners, 2013, pp.27-32). In addition, the list of mines to be closed is constantly changing. New units are occasionally added, and project completion times are delayed. Information on the finance behind mine closures is incomplete and often inaccurate, indicating corruption risks.

One of the most important strategic documents that determines the future development of Ukraine’s regions is the State Strategy for Regional Development until 2020, which was approved by the Cabinet of Ministers of Ukraine Decree #385 on August 6, 2014. One of the goals of the State Strategy is to diversify energy sources and increase the level of energy efficiency in the regions.

Hence, it can be concluded that coal production can be reduced by improving energy efficiency. According to a simulation by the Institute of Economics and Forecasting of the National Academy of Sciences of Ukraine conducted at the request of the Ministry of Energy, provided that the main indicators of the Energy Strategy are fulfilled, the share of coal could be reduced by up to 15% in the total primary energy supply by 2035 (TIMES-Ukraine, 2018).

The reduction of coal consumption is confirmed by the report on the implementation of the Energy Strategy of Ukraine until 2035 (Ministry of Energy and Coal Industry, 2019). According to the report, the percentage of coal in the structure of total primary energy supply decreased from 30.4% in 2015 to 28.7% in 2017. At the same time, the percentage of energy from renewable resources increased from 4% to 5% in 2 years.

The comprehensive document defining the strategic guidelines for the development of the fuel and energy complex in Ukraine is the Energy Strategy of Ukraine until 2035 “Security, Energy Efficiency, Competitiveness”. It was approved by Decree #605-p of the Cabinet of Ministers of Ukraine on August 18, 2017. The Energy Strategy is to be implemented in 3 stages:

- Reforming the energy sector by 2020;
- Optimization and innovative development of energy infrastructure by 2025;
- Ensuring sustainable development by 2035.

To implement the Energy Strategy of Ukraine until 2035, the Cabinet of Ministers of Ukraine adopted a Plan of Measures to Implement the “Reforming the Energy Sector by 2020” phase. The plan envisages the implementation of 15 measures to reform the coal sector. At the same time, 7 measures were set to be implemented in 2018, 2 in 2019 and 6 in 2020. As of March 2019, no measures have been fully implemented (Ministry of Energy and Coal Industry, 2019).

The document which governs targeted restructuring of the coal industry is the Concept of Reforming and Development of the Coal Industry for the period up to 2020, approved by the Decree No. 733-p of the Cabinet of Ministers of Ukraine of May 24, 2017. The purpose of the Concept is to solve complex problems of the coal industry, to implement measures that increase the volume of coal production, to increase efficiency and to switch the coal industry to a self-sustaining mode of operation while simultaneously solving the environmental and social problems in mining regions.

The Concept also defines an Action Plan for its implementation, which contains 12 measures. However, an analysis of the Ministry of Energy and Coal Industry reports for 2017 and 2018 shows (Ministry of Energy and Coal Industry, 2019) that only one action was taken: the formation of the state-owned enterprise "National Coal Company".

Although the document, along with the Energy Strategy 2035, foresees the closure of individual coal mines and the termination of state subsidies to the industry, the Concept also provides for an increase in projected coal production in 2017 of 6.3 million tonnes; in 2018, 8.7 million tonnes; and in 2019 and 2020 over 10 million tonnes each year. Thus, there are serious contradictions between the various strategic documents on the national level, as well as actual actions and short-term plans.

International assistance to coal sector restructuring: Measures and Results

Since the mid-1990s, Ukrainian authorities and international partners have been trying to develop comprehensive programs to restructure the coal sector and support the mining regions that are suffering the greatest economic losses. As a result of the implementation of individual projects by the World Bank, the European Union and the Government of the UK, the relevant ministries received specific recommendations on energy transformation. These plans were not implemented due to a lack of political will.

This process began with the World Bank in the mid-1990s. Since 1996, the institution has provided two loan tranches to close unprofitable coal mines.

The late 1990s and early 2000s were marked by a number of international assistance programs for the restructuring of the Ukrainian coal industry. These included the activities under the European Technical Assistance to the Commonwealth of Independent States (TACIS) initiative, programs supported and implemented by the local office of the Ministry of International Development of the United Kingdom (DFID) and the Know-How Foundation (UK).

There are two major international projects in recent years:

- EU Coal Restructuring Project (2009-2013), which contains step-by-step recommendations, spread out over the coming years.
- Miners' Retraining Project, supported by the Government of the United Kingdom (2015).

Unfortunately, none of the aforementioned projects have reached a positive result. The Ukrainian government has often ignored the recommendations given, focusing instead on further support for the coal industry through annual multi-billion state budget subsidies.

According to the official portal for coordination of international assistance to Ukraine, 118 projects were implemented as part of the "Energy Independence and Energy Reform Program" during 1991-2018 (Open Aid Ukraine, 2018).

Of these, 48 projects or 40% have the Ministry of Energy and Coal Industry as its beneficiary. The areas of implementation of these projects are nuclear energy (28 projects), electricity (5), oil and gas (3), renewable energy (2), others (3), energy reforms, energy efficiency, and ensuring transparency of the industry (7).

Of the 48 projects with the Ministry of Energy and Coal Industry as a beneficiary, only 5 concern the coal industry. An additional 4 projects are indirectly related to the coal sector and are aimed at implementing energy reforms in general. These are projects such as:

- Assistance to Ukraine in the implementation of energy sector reforms in line with Ukraine's international commitments (supported by the European Union);
- Support Project for the Extractive Industries Transparency Initiative (supported by the International Bank for Reconstruction and Development);
- Continued support for the implementation of the Energy Strategy of Ukraine (supported by the European Union);

- Supporting the implementation of the Partnership and Cooperation Agreement (supported by the European Union)

Only one project is directly related to the coal industry:"Mine Security in Ukraine", worth $8 million. The project was implemented over the period of 17.09.2004 - 30.06.2015 with support from the US Department of Labor in the Donetsk and Luhansk regions, as well as in Kyiv. The project activities are aimed at lowering the number of fatal injuries at Ukrainian coal mines by reducing the possibility of methane explosions.

Economic prospects

Recommendations concerning potential measures for the affected territories

The coal industry, which is one of the major sectors of the national economy, has been in crisis for a long time. Despite state measures and support,the coal industry crisis is only worsening. Almost 96% of mines have been operating without renovations for over 20 years. Due to the slow restructuring of the industry, a significant number of unprofitable mines are still in operation (Cabinet of Ministers of Ukraine, 2017).

The coal industry needs immediate restructuring in the context of global decarbonisation and gradual abandonment of coal. Effective restructuring requires:

1) Amendments to prior coal restructuring plans that take into account the requirements of decarbonisation.

2) Involving international partners to support the restructuring of the coal industry and to address the industry's negative effects:

- Develop, together with international partners, a program of international technical assistance aimed at overcoming the economic, social and environmental impacts of restructuring the coal industry;
- Fund international technical assistance programs for coal restructuring in local, regional, and state budgets;
- Involve international partners in exchanging best practices with countries that have had a positive experience with transforming mining regions.

Given the considerable international technical assistance provided to Ukraine to implement reforms in various fields, involvement of international partners to restructure the coal industry is possible. The Ministry of Energy and Coal Industry needs to intensify its work with foreign partners to restructure the coal industry, since only 2% of all projects where the Ministry is listed as a beneficiary are related to the coal industry.

Authorities at the national level also need to reduce subsidies for coal companies. Subsidies should only be used to provide drainage at closed mines. It is recommended to spend the money that will be saved in this way to alleviate the economic, social and environmental consequences of restructuring the coal industry. These consequences will intensify over time and will require rapid responses from national, regional and local authorities. Below is a list of possible recommendations for different levels of government that can help mitigate the negative effects of restructuring.

Regional study: Luhansk and Volyn Regions

Kostiantyn Krynytskyi, Just Transition Campaign Coordinator, Ecoaction

Lysychansk, Luhansk region

General information	
Population:	98 226 (01.01.2018) / 112 574 (01.01.2018)
Area:	95,64 km²
Population density:	1027 inh/km²
Budget revenue (2018):	₴854,496,322,28
Budget expenditure (2018):	₴859,631,002.53
Coal mines still in operation:	4
Coal mines closed since 1991:	2

Note: The author carried out this study partially by interviewing the representatives of local authorities and local resident of Lysychansk and Novovolynsk. These transcripted interviews are the basis for quotations and "first-hand" information mentioned below..

Starting 1991, over the years of Independence of Ukraine, two mining companies were liquidated in Lysychansk: coal mines "Chernomorka" and "Matroska". At the same time the processes of closing other industrial enterprises continued (OJSC "Lysychanska Soda", PJSC Lysychansk Glass Factory "Proletar"), which negatively affected the socio-economic situation in the city.

As a result, analyzing the labor market, we can observe increasing number of unemployed people. Thus, as of the beginning of 2018, the number of unemployed people increased by 14.7% in comparison with the beginning of 2017 (Lysychansk Town Council, 2018).

According to the State Statistics Service of Ukraine (2018), as of January 1, 2018, the main amount of arrears (76.7%) on payment of wages at the enterprises of the city falls on PJSC “Lysychanskvuhillia” and its 11 separate divisions. In the same time, 4 of the operating state mines are unprofitable (Cabinet of Ministers, 2018).

The combination of these factors creates additional concerns in the city that the process of closing mines will continue.

Statistical information about coal mines (01.01.2018)	
General info	
Employees:	3896
Coal production in 2017 (thousand tonnes):	234,1
“Pryvilnianska”	
Employees:	319
Coal production in 2017 (thousand tonnes):	4,8
“H. H. Kapustina”	
Employees:	941
Coal production in 2017 (thousand tonnes):	28,5
“D. F. Melnykova”	
Employees:	1626
Coal production in 2017 (thousand tonnes):	179,6
“Novodruzheska”	

Employees:	559
Coal production in 2017 (thousand tonnes):	21,5

Preparation and liquidation

The process of liquidation of coal enterprises was carried out according to the standard procedure provided by the Procedure of liquidation of unprofitable coal-mining and coal-processing enterprises, approved by the Decree #939 of the Cabinet of Ministers of Ukraine "On approval of the Procedure for liquidation of unprofitable coal-mining and coal-processing enterprises of the Ministry of Coal Industry", adopted on 27th August 1997. The actual contractor was state enterprise “Ukrvuglerestrukturizatsiia”, which acted on the basis of the liquidation project developed by the “Institute Ukrndiproekt”. The total budget of liquidation of the Chernomorka mine amounted to ₴49.232 million, and of the Matroska mine - ₴18.518 million (Cabinet of Ministers of Ukraine, 2004).

According to the representatives of the coal-mining enterprise, no preliminary consultations with the local authorities on the closure of the mines were held. For the destruction of the terrestrial infrastructure, Ukrvuglerestrukturizatsiya involved private firms that dismantled and disposed of scrap. In the same time, during the 1990s, trade unions organized several protests, mainly focused on the problem of late payment of wages. According to the people who worked at the liquidated enterprises, the lack of clear communication between the national and local authorities and the lack of their coordinated actions caused the social and economic instability of the region after the closure of the mines.

Real consequences

An exemplary case is the village near the Matroska mine. The actual mining work was discontinued in 2005. The same year, the gradual closure of social infrastructure buildings began. Thus, the local school, kindergarten, hospital, post office and a coal boiler house were closed during the next 13 years. The only places still operating are the local grocery store and the library.

Quote from a former miner (56 years of service): “*If your family member is taken away, how will you react? And then, if you worked 15-20 years in the coal mine, you know how painful it is to leave it. So here, too, there is a ... Psychological fracture*.”

During conversations, local residents emphasize that after the mine was liquidated, former workers went to work in other mines in the region or left to work in private mines in the Donetsk region. There were no specific retraining programs offered to miners at the

local employment center. Currently, the village is a home to about 300 people, while as at the beginning of the 2000s the population was 1,300. After the start of the war in Donbas, the migration movement has only strengthened. And the process of rapid aging of the population coincides with the general trend in the region. This suggests that the city is threatened with extinction in the next decade.

Water disposal in the closed coal mines

The closure of mines, which took place without an approved program of social reconversion of the territory, resulted in not only negative social but also environmental consequences. For example, Chernomorka mine has been operating in the drainage mode for the last 20 years. This process is continuous and needs ongoing funding. The drainage complex of Chernomorka mine protects the existing mine “D.F. Melnikova” from flooding and provides employment for 15 people. According to the information provided by the Ministry of Energy (2018), the operation of pumps at one state mine costs ₴1.216 million per month. On average, thousands of liters of water are pumped out of a closed mine a day, which is then processed at a filter station located nearby and dumped into the Siverskyi Donets River. However, emergency pump stops are common. In these cases, untreated water from the mine enters the groundwater and begins to flood houses situated nearby. According to local residents, such situations occur every few months.

Illegal coal mining

A phenomenon unique to coal regions is the illegal mining of coal. In the case of Lysychansk, the so-called "kopanky" appear just outside the administrative-territorial boundaries of the city. This raises a number of problems. On the one hand, this activity is illegal and involves criminal liability (Article 240 of the Criminal Code of Ukraine). On the other hand, working on the illegal mines is a real alternative for miners who have been fired due to the shutting down of local mines. According to locals, workers receive up to ₴1.000 per day and work part-time. Given that the actual wages at the mines are reduced by 3 or 4 times due to inflation and the devaluation of the national currency, this activity is also attractive to miners who are still employed.

It is also significant that the entire logistical infrastructure is equipped to transport illegally produced coal. In addition to trucks that transport coal from quarries, there is also a separate station on the local railroad, which is used solely to transport coal further across the region and beyond.

New economic opportunities

The mine liquidation projects developed by the research and design institutes provide the complete liquidation of the mining enterprises' terrestrial structures. Therefore, the use of former office buildings by other enterprises in most cases becomes impossible. However, in Lysychansk there are individual cases when small private enterprises bought from the state property buildings of former miners' canteens and turned them into factories for the production of furniture and shoes. These small businesses provide jobs for a small number of people (30-50) and are not able to mitigate the employment losses from the liquidated coal mines.

Novovolynsk, Volyn region

General information	
Population:	52 188 (01.01.2018)
Area:	20 km²
Population density:	3406 inh/km²
Budget revenue (2018):	₴537,506,754.41
Budget expenditure (2018):	₴224,873,936.29
Coal mines still in operation:	2
Coal mines closed since 1991:	7
1 coal mines under construction (since 1989)	

Since 1991, seven coal mines were liquidated in the city. As of 2019, Novovolynsk is the only city in Ukraine where a new coal mining enterprise is being built.

Construction works of a mine # 10 “Novovolynska” began in April 1989. According to a paragraph 143 of the Action Plan for the implementation of the “Energy Sector Reform (2020)” phase of the Energy Strategy of Ukraine 2035, in Q3 of 2018 a financing mechanism for the completion of this mine must have been determined in order to ensure completion of the construction in 2019.

According to information provided by the Ministry of Energy and Coal Industry (2019), "the only source of financing for the construction of mine # 10 “Novovolynska” remains the state budget" and "the amount of allocated funds does not ensure completion of construction in 2019". As of 01.01.2019, the mine readiness was at the estimated 87.6%.

Statistical information about coal mines (01.01.2018)	
General information	
Employees:	1,646
Coal production in 2017 (thousand tonnes):	101,4
“#9 Novovolynska”	
Employees:	632
Coal production in 2017 (thousand tonnes):	52,5
“Buzhanska”	
Employees:	811
Coal production in 2017 (thousand tonnes):	48,9

Having analyzed the information provided by the local authorities and having communicated with the residents of the city, we can conclude that the process of preparation for the closure of mines and the actual liquidation coincides with Lysychansk example.

At the same time, the case of Novovolynsk is more positive in terms of economic and social transformation of the region. There is a number of reasons for this.

Granting the region the status of “priority development territory”.
The Law of Ukraine “On special regime of investment activity in the priority development territory in Volyn oblast” was adopted in 2001. According to it, the priority development territory (PDT) is a "territory in which unfavorable socio-economic and environmental

conditions were developed; poor employment status of the population and where a special regime of investment activity is introduced for creating new workplaces".

Article 2 of the Law stipulates that “a special regime of investment activity on the territory of priority development in the Volyn region is introduced with the purpose of attracting investments in major branches of production to create new workplaces and employment of workers who are dismissed in connection with the closure, restructuring and conversion of mining and other enterprises; for introduction of new technologies, development of foreign economic relations; to increase the volumes of high-quality goods and services; for creation of a modern industrial, transport and market infrastructure; for efficient use of natural resources".

In personal communication with representatives of the local authorities, they have repeatedly emphasized that granting the PDT status to the region helped to cope with some of the negative effects of the closure of coal mines.

As a result of the investment attraction policy, new businesses have started to open in the city. Examples include PLC "BRV-Ukraine" (furniture production) and "Kronospan UA" (wood based sheet production). According to locals, the number of new jobs almost offset the number of jobs lost after the closure of seven coal mines. At the same time, it is necessary to emphasize the lack of statistical information that could confirm that the laid-off miners did find a job in newly established enterprises.

Proximity to the border with Poland.

The geographical location of Novovolynsk promotes the labor migration of residents of the city to the countries of the European Union, first of all Poland. Most of the former miners either tried to find employment in the coal mines of Poland and the Czech Republic after the liquidation of the coal enterprises or changed their vocation altogether and went to work abroad.

Particularly popular are the sectors of trade (clothing, tobacco) and construction. As a result, some people, after being laid-off from coal mines, are able to earn money in another country and send remittances to support their families that remain in Ukraine.

This kind of "seasonal" workers does not bring money to the local budget (because they do not pay taxes), but help to boost the local economy by spending money in local establishments.

Local government initiatives.

Local governments play an important role in the processes of ensuring a Just Transition of the mining regions. Thus, since the 1990s, re-training programs for miners have been developed by the local authorities of Novovolynsk. In a personal interview with the deputy mayor, he repeatedly emphasized the ongoing efforts of the local authorities to find

foreign investors and to simplify business procedures by making appropriate decisions by city councils.

A preferential retirement benefit is also offered as a model solution to the social security issues of discharged miners. Employees that were laid-off may be offered a 50% of the total pension. It will be paid out until the completion of a mandatory requalification process.

By analogy with the dismissal of employees from OJSC "Kryvorizhstal" in the mid-2000s, it is also proposed to give each dismissed employee a six-month salary. This, in turn, can serve as the start-up funds to open their businesses.

It should be emphasized that the options given above are not yet official and aren't presented in any documents. At the same time, they represent an important field for further research on the positive and negative consequences of their adoption.

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Transformation Experiences of Coal Regions:

Recommendations for Ukraine and other European countries

(full study)

The purpose of this research is to provide recommendations for the Ukrainian authorities, both national and regional, on how to manage the closure of coal mines with a sound economic perspective and minimal negative social consequences on the basis of the analysis of positive and negative experiences of coal mines' closure in Ukraine and select EU countries (Germany, Romania and the Czech Republic).

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What do European coal regions need today?

The people and different stakeholders need a clear message and roadmap for development, instruments for support to embark on a journey for change, sustainability and prosperity.

Decision makers need support in assessing the local potential, exchange with other regions, dialogue to develop ideas and pathways for a sustainable development.