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Contested Futures for Energy Transitions

Ulrike Zeigermann, Gilles Lepesant, Katrin Beer *Hrsg.*

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Ulrike Zeigermann, Gilles Lepesant, Katrin Beer *Hrsg.*

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Contested Futures for Energy Transitions

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PoWiNE Working Paper

Vor knapp fünf Jahren – im Herbst 2016 – wurde an der Otto-von-Guericke-Universität Magdeburg die Professur für Politikwissenschaft mit dem Schwerpunkt Nachhaltige Entwicklung eingerichtet. Die Wissenschaftlerinnen und Wissenschaftler des Lehrstuhls forschen seitdem in Magdeburg aus politikwissenschaftlicher Sicht zu Nachhaltigkeitsfragen. Nachhaltigkeit ist dabei weit gefasst: Ausgehend vom klassischen Nachhaltigkeitsdreieck zwischen Ökonomie, Sozialem und Ökologie sowie an den 17 Sustainable Development Goals der UN (SDG) orientiert, stellt seitdem die empirisch-analytische Politikfeldforschung bezogen auf aktuelle und zukünftige Probleme der Governance von Nachhaltigkeit den Fokus der Arbeit des Lehrstuhls dar. Insbesondere werden politische Prozesse der Umwelt-, Energie- und Klimapolitik, der Bioökonomiepolitik und der nachhaltigen Regionalentwicklung erforscht und in der Lehre mit Studierenden bearbeitet. Einen weiteren Forschungsschwerpunkt stellen Wissenstransfer und Politikberatungssysteme in der Umwelt- und Nachhaltigkeitspolitik dar. Dazu kommen aufgrund des „Standortes" landespolitische Fragen zum politischen System und der Landesentwicklung Sachsen-Anhalts sowie seit 2020 auch Analysen zur Corona-Politik. „Klassische" politikwissenschaftliche Fragen wie die Rolle von Parteien oder Aspekte der politischen Theorie ergänzen neuerdings das Lehrstuhl-Portfolio.

Abbildung 1 Der Lehrstuhl Politikwissenschaft mit Schwerpunkt Nachhaltige Entwicklung, Bild von Jana Dünnhaupt, OVGU, 2020

Aus der vielfältigen Arbeit der Wissenschaftlerinnen und Wissenschaftler des Lehrstuhls heraus entstand die Idee einer Schriftenreihe, der „PoWiNE Working Paper". Diese soll Beiträge enthalten, die ausgehend von der Forschung und Lehre im Bereich Politikwissenschaft mit dem Schwerpunkt Nachhaltige Entwicklung, einen Einblick in die Arbeit des Lehrstuhls und seiner Wissenschaftlerinnen und Wissenschaftler erlauben. Die Beiträge stellen unsere „Magdeburger politikwissenschaftliche Forschungsperspektive" auf Nachhaltigkeit dar und werden im Rahmen verschiedener Schwerpunktthemen der einzelnen Ausgaben der Schriftenreihe als „Denkanstöße" oder als „Beiträge aus der Nachhaltigkeitslehre" veröffentlicht.

Bei den Denkanstößen handelt es sich um Kurzberichte aus der politikwissenschaftlichen Nachhaltigkeitsforschung. Wir verstehen darunter u.a. Kurzberichte über empirische oder theoretische Studien, interdisziplinäre und politikwissenschaftliche Konferenzen, erste Forschungsergebnisse, transdisziplinäre Tagungen und Veranstaltungen, sowie Forschungsberichte, Diskussionsbeiträge und Vorstellungen neuer Forschungsansätze und methodische Reflexionen. Darüber hinaus werden wissenschaftliche Essays und Gastbeiträge aus Nachbardisziplinen und anderen Institutionen veröffentlicht, deren Bezug zu politikwissenschaftlichen Fragen deutlich gemacht wird, oder die als Inspiration für politikwissenschaftliche Untersuchungen dienen können.

Forschungsarbeiten, die als Zeitschriftenartikel veröffentlicht werden, können in einem frühen Stadium oder in sehr verkürzter Version zusätzlich als Denkanstöße in dieser Working Paper Reihe veröffentlicht werden. Verfasst werden die Denkanstöße in der Regel von Wissenschaftler*innen, die einen Masterabschluss oder eine höhere wissenschaftliche Qualifikation haben und in der Forschung arbeiten.

Bei den Beiträgen aus der Nachhaltigkeitslehre handelt es sich um Studien und Erfahrungsberichte aus der Hochschullehre, bei denen das Thema Nachhaltigkeit im Zentrum steht. Wir fassen unter diese Rubrik zum einen Berichte von Lehrenden und Studierenden über erarbeitete Inhalte aus Seminaren und Kolloquien, über studentische Exkursionen, Veranstaltungen und Tagungen sowie über Planspiele und Simulationen. Zum anderen umfasst die Rubrik Beiträge über Lehrkonzepte, Erfahrungen und Best Practices in der Nachhaltigkeitslehre, über Erfahrungen mit neuen Lehrformaten wie der Online-Lehre sowie Berichte über das Nachhaltigkeitszertifikat der Otto-von-Guericke-Universität (NAO). Mit diesen vielfältigen Beiträgen soll ein Einblick in die Lehre über Nachhaltigkeit und Nachhaltigkeit in der Lehre geleistet werden. Verfasst werden die Beiträge von Lehrenden und Studierenden an der OVGU Magdeburg.

Durch Kombination verschiedener Formate der Beiträge in deutscher und englischer Sprache möchte die Schriftenreihe „PoWiNE Working Paper“ eine Plattform für die Publikation von wissenschaftlichen Überlegungen, Projektergebnissen, Veranstaltungsdokumentationen und studentischen Arbeiten bieten, die einen Beitrag zur politikwissenschaftlichen Nachhaltigkeitsdebatte leisten. Sie ermöglicht einen frei zugänglichen Einblick in aktuelle theoretische und empirische Forschungsarbeiten sowie in den Lehrbetrieb und die Arbeit mit Studierenden an der Universität Magdeburg.

Wir wünschen den Leserinnen und Lesern der ersten (und der weiteren Ausgaben) eine anregende Lektüre und freuen uns über Ihr Feedback!

Michael Böcher, Ulrike Zeigermann und Katrin Beer

Für das PoWiNe-Team

Neben den aktuellen Ausgaben der open-access Schriftenreihe auf der Website der Universitätsbibliothek Magdeburg http://journals.ub.uni-magdeburg.de/ubjournals/index.php/NFL/about finden Sie Informationen über neue Meldungen zu politikwissenschaftlicher Nachhaltigkeitsforschung und Lehre an der Otto-von-Guericke Universität auf der Website des Lehrstuhls Politikwissenschaft mit Schwerpunkt Nachhaltige Entwicklung: www.pw.ovgu.de/Lehrst percentC3 percentBChle/Lehrstuhl+Nachhaltige+Entwicklung.html

Inhalte des Themenhefts
Contested Futures for Energy Transitions

Denkanstöße

Beiträge aus der Nachhaltigkeitslehre

Contested Futures for Coal – Foundations of the Energy Transitions and Regional Challenges

Despite broad agreement in research and global politics about the need of renewable energy in order to reduce greenhouse gas emissions and combat climate change, socio-economic and political efforts towards phasing out of fossil fuels are highly contested. This is reflected in diverse energy trends across countries and regions, but also in different political goals and understandings of 'clean energy'. As a result, we observe several parallel and sometimes even conflicting energy transitions. Focusing on developments in Europe and Germany in particular, the contributions in this working paper show that energy transitions have different historical and economic foundations and that they bring new regional challenges or even conflicts.

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Although there is a broad agreement among researchers that tackling climate change and global warming requires drastically reducing man-made greenhouse gas emissions, globally phasing out of fossil fuels and moving to renewable energies[1], current trends show that energy transitions remain highly contested. This is, among others, reflected in global energy trends. While the report *Coal 2020* of the International Energy Agency shows that global production and demand in coal slightly decreased in 2019 and 2020, it also predicts that the demand and production in coal will increase worldwide in 2021[2]. In particular, China and India continue to rely on fossil fuels. The amount of coal has constantly risen in their energy supply over the last two decades[3]. Accordingly, energy transitions in China and India often associated with increasing the efficiency of fossil energy and with adding renewable and nuclear energy into the national energy mix in order to meet the increasing demands for energy and electricity.

The Paris Agreement and the 2030 Agenda for Sustainable Development, that were adopted in 2015, outline the way for a common and ambitious global effort to tackle climate change and promote sustainability. However, five years later, initiatives for economic and social transitions that are required in order to promote "affordable and clean energy" (Sustainable Development Goal 7) remain fragmented and rare. Progress reports indicate that with a growing global population and increasing needs for cheap energy, immediate economic and social needs of economies tend to outweigh efforts for

1 IPCC (2018), *Global Warming of 1.5 °C.*, IPCC Special Report, IPCC, https://www.ipcc.ch/sr15/.
2 IEA (2020), *Coal 2020*, IEA, Paris https://www.iea.org/reports/coal-2020
3 IEA (2020), World Energy Balances 2020, IEA, Paris: https://www.iea.org/subscribe-to-data-services/world-energy-balances-and-statistics

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renewable energy transitions in many countries[4].

As of 2018, only 13.5 percent of the world total energy supply was produced from renewable sources[5]. Nonetheless, it is important to note the efforts of many countries towards increasing the capacities of renewables. For instance, in the European Union and India, the capacity of renewable energies is expected to rise significantly in 2021 despite the Covid-19 crisis and even in Latin America, North Africa and the Middle East capacities of renewables are predicted to recover[6]. In addition, lessons learned from approaches towards 'clean energy' may facilitate a global and sustainable transition towards a carbon-free world (Cash, 2018).

Among the countries, which have already adopted policies for reducing greenhouse gas emissions by phasing out of their production and consumption of fossil fuels, there exist controversial views about what counts as 'clean' and environmentally friendly energy. For instance, while France and Germany both agree on the need for phasing out of coal, Germany also seeks to phase out of nuclear energy until 2022 due to the long-term environmental and economic costs associated with nuclear waste and the high risks linked to the production of nuclear energy. In Germany, the latest amendment of the Atomic Energy Act (adopted in 2011), the Act on the Phase-out of Coal-fired Power Plants (adopted on January 2020) together with the Structural Reinforcement Act for Mining Regions (adopted in August 2019) and the Federal Climate Change Act (adopted in December 2019) define the framework for Germany's transition towards renewable energy. Accordingly, Germany intends to shut down all nuclear plants by 2022 and to gradually reduce carbon emissions until a complete phase out of coal by 2038 at the latest in order to achieve the objective of a 100% renewable energy mix. In contrast, France highlights the potentials of nuclear energy in times of climate change. The discussion about the civilian application of nuclear energy has emerged out of the military nuclear industry and was therefore always linked to geopolitical concerns for energy autonomy and energy security (Prant, 2017). In the context of climate change, three further arguments are used to support the use of nuclear power:

1. Urgent and increasing needs for energy and electricity cannot be met with renewables alone;
2. Nuclear energy is an affordable low-carbon bridge technology and technical innovation will help resolve current safety and environmental concerns;
3. Nuclear power is required for combatting climate change (Haas and Ajanovic, 2019).

With these controversial approaches for phasing out of coal across countries, we are observing an increasingly segmented and competitive market in terms of the global energy mix. Trends indicate several parallel multidimensional and sometimes even conflicting energy transitions across countries. They may involve increased supply of energy with or without renewable resources but also reduced energy demands. As a result, diverse energy transitions include complex interactions of various technologies but also the decline of established business models and political struggles (Markard, 2018) due to persisting social inequalities in energy

4 United Nations (2020) The Sustainable Development Goals Report 2020, UN, New York, p. 38, https://unstats.un.org/sdgs/report/2020/The-Sustainable-Development-Goals-Report-2020.pdf
5 IEA (2020), Renewables Information: Overview, IEA, Paris https://www.iea.org/reports/renewables-information-overview
6 IEA (2020), Renewables 2020, IEA, Paris https://www.iea.org/reports/renewables-2020

transitions (Bartiaux et al., 2019) and new challenges for governance.

Tensions and challenges emerging from the reduction of fossil energy cannot only be observed across countries but also within countries. At the subnational level, regional identity and development are often linked to energy sources. Furthermore, local actors have started to develop and implement their own strategies for realizing energy transitions at the regional or municipal level. This adds to the fragmentation of energy transitions and protest – both, against and for fossil energy and renewable energy (Hoeft et al. 2017).

Contested Futures for Coal

At the international Workshop "Contested futures for Coal", which was organized as a cooperation of the University of Magdeburg and the Centre Marc Bloch in Berlin on 19 December 2019, the challenges indicated in the previous section were discussed in greater detail. The Workshop brought together researchers studying energy transitions from different disciplinary backgrounds, including political science, geography, history, sociology and economy as well as practitioners from civil society organisations and politics. It was organized along two thematic research-oriented panels and a broader practice-oriented roundtable discussion.

The first panel analysed the Phase-in Coal in European and Global History in the 19th and 20th Century with presentations from Silke Mende (CMB), Jakob Vogel (CMB), Helge Wendt (MPIWG), Thomas Turnbull (MPIWG) and Pao-Yu Oei (TU Berlin). The second panel and the roundtable discussion focused on questions related to the process of phasing-out of coal and pathways for a carbon-free future.

Figure 2 Poster from the International Workshop "Contested futures for Coal", organized by Ulrike Zeigermann and Gilles Lepesant in December 2019, Design: Juliane Hübner

The workshop started with a discussion on the invention of a tradition related to the new (professional) practices of mining in Germany in the 19th century (Jakob Vogel). After that, the participating scholars and practitioners discussed the historical developments of primary and secondary coal regions in Germany with a presentation from Helge Wendt. Drawing on comparative case studies from Britain, the United States and Germany, Tom Turnbull explained the histographies of coal phase-in arguing that "*history can, in some sense, be told as a story of transitions between different sources of power*" (Turnbull, 2019). He showed that different countries can be characterized by their specific 'energy profile' in time. At the end of this historical perspective on coal, Pao-Yu Oei compared the pathways in East and West Germany from 1950 to 1990.

The second panel analysed the question of a phase-out of coal. Presentations from Hannah Schindler (HU Berlin), Zofia Wetmańska (WiseEuropa), Ludger Gailing (IRS Erkner) and Johannes Staemmler (IASS) discussed economic challenges and contested pathways of energy transitions in the 21st century. The first presentation focused on the social and political challenges that Lusatia (German: Lausitz). The region is located in Saxony, Brandenburg and western Poland. Mining has not only a long tradition in the region but it remains also one of the regions in Germany, which are socially and economically highly dependent on coal. Therefore, the report from the so-called 'Coal Commission'[7] of the Federal Government, which intended to show a way for an incremental phase-out of coal-based electricity without leaving behind the regions most affected by the required structural changes, has led to social tensions in Lusatia. While some see the potentials from important investments and an energy transition for regional development in Lusatia, others reject the plans for a coal phase-out.

Adding to the debate on regional conflicts and challenges emerging from the coal phase-out, Zofia Wetmańska analysed the case of Upper Silesia. She discussed not only the specific economic, cultural, and social characteristics of the region, but also the potentials emerging from energy transition processes for sustainable development. Picking up these debates on the social and economic implications of the coal phase-out, Ludger Gailing argued that the coal-phase out cannot be fully understood without conceptualizing the socio-spatial implications. This includes social and economic developments but also cultural and everyday practices, which are changing in energy transitions. He presented the Territory, Place, Scale, and Network (TPSN) framework and applied it to energy spaces in four German Laender (Bayreuth, Baden-Württemberg, Brandenburg and the Rhineland)[8].

At the end of the second panel, Hannah Schindler offered an inspiring outlook on the challenges and opportunities of coal transitions by adopting a broader perspective on G20 countries. She argued that political strategies for phasing out of coal "should be economically feasible and just, but also take factors such as development, participation and identity into account" (Schindler, 2019). Hannah Schindler presented insights from Germany but also from Indonesia and South Africa in order to discuss important economic and social considerations in coal transitions.

Figure 3 Panel II: Coal Phase-Out? Socio-Economic Challenges and Contested Pathways in the 21st Century, Photo: Sébastien Vannier, CMB Berlin

The roundtable discussion aimed to bring together research and practice in order to discuss the 'Contested Futures for Coal'. In his

7 The official name is: Federal Government's Commission "Growth, Structural Change and Employment". It was created in 2018 and submitted its final report in January 2019 (https://www.bmwi.de/Redaktion/EN/Publikationen/commission-on-growth-structural-change-and-employment.pdf?__blob=publicationFile&v=3). The report entails measures in the energy sector (chapter 4) but also prospects for regional development and energy transitions (chapter 5).

8 His research was later published in: Gailing L, Bues A, Kern K, Röhring A. Socio-spatial dimensions in energy transitions: Applying the TPSN framework to case studies in Germany. Environment and Planning A: Economy and Space. 2020;52(6):1112-1130.

opening remarks, Uwe Steffen, Head of Division in the Ministry of Economic Affairs and Energy of the State of Brandenburg, explained the current political debate on energy transitions in Brandenburg. A day before the workshop, Tesla had announced its decision to put its new factory for the production of electric cars in Brandenburg, raising hopes for accelerating a fossil-free infrastructure and economic development in the structurally weak region, which is affected by Germany's coal exit. Invited discussants included Rebekka Popp from Third Generation Environmentalism (E3G), Wiebke Witt from Klima-Allianz Deutschland and Gretchen Bakke (IRI THESys). The roundtable discussion addressed mainly the question of regional challenges and opportunities emerging from energy transitions but also the broader question of energy transitions in times of climate change. The debate highlighted that it is only possible to grasp energy transitions if we consider its economic, spatial, political and historic foundations. Taken together, the insightful presentations and debates during the workshop have inspired the outline of this issue of the PoWiNe Working Paper on Contested Futures for Energy Transitions.

Outline of the Issue

This issue is the result of an interdisciplinary effort undertaken by the participating scholars and practitioners from the 'Contested Futures for Coal'-Workshop as well as the students from the 'Conflicts in Energy Transitions' MA course at the university of Magdeburg. Their contributions were organized in a way to reflect, first, the economic and historic foundations of energy transitions and, second, regional challenges and contestations.

Economic and Historical Foundations of Energy Transition

In order to understand the challenges and tensions emerging from today's transitions towards renewable energies, it is inevitable to study the increasing production and demand of energy from a historic perspective. In his contribution to this volume, Jakob Vogel (Chapter 2) shows that mining was not only a way of producing coal energy. It had also cultural implications, including the emergence of folkloric traditions, the identification with and professionalization of the mining profession, new forms of social organization, administration and role of knowledge.

Helge Wendt (Chapter 3) adds to the analysis on the foundations of today's debate on fossil energy by adopting a global history perspective. He shows that the coal phase-in was a long-term and complex process, which contributed not only to diverse primary coal regions but also to various secondary coal regions outside the coal basin. He argues that these secondary coal regions should be included in the historiography of industrialized mining because the organization of technology, work and knowledge regarding coal in one region affected their partners in other regions.

In his contribution on the shrinking geographies of coal, Gilles Lepesant (Chapter 3) examines the economic foundations of energy transitions. He examines the trends that are affecting coal's geography at the global, European and regional level and shows that Coal's geography is declining at a very different pace around the world. He contrasts Asia, which remains a key consumer and supplier of fossil energy, and European countries, which have either phased-out coal or have committed to do so.

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Regional Challenges in Energy Transitions

With the 'spatial turn' in energy studies (Bridge 2018, p. 12) researchers have focused on the varying relationships between the energy and society across different regions. In his contribution to this issue, Ludger Gailing shows that energy regions differ regarding their socio-material infrastructure and visions of the future. He finds that there are overlaps between 'old energy regions' based on fossil energy and 'new energy regions' focusing on renewable energies. This may lead to social conflicts. Analysing the case of the mining region between Aachen and Cologne in Germany, however, Ludger Gailing demonstrates how dispositions of renewable energies can also been integrated in 'old energy regions' in 'preventive' transformation processes (Chapter 4).

In Chapter five, Gilles Lepesant studies how coal has shaped regional and social identities and the European industrial geography. He shows that the historical process of phasing-out of coal can be considered a threat to the regional economy and people's identity as it has let to high rates of unemployment and an emigration of young and skilled people. Hence, Gilles Lepesant argues that the challenge is to develop diverse pathways for local energy transitions that allow European regions to link their specific needs for regional development with new approaches focusing on renewable energy transitions.

Zofia Wetmańska and colleagues study the case of Silesia, where coal has shaped the economic development and local identity of the region since the 18th century. Despite the gradual phase-out of coal mining and change towards modern manufacturing and services, many challenges remain. The authors argue that the year 2021 is important to define future transition pathways for the region with the preparation of Territorial Just Transition Plan, and the development of the Polish mining restructuring strategy.

In Chapter six, Uwe Steffen presents the challenges and potentials emerging from an energy transition from fossil energy to renewable energies in the former coal region in Brandenburg. He discusses the role of the national Structural Reinforcement Act for Mining Regions (adopted in August 2019) for Lusatia and Brandenburg, and the strategies of the regional government in order to link the coal phase-out with regional development.

Energy Transitions in Higher Education

At the university of Magdeburg, the debates on coal and energy transitions from the 2019 workshop have led to a new MA seminar for students in Peace and Conflict Studies, European Studies and the Social Sciences, conceptualized and offered by Ulrike Zeigermann and Michael Böcher. The aim of the seminar "Conflicts in Energy Transitions", which was first offered in Summer 2020, is to examine tensions in energy transitions.

Central areas of conflicts in energy transitions include, but are not limited to social acceptance (vs. protest) and decision-making processes for handling diverse political goals, contested knowledge and norms at the intersection of energy policy, technological innovation and societal transformation. In energy transitions, (violent) conflicts occur both at the local and regional level, and at the global level. These conflicts in energy transitions involve and affect diverse actors, including political decision-makers but also administrations, businesses, civil society organizations and citizens. In the first introductory part of the seminar, students discuss such theoretical aspects of energy transitions based on literature review. They are asked to choose one energy source to analyse in greater depths potential conflicting public goals and forms of social protest.

Drawing on the initial literature review and the comparison of different case studies on energy sources, part two of the seminar engages with regional and international conflicts related to energy transitions. In part three of the seminar, students are exploring specific challenges in energy transitions, including the role of marginal groups, stakeholder participations and diverse pathways. The latter also entails a discussion on the contested role of nuclear power in future energy policy.

Combining theoretical and empirical perspectives, the modules of this seminar are organized in a way to study how different actors and societies are affected by current changes in energy-security landscapes and how they deal with environmental and energy conflicts. The objective of the course is to engage students with the multidimensional and multi-level challenges. At the end of the seminar, they are expected to be able to apply key concepts to empirical cases and current situations in multi-level energy governance, to critically reflect on problem structures and the role of key actors and institutions at different levels, distinguish different positions in the literature on energy transitions, analyse energy policies and evaluate policy instruments in regard to their likely intended and unintended effects.

The seminar is organized as a twelve-week online course. This means that students work independently through various reading and learning materials provided on the e-learning platform Moodle. They complete the creative course works for each part in a certain time frame but asychronically in their own time. At the end of each part, a virtual meeting is organized via zoom to discuss questions and the results of the learning activities. The main arguments from these discussions in groups and in the plenary were noted as a digital protocol (e.g., figure 4). In addition, an online knowledge-sharing forum serves to discuss organizational or content-related questions, news, interesting events or other issues linked to the seminar topic. With their feedback in the virtual seminar meetings after each part and a structured anonymous evaluation at the end of the seminar, the students help to improve the course.

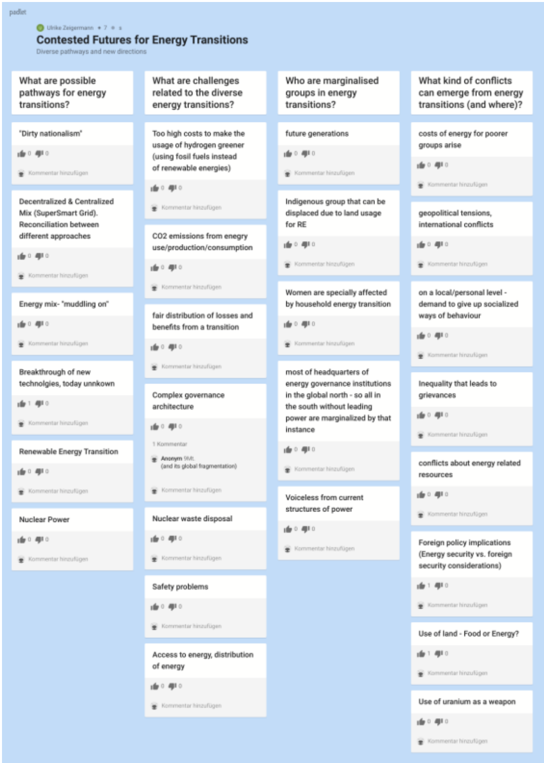

Figure 4 Results of a group work on 'Diverse Pathways and New Directions in Energy Transitions' collected with Padlet, 25 June 2020

Djamila Jabra, a MA student in Peace and Conflict Studies at the University of Magdeburg, who participated in the course in the summer term 2020, discusses the content, methods and didactic approach of the course. In her contribution (Chapter 7), she reflects her experience from the online seminar and explains the different thematic modules on conflicts in energy transitions. Djamila Jabra also presents her course work on nuclear energy.

Outlook

According to Hoesung Lee, Chair of the Intergovernmental Panel on Climate Change, and Dr Fatih Birol, Executive Director of the International Energy Agency, "*Energy is at the heart of the solution to the climate challenge"* as it accounts for over two-thirds of global greenhouse gas emissions (Lee and Birol, 2020). With current challenges emerging from the Covid-19 pandemic and tendencies towards increasing societal polarization and populisms, both energy transitions and climate change mitigation are at risk (e.g., Radke et al. 2019). At the same time, Lee and Birol argue that the recovery plans that governments are pursuing offer an opportunity to foster "*ambitious, near-term reductions in emissions and accelerating investment in the full range of clean and sustainable energy technologies necessary to get all the way to net zero*" (Lee and Birol, 2020). This issue offers a collection of insightful pieces of thought "*Denkanstöße*" that may inspire future reflections in research and practice on the coal phase-out at the national and regional level and energy transitions in a broader sense.

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Historical and Economic Foundations of Energy Transitions

Part I Denkanstöße

Bergbau – Die « Erfindung einer Tradition »

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„Beim Familientag des 13. Deutschen Bergmanns-, Hütten- und Knappentag [sic] in Bochum zogen am Sonntag nach einem ökumenischen Gottesdienst im Anneliese Brost Musikforum rund 2.000 Berg- und Hüttenleute von Knappen- und Traditionsvereinen aus der ganzen Bundesrepublik durch die Stadt zum Deutschen Bergbaumuseum. […] Die bergmännische Großveranstaltung stand in diesem Jahr, das das Ende der deutschen Steinkohleförderung markiert, unter dem Motto "Tradition erhalten - Zukunft gestalten.“
Stadtspiegel Bochum, 2.7.2018[1]

„Schicht im Schacht“ – so lautete im August 2018 das Motto einer großen Festveranstaltung, die vom Westfälischen Landesmuseum für Industriekultur und dem Förderverein Zeche Hannover zum „Abschied vom Steinkohlebergbau“ in der Region und in Deutschland veranstaltet wurde.[2] Ähnlich wie andere „Traditionsveranstaltungen“ mit Bergbaubezug wurde der Tag in Bochum ebenfalls mit einer sog. „Knappenparade“ begangen, bei der die bergmännischen „Traditionsvereine“ der Region mit Fahnen und Spielmannszug in Uniform durch die Straßen der Stadt zogen. Gerade im Kontext des tiefgreifenden industriellen Umbruchs, der für viele ehemalige Betriebsangehörige der Zechen mit großen sozialen Härten verbunden ist, mögen derartige Veranstaltungen sicherlich eine wichtige Funktion besitzen, da sie - ganz abgesehen von dem Unterhaltungswert der mit bunten Fahnen, Musik und uniformbewehrten Teilnehmern glänzenden Veranstaltungen -

1 Petra Vesper, „Lebendige Traditionspflege“, in: Stadtspiegel Bochum, 2.7.2018, online unter: https://www.lokalkompass.de/bochum/c-ueberregionales/lebendige-traditionspflege_a928740 [2.2.2021]
2 Siehe den Veranstaltungskalender des LWL Landesmuseums, online unter: https://www.lwl.org/lwlkalender/VeranstaltungAction.do?id=1054099 [2.2.2021]

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den Zuschauern und der breiteren Öffentlichkeit ein bildliche Anschauung einer vermeintlich „jahrhundertealten Tradition" im Bergbau und seiner spezifischen Arbeitskultur als Kern einer nicht nur lokal, sondern auch regional und national bedeutsamen Geschichtskultur präsentieren.

Umso interessanter ist aber für den Beobachter der Umstand, dass die auf diese Weise präsentierte „Bergbautradition" geradezu in paradigmatischer Weise eine „erfundene Tradition" im Sinne der von Eric Hobsbawm und Terence Ranger beschriebenen Phänomene[3] darstellt. Tatsächlich ist, wie der Beitrag darstellen will, auch die so oft beschworene folkloristische „Bergbautradition" überhaupt erst im Laufe der Industrialisierung des Bergbaus unter Rückgriff auf historische Versatzstücke entstanden, die zwar tatsächlich in einzelnen Regionen Mitteleuropas bereits in der Frühen Neuzeit bedeutsam waren, vor dem ausgehenden 18. Jahrhundert jedoch nie eine wirklich übergreifende oder gar „nationale" Bedeutung besaßen. Ihre übergreifende Stellung erhielt sie tatsächlich erst dadurch, dass im Laufe der Zeit mehr und mehr auch Bereiche in diese „Bergbaukultur" einbezogen wurden, die historisch weder sozial noch technologisch in direkter Beziehung zum klassischen vormodernen Bergbau gestanden hatten, wie etwa die Salzherstellung oder auch die Produktion von Braun- oder Steinkohle. Die gerne gepflegte „Bergbautradition" der „Knappenparaden" und bergmännischen Spielmannsumzüge bildet insofern eine durchaus moderne Sinnstiftung, welche letztlich die einschneidenden Brüche und die tiefgreifenden technologischen, aber auch sozialen und rechtlichen Veränderungen überdeckt, welche die industrielle Wirklichkeit des Industriezweiges „Bergbau" in den vergangen zwei Jahrhunderten auszeichneten.

Die Repräsentation des sächsischen „Bergstaates"

Ausgangspunkt für die Entwicklung der im Laufe des 19. Jahrhunderts weit über den deutschen Kontext hinaus einflussreichen folkloristischen „Bergbaukultur" waren die tiefgreifenden Reformen, die in den späten 1760er Jahren im Gefolge des Siebenjährigen Kriegs im sächsischen Bergbau durchgeführt wurden.[4] Der Ausbau der kameralistischen Bergbauverwaltung und die Einrichtung der „Bergakademie" in der Erzgebirgsstadt Freiberg rekurrierte dabei auf die Vorstellung eines einheitlichen paternalistischen „Bergstaates", an dessen Spitze neben dem König eine aufgeklärte Beamtenschaft für das Wohl der „Bergleute" sorgen sollte.[5] Die Einrichtung der Freiberger Bergakademie setzte die kulturellen Standards für die Herausbildung einer umfassenderen Bergbaukultur, die sich ganz weitgehend an den Gebräuchen im sächsischen Erzbergbau orientierte. Dies betraf nicht nur den engeren Bereich des technischen und institutionellen Wissens, das sich primär auf die Gegebenheiten des regionalen Silberbergbaus konzentrierte, sondern auch andere Lebensbereich wie etwa die äußere Inszenierung des „Bergstaates" in den sogenannten „Bergparaden". Diese wurden etwa bei königlichen Besuchen und anderen festlichen Gelegenheiten abgehalten, um die enge Verbindung der Bergleute mit dem Fürstenstaat zu unterstreichen, wobei sie mit

3 Eric Hobsbawm, Terence Ranger (Hg.), The Invention of Tradition, Cambridge 1983.
4 Vgl. zum breiteren Hintergrund Wolfhard Weber (Hg.), Salze, Erze und Kohlen. Der Aufbruch in die Moderne im 18. und frühen 19. Jahrhundert (Geschichte des deutschen Bergbaus, Bd. 2), Münster 2015.
5 Jakob Vogel, Aufklärung untertage: Wissenswelten des europäischen Bergbaus im ausgehenden 18. und frühen 19. Jahrhundert, in: Harmut Schleiff, Peter Konečný (Hg.), Staat, Bergbau und Bergakademie. Montanexperten im 18. und frühen 19. Jahrhundert, Stuttgart 2013, S. 13-31.

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ihren am militärischen Vorbild orientieren Inszenierung die ständischen Hierarchiestufen der um den Bergbau gruppierten lokalen Gesellschaft kenntlich machten.[6] Die schwarzen Uniformen der Bergleute entsprachen daher auch weniger der industriellen Praxis, als vielmehr den Gepflogenheiten einer höfisch-militärischen Inszenierung, welche lediglich auf Versatzstücken der industriellen Geschichte und Gegenwart aufbaute.[7] Noch heute werden derartige „Bergparaden“ gerne im Rahmen von regionalen Kultur- und Folkloreveranstaltungen abgehalten, allerdings ohne dass dabei der ursprüngliche höfische Rahmen ihrer Inszenierung Berücksichtigung findet.

Abbildung 5 Bergparade in Marienberg, Sachsen 2005. Quelle: Von geme - Eigenes Werk, CC BY 2.5, https://commons.wikimedia.org/w/index.php?curid=462291 (zuletzt abgerufen am 20.4.2021)

Auch auf der Ebene der Volkskunst sind die Bergparaden bis heute ein zentraler Bestandteil der Regionalkultur, bieten sie doch die Motive für zahllose Holzfiguren und Räuchermännchen, welche die touristische Folklore des Erzgebirges in die weite Welt tragen.

Ähnlich wie auch das sächsische Modell der bergbaulichen Verwaltung und ihrer wissenschaftlichen Ausbildung wurde auch das Repräsentationsmodell des „Bergstaates“ im späten 18. und 19. Jahrhundert zu einem Exportschlager, da sich die zunächst regional begrenzte Praxis nicht nur im deutschen

6 Hartmut Schleiff, Aufstieg und Ausbildung im sächsischen Bergstaat zwischen 1765 und 1868, in : ebd., S. 125-159, insb. S. 134.

7 Klaus Tenfelde, Bergarbeiterkultur in Deutschland. Ein Überblick, in: Geschichte und Gesellschaft 5 (1979), S. 12-53.

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Sprachraum, sondern auch in anderen Ländern verbreitete. Im Gefolge der spanischen Kolonialherrschaft trugen selbst die Dozenten des Real Seminario de Minería in Mexico City die schwarze Uniformjacke zu weißen Hosen, um ihre Zugehörigkeit zur internationalen Gemeinschaft der Bergbaubeamten auch äußerlich kenntlich zu machen![16]

Die größte Ausstrahlungskraft besaß die ursprünglich sächsische Bergbaufolklore zunächst vor allem in den deutschen Ländern. Zentral war hierfür das Königreich Preußen, das mit der Verpflichtung von Friedrich Anton von Heynitz, dem ersten Direktor der Freiberger Bergakademie und späteren preußischen Minister, nicht nur das Modell der sächsischen Bergbauverwaltung, sondern auch andere Elemente der erzgebirgischen Bergbaukultur einführte.[17] In den schlesischen Revieren etwa ordnete der Direktor des schlesischen Oberbergamtes Oberbergrat Friedrich Wilhelm Graf von Reden, ein ehemaliger Absolvent der Sächsischen Akademie und Neffe von Heynitz, bereits 1795 das Tragen der schwarzen Uniformen nach sächsischen Vorbild für die Bergarbeiter und -beamten an.[18] Die Umsetzung dieses Beschlusses rieb sich vereinzelt an Widerständen des regionalen Adels, der in seinen privaten Bergwerken nicht auf den Gebrauch eigener Hoheitszeichen verzichten wollte. Sieht man aber von solchen lokalen Widerständen ab, wurde Preußen dank der immensen Vergrößerung seines Territoriums im späten 18. und im 19. Jahrhundert insgesamt jedoch zum wichtigsten Motor der Verbreitung der sächsischen Bergbaukultur im deutschen Sprachraum.

Selbst im Habsburgerreich, das bereits in der Frühneuzeit über eine starke Zentralverwaltung des Bergbaus und daher auch über eine sehr eigenständige Bergbaukultur verfügte, lässt sich der Einfluss der sächsischen Kulturelemente nachweisen. Mit der Gründung der Bergakademie im „niederungarischen“ Schemnitz (heute Slowakei) in den 1760er Jahren hatte die habsburgische Verwaltung einen ähnlichen Professionalisierungsschub wie der sächsische Bergbau erlebt, dabei aber keine vergleichbare höfische Repräsentationskultur ausgebildet. Die ersten Generationen der „Zöglinge“ der Bergakademie mussten daher trotz entsprechender Eingaben auf eigene Uniformen verzichten.[19] Erst in den 1830er Jahren hielt die nach dem sächsischen Vorbild gestaltete „Bergtracht“ auch in Schemnitz Einzug.[20] In der Mitte des 19. Jahrhunderts gegründeten österreichischen Bergakademie im steyrischen Leoben wurde den Studenten das Tragen der schwarzen Berguniform ausdrücklich nahegelegt, auch wenn anders

16 Vgl. etwa das von dem Maler Rafael Ximeno y Planes (1759-1825) angefertigte Gemälde des spanisch-mexikanischen Bergbaubeamten Andrés Manuel de Rio (1764-1849) in: https://de.wikipedia.org/wiki/Andr%C3%A9s_Manuel_del_R%C3%ADo#/media/Datei:Andr%C3%A9s_Manuel_del_R%C3%ADo_(Rafael_Ximeno_y_Planes_1825)_retrato.png [12.2.21]

17 Vgl. hierzu Wolfhard Weber, Innovationen im frühindustriellen deutschen Berg- und Hüttenwesen. Friedrich Anton von Heynitz, Göttingen 1976; sowie Jakob Vogel, Ein schillerndes Kristall. Eine Wissensgeschichte des Sales zwischen Früher Neuzeit und Moderne, Köln 2008.

18 Damian Spielvogel, Die schlesische Bergmannsuniform, online unter: https://landsmannschaft-schlesien.de/die-schlesische-bergmannsuniform/.

19 Peter Konečný, Die montanistische Ausbildung in der Habsburgermonarchie, 1763-1848, in: ebd., S. 95-124, hier S. 109.

20 Liselotte Jontes, Zur Tracht der Leobner Bergeleven um die Mitte des 19. Jahrhunderts. In: Der Leobener Strauß. Beiträge zur Geschichte, Kunstgeschichte und Volkskunde der Stadt und ihres Bezirkes, 5 (1977), S. 156f.

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als in Sachsen keinerlei Zwang zum Uniformtragen herrschte.[21]

Aufgrund der in den verschiedenen Ländern unterschiedlich geprägten staatlichen Repräsentationstraditionen verlief die internationale Verbreitung der sächsischen Bergbaufolklore keineswegs parallel zum breiten Siegeszug des Freiberger Modells der Bergbauwissenschaften.[22] In Frankreich beispielsweise blieben die Ingenieure des Corps de Mines bis in die Mitte des 19. Jahrhunderts für ihre Uniformen an das übliche grau-blaue Tuch des Militärs gebunden, obwohl ihre Ausbildung elementar durch den wissenschaftlichen Kanon der sächsischen Bergakademie bestimmt wurde.[23] Auch in Russland orientierte sich das äußere Erscheinungsbild der Beamten im Bergbau im 19. Jahrhundert ganz an dem Vorbild der militärischen Uniformen: nach den Reformen der Jahrhundertmitte trugen die russischen Bergbeamten grüne Uniformröcke, die lediglich durch ein paar sekundäre Zeichen (insbesondere das aus Schlegel und Eisen geformte Bergbausymbol) in ihrer spezifischen Bestimmung gekennzeichnet war.[24]

Nicht nur die territoriale Verbreitung kennzeichnete die Entwicklung der folkloristischen Bergbaukultur im deutschen Sprachraum im 19. Jahrhundert, sondern auch ihre Ausbreitung in immer neue Felder des industriellen Alltags. Begünstigt wurde dies von dem großen Expansionsdrang einer Bergbauverwaltung, die in Preußen wie in vielen anderen kontinentaleuropäischen Staaten im frühen 19. Jahrhundert zu einem zentralen Motor der industriellen Entwicklung wurde.[25] Einbezogen in den Wirkungsbereich der Bergbauverwaltung wurden dabei sowohl das in vielen Ländern traditionell unabhängige Salzwesen[26] als auch die Kohleförderung, die in der Frühneuzeit ebenfalls üblicherweise als ein vom „Bergbau“ getrennter Industriezweig betrachtet worden war. Anders als die Förderung von Silber, Kobalt und anderen Erzen unterlag der Abbau der Kohle tatsächlich in den meisten mitteleuropäischen Staaten der Frühneuzeit nicht dem königlichen Bergregal, sondern wurde zumeist im Tagebau durch die Grundeigentümer vorgenommen.[27]

Dank ihrer administrativen Stellung importierten die Bergbeamten nicht nur ihr technisches Wissen in die entsprechenden Industriezweige, sondern führten auch andere Elemente ihrer aus dem Erzbergbau geprägten professionellen Kultur ein. Die in den preußischen Salinen beschäftigten „Arbeiter“ wurden durch die verschiedenen rechtlichen Neuregelungen ab der Mitte des Jahrhunderts gemäß des aus dem Bergbau stammenden Usus nun in „Knappschaften“ zusammengefasst und in den Gesetzestexten

21 Siehe: Bergmännische Brauchtum – Zur Geschichte der Montanuniversität Leoben, online unter: http://www.eisenstrasse.co.at/wp-content/uploads/2018/01/Bergstudentisches_Brauchtum_-_Oesterreich.pdf [2.2.2021]

22 Vogel, Aufklärung unter Tage.

23 Decret du 4 octobre 1852, in: Annales de Mines 1852, S. 364-380. Siehe allgemeiner zur Vorbildfunktion des sächsischen bergbauwissenschaftlichen Modells in Frankreich: Jakob Vogel, Les experts des Mines: Transferts et circulations entre les pays germaniques et la France (1750-1850), in: Anne-Françoise Garçon, Bruno Belhoste (Hg.), Les Ingénieurs des Mines : cultures, pouvoirs, pratiques, Paris 2012, S. 103-116.

24 Leonid Shepelev, Uniforms of the Mines Administration from 1745 to 1855, online unter: http://www.xenophon-mil.org/rusarmy/arsenal/uniforms%20of%20mines.htm [17-2-21]

25 Jakob Vogel, Reform unter staatlicher Aufsicht. Wirtschafts- und Sozialgeschichte des deutschen Bergbaus und des Salzwesens in der frühen Industrialisierung, in: Weber (Hg.), Salze, Erze und Kohlen, S. 11-110

26 Vogel, Schillerndes Kristall, S. 133-171. Eine enge technologische Einheit bildeten Bergbau und Salinen lediglich im alpenländischen Raum, wo die für die Salzherzstellung nötige Sole schon in der Frühneuzeit in einem bergmännischen Verfahren gewonnen wurde.

27 Christoph Bartels, Rainer Slotta (Hg.), Der alteuropäische Bergbau. Von den Anfängen bis zur Mitte des 18. Jahrhunderts (Geschichte des deutschen Bergbaus, Bd. 1), Münster 2012.

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unter dem Begriff der „Bergleute“ subsumiert.[28] Allerdings übernahmen die Salzarbeiter nicht ihrerseits die schwarzen Uniformen und die bergbauliche Repräsentationskultur. Vielmehr schlossen sie sich wie etwa in Halle zu einer eigenen „Bruderschaft“ der „Salzwirker“ oder „Halloren“ zusammen, die in der städtischen Gesellschaft mit historisierenden Uniformen als eigenständiger Berufsverband auftrat. Auch im bayerischen Berchtesgaden nutzten die hier als „Saliner“ bezeichneten Arbeiter des Salzwerks weiterhin die ihnen seit dem ausgehenden 18. Jahrhundert verliehene eigene Uniform mit weißen Hemden zu blauen Hosen.[29] Demgegenüber tritt die örtliche, 1851 gegründete „Salinenmusikkapelle“ in Bad Ischl im oberösterreichischen Salzkammergut in schwarzen „Bergmannskitteln“ auf – ein deutliches Zeichen dafür, dass sich die an der Gründung beteiligten Bergarbeiter am Ende farblich und uniformtechnisch gegenüber den namensgebenden Salinenarbeitern durchsetzen konnten.[30]

Weitaus unproblematischer verlief die Übernahme der Uniformen und anderen Kulturelementen des sächsischen Erzbergbaus dagegen in der Kohleindustrie. Verantwortlich hierfür war sicherlich in erster Linie der Umstand, dass die Kohlegewinnung in der Industrialisierung des 19. Jahrhunderts dank des rapide anwachsenden Steinkohleabbaus tatsächlich hauptsächlich auf dem Einsatz der bergbaulichen Technik beruhte. Hilfreich war vermutlich auch, dass die traditionelle schwarze Uniform darüber hinaus auch eine gewisse farbliche Nähe zum Werkstoff Kohle suggerierte. Seine Unterwerfung unter die Regeln des staatlichen Bergrechts und damit in den Kompetenzbereich der Bergverwaltungen ließ die Arbeiter in diesem Industriezweig gewissermaßen ‚naturgemäß‘ als Teil einer breiteren Bergbaukultur erscheinen, deren Ursprünge aus dem Erzbergbau im Kontext der rasanten industriellen Entwicklung des Sektors dabei vollkommen in den Hintergrund trat.

Weitaus bemerkenswerter ist jedoch der Umstand, dass sich auch die im mitteldeutschen Braunkohletagebau beschäftigten Arbeiter die Repräsentationskultur des Erzbergbaus aneigneten, denn beim oberirdischen Abbau der Kohle fehlte der Bezug zu den traditionellen Techniken des Stollenbergbaus, der die Grundlage für die Erzgewinnung in Sachsen wie auch in den anderen traditionellen „Bergbauregionen“ bildet. Braunkohle unterlag daher auch dem frühneuzeitlichen Gebrauch zufolge nicht dem eigentlichen „Bergrecht“, sondern wurde wie andere Techniken der Gewinnung von Bodenschätzen an der Oberfläche zumeist dem Grundeigentum zugeschrieben.[31] Dennoch nahmen auch in dem sich seit Beginn des 20. Jahrhunderts rapide entwickelnden mitteldeutschen Braunkohletagebau die Arbeitervereinigungen die äußerlichen Elemente der überaus attraktiven sächsischen Bergbaufolkore an, so dass noch heutzutage beispielsweise der „Traditionsverein Braunkohle Senftenberg e.V.“ in schwarzen Bergmannsuniformen auftritt.[32] Diese

28 Vogel, Schillerndes Kristall, S. 141.
29 Vgl. Manfred Treml (Hg.), Salz Macht Geschichte, Augsburg 1995, S. 141.
30 Vgl. Manfred Brandner, Federn symbolisieren Salz, Schwarz steht fürs Bergwerk, in: Oberösterreichische Nachrichten, 23.7.2015, online unter: https://www.nachrichten.at/oberoesterreich/salzkammergut/Federn-symbolisieren-Salz-Schwarz-steht-fuers-Bergwerk;art71,1917161 [12.2.2021].
31 Paul Kressner, Systematischer Abriss der Bergrechte in Deutschland mit vorzüglicher Rücksicht auf das Königreich Sachsen, Freiberg 1858.
32 Vgl. die Schrift Anonym, Der Tradition des Bergbaus um Senftenberg verpflichtet, online unter: https://www.senftenberg.de/media/custom/2055_473_1.PDF?1321616365 [10.2.21]

Prozesse der Aneignung zeugen von der großen Attraktivität der bergbaulichen Repräsentationselemente in einer Region, die zwar stark unter der Drosselung der Braunkohleförderung in den letzten Jahrzehnten litt, in der aber dennoch die vermeintlich glorreiche Geschichte „ihres" Industriezweiges unter Rückgriff auf die folkloristische Inszenierung gerne in Erinnerung gerufen wird.

Fazit

Die hier nur kurz nachgezeichnete Geschichte der „Erfindung", Inszenierung und Verbreitung der ursprünglich in Sachsen geprägten „bergbaulichen Tradition" unterstreicht die große Bedeutung der aus dem Erzbergbau entstammenden Folkloreelemente für die kulturelle Identifikation und Repräsentation eines Industriezweiges, der trotz seines realen Niedergangs in vielen Teilen Mitteleuropas weiterhin eine zentrale Stellung im Rahmen der Inszenierung einer volksnahen „Regionalkultur" beansprucht. Selbst in jenen Regionen, die wie die mitteldeutschen Tagebaugebiete nicht im eigentlichen Sinne als „ehemalige Bergbauregionen" bezeichnet werden können, wird auf diese Weise ein folkloristisches Idealbild einer „industriellen Vergangenheit" inszeniert, die den obrigkeitlichen Erzbergbau des sächsischen „Bergstaates" des 18. Jahrhunderts als Ausgangspunkt einer bis ins frühe 21. Jahrhunderts reichenden Geschichte des „Deutschen Bergbaus" inszeniert. In einer Zeit, in der der industrielle Bergbau und die Produktion von Erzen, Kohlen und Salzen in Mitteleuropa inzwischen weitgehend aus dem industriellen Alltag verschwunden ist, zeigt sich damit die Kraft einer imaginären Erzählung, welche nicht nur die Industrialisierung als maßgeblich von „Kohle und Eisen" und damit als von einer als einheitlich gedachten „Bergbauindustrie" getragen darstellt, sondern auch gleichzeitig ihre „Berufskultur" als zentrales Element der regionalen und nationalen „Volks-" bzw. „Industriekultur" beschreibt. Weitgehend ihres realen industriellen Hintergrunds entkleidet, entfaltet sie in der touristisch verwertbaren Kultur der öffentlichen Folklore und Feiern ihre elementare sinnstiftende Bedeutung auch dort, wo eine tiefere technologische und soziale Beziehung zum Bergbau nie wirklich existiert hat, da sie der durch den Strukturwandel gebeutelten Bevölkerung eine wichtige kulturelle Orientierung und soziale Aufwertung bieten kann.

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Shifting the Phase-In: Primary and Secondary Coal Regions, the Protoanthropocene, and Early Industrializations

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The history of fossil fuel energy transition is a long-term and global historical process with a high degree of regional diversification. The intensified usage of coal can be traced back well into the early modern period and is not limited to the more recent era of industrialization, as commonly believed. This paper suggests to rather than focus on a single industrialization or industrial revolution, a more complex understanding of the phase-in to a coal-based economy is to be considered through the analysis of the very diverse processes and time frames of energy transitions on a regional level. The change in the supply and usage of energy-rich fuels is a complex interplay of social, economic, political, epistemological, technological, territorial, institutional, and material factors. In this complex interaction, knowledge played a key role in three major points: the correct use of coal; the differentiation between the many types of coal, as certain kinds are preferred or even required for specific processes; and the identification of deposit locations, as well as the development of a more systematic and scientific approach to mining.

Though the usage of this fossil fuel rose in popularity over an extended period and varied greatly by region, there are a few key transitions that illustrate its increasing historical importance. In a global history perspective, this phase-in lasted from the late sixteenth to the early twentieth centuries although the process happened at very different speeds and on a regionally to be differentiated regional level. The various steps are not to be understood as successive stages or phases. Instead, the transitions should be understood in the regional context as potential links to other regions with more coal experience.

Hard coal as a simple fuel for heating is an example of an early usage of the material and can be studied comparatively on a global scale. From this starting point, processes diversified tremendously, such as the use of hard coal in forging and smelting metals, salt cooking, beer brewing, and lime and brick

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burning, among many other usages.[1] Coal continued to be used for heating in conjunction with the newly found applications. The fuel was (and still is) employed in an adapted manner in furnaces and smelts to transform metallic materials like iron and copper. Later, coal was burned to convert its energy into mechanical power as is seen in the steam engine. Finally, the combustion of coal served to produce electricity—a secondary energy.[2] The invention of new chemical processes in industrial laboratories, which extracted byproducts either directly from the coal or from its waste products, further expanded the possibilities of that material.[3]

This material, which would have such a major impact on the world that it would ultimately give its name to the age of coal energy system, stood in competition with wood, charcoal, and peat (among others). As with any new resource, practical knowledge from long-term experience first needed to be gained before the process of dissemination, diversification, and enforcement of coal utilization could properly begin. Craftspeople all over the world, for instance, had to master temperature control so as not to overheat the material. Furthermore, pricing mechanisms became just as important as the reliable supply of the fossil fuel. Most historians see the breakthrough of coal use as coupled with James Watt's improved steam engine.[4] Although this association is not inherently wrong, the economic base is far too thin to account for the long-term increase in coal demand. Instead, the diverse use of hard coal was far more critical to the rise in popularity of the resource. Development also depended on the type of hard coal that was mined or acquired in a region. Furthermore, available coal types determined technical implementation, as it was learned that some mineral compositions were better suited to certain processes than others. For example, a high bitumen content and a low carbon rate was not suitable for steam engines. For smelting iron, a high phosphate content had a negative effect on the pig iron. Practical experience led to the coevolution of the field of knowledge along with the use of coal and its by-products.

Mined hard coal had to have a sales market and continuous demand so that mines would be economically viable. One approach, practiced worldwide, was that companies would not only mine coal but would also use the combustion residuals in production processes or transportation. This business model led the development of the coal and steel industry in many parts of Europe, as well as in North America, India, and China.[5] Other industrial combinations also emerged. In parts of Scotland, one feudal enterprise used the locally-produced coal for salt cooking until the mid-eighteenth century.[6] Several copper-coal companies based near Swansea, Wales, converted the port city into the famous *Copperopolis*.[7] All over the world, coal mining companies merged with railway companies,

1 Barbara Freese, *Coal. A Human History* (Cambridge: Perseus, 2003).

2 Vaclav Smil, *Energy Transitions. History, Requirements, Prospects* (Santa Barbara: Praeger, 2010).

3 Franz Fischer (ed.): *Gesammelte Abhandlungen zur Kenntnis der Kohle (*Berlin: Bornträger 1917).

4 David S. Landes, *The Unbound Prometheus* (Cambridge: Cambridge University Press, 1969).

5 Kenneth Pomeranz, *The Great Divergence: China, Europe, and the Making of the Modern World Economy* (Princeton: Princeton University Press, 2000). Pomeranz; Shellen Xiao Wu, *Empires of Coal. Fueling China's Entry into the Modern World Order, 1860–1920* (Stanford: Stanford University Press, 2015).

6 Baron F. Duckham, *A History of the Scottish Coal Industry. Vol. 1: 1700–1815* (Newton Abboz: David & Charles, 1970).

7 Stephen Hughes, *Copperopolis: Landscapes of the Early Industrial Period in Swansea* (Aberystwyth: Royal Commission on the Ancient and Historical Monuments of Wales, 2000); Edmund Newell, „'Copperopolis': The Rise and Fall of the Copper Industry in the Swansea District, 1826–1921", *Business History* 32, Nr. 3 (1990): 75–97.

underlining the highly mobile and transregional potentials of the fuel.

These partnerships helped developing factories outside the coal regions and transformed coal into the most important source of energy on a global level. The industrial sites in London, in the iron-smelting region of Burgundy, France, in the late eighteenth century,[8] and in Monterrey, Mexico, in the early twentieth century[9] show that industrial development was determined by regional differentiations of using this resource. This regional development of the coal industry outside coal basin areas should be considered the second phase-in.

These long-term transformation and adaptation of protoindustrial and industrial societies, required a transformation of how technology, labor organization, and energy were considered. These changes gave rise to new methods of production in agriculture, craftsmanship, and manufacturing. As coal became the chief material in production and transportation sectors, production chains expanded considerably. The regions outside the coal basin that belong to the second phase-in should be included in the historiography of (proto-)industrialization and industrialized mining.[10] The supply of the fossil fuel to certain sectors of production was an important prerequisite for these regional and interregional production chains that mark the age of the protoanthropocene and the anthropocene.[11] Early industrial coal mining provided a relatively high concentration of mining and processing sites, as well as an early division of labor for extraction and onward transport.[12] During the phase-in of protoindustrialization, the hard coal operation was often run as an exclusive business in which coal mining businesses could also be involved in further processing, for instance, smelting ores at other sites outside the mining region. Lastly, coal mining regions helped the development of other industrialized regions where this combustible resource was not mined. For a global history of regional industrialization, the development of such secondary coal regions allows for more complex and varied histories of the phase-in to the fossil fuel period. Primary and secondary coal regions depended on each other and interpretations of fossil fuel history should reflect that relationship. The mobilization of energy, work organization, technology, and knowledge regarding coal in one region had an impact on the other regions with which they conducted business.

8 C. Javey, *Recensement et localisation des anciens puits de mine des houilleres du Creusot (71)* (Dijon: Bureau de recherches géologiques et minières, 1989).

9 Mario Cerutti, *Propietarios, empresarios y empresa en el norte de México. Monterrey: de 1848 a la globalización* (Mexico: Siglo Veintinuno Editores, 2000).Helge Wendt, „Interrelations and Disruptions in the Exchange of Knowledge: Coal, Geology, and Industrialisation in Mexico.“, *History of Technology* 34 (2019).

10 Pierre Deyon, „Proto-Industrialization in France“, in *European Proto-Industrialization*, hg. von Sheilagh C. Ogilvie und Markus Cerman (Cambridge: Cambridge University Press, 1996), 38–48; Pat Hudson, „Proto-Industrialization in England“, in *European Proto-Industrialization*, hg. von Sheilagh C. Ogilvie und Markus Cerman (Cambridge: Cambridge University Press, 1996), 49–66; Sheilagh C. Ogilvie und Markus Cerman, „Proto-Industrialization, Economic Development and Social Change in Early Modern Europe“, in *European Proto-Industrialization*, hg. von Sheilagh C. Ogilvie und Markus Cerman (Cambridge: Cambridge University Press, 1996), 227–239; Jürgen Schlumbohm, „‚Proto-Industrialization‘ as a Research Strategy and a Historical Period – a Balance-Sheet“, in *European Proto-Industrialization*, hg. von Sheilagh C. Ogilvie und Markus Cerman (Cambridge: Cambridge University Press, 1996), 12–22.

11 Erle C. Ellis, *Anthropocene. A Very Short Introduction* (Oxford: OUP, 2018); Jürgen Renn, *The Evolution of Knowledge. Rethinking Science for the Anthropocene* (Princeton, Oxford: Princeton University Press, 2020); Helge Wendt, „Epilogue: The Iberian Way into the Anthropocene“, in *The Globalization of Knowledge in The Iberian Colonial World*, hg. von Helge Wendt (Berlin: Edition Open Access, 2016), 297–314.

12 Franz-Josef Brüggemeier und Thomas Rommelspacher, *Blauer Himmel über der Ruhr. Geschichte der Umwelt im Ruhrgebiet (1840-1990)* (Essen: Klartext, 1992).

The Shrinking Geographies of Coal: European Pathways in a Global Context

This contribution aims at highlighting trends that are affecting coal's geography at different levels (world, European and regional ones). To reach the emission targets agreed in the Paris Agreement (2015), coal's decline looks necessary but it still contributes for almost half of power production. Coal's geography is however shrinking albeit at a different pace around the world with Asia remaining a key consumer and supplier and European countries being for most of them committed to phase it out. China produces and consumes around 40 percent of the coal extracted while most of the EU Member States have either phased-out coal or have committed to do so. Different EU policy instruments aiming at lowering GHG emissions are affecting cost-effectiveness of coal fired power-plants.

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To reach the emission targets agreed in the Paris Agreement (2015), coal's decline looks necessary but is actually the main source of electricity production worldwide. Whether a sharp decline is likely or not in the years to come remains unknown as contradictory signals have emerged, especially in the context of the 2020 pandemic.

Coal consumption decreased by 1.2 percent in 2019 but it still contributes for almost half of power production (40 percent) globally and is responsible for 40 percent of the Greenhouse Gases (GHG) emissions of the energy sector. Climate international negotiations do not seem to have had a significant impact on its use. During the 3 years following the adoption of the Kyoto protocol (1997-1999), coal use declined but mainly because of the financial crisis. Between 2000 and 2013, consumption increased again. In 2018, three years after the Paris Agreement, the volumes extracted reached a historic high. Three of the six main world producers posted an unprecedented level of production (India, Indonesia, Russia) and coal became in Australia the first raw material exported (IEA, 2020a).

However, coal's future looks bleak. Cost reductions and policy support in several major economies are driving a strong renewables growth. Solar photovoltaics (PV) and onshore wind are already the cheapest ways of adding new electricity-generating plants in most countries today (IEA, 2020b). Whenever low interest rates are available in addition to appropriate solar and wind resources, fossil fuel and especially coal are challenged. Following the pandemic, renewables are set to account for 95 percent of the net increase in global power capacity through 2025. According to IEA, installed wind and solar PV capacity is on course to surpass natural gas in 2023 and coal in 2024. Should such a scenario prevail, renewables would overtake coal to become the largest source of electricity generation worldwide in 2025 (hydropower supplying almost half of global renewable

https://doi.org/10.24352/UB.OVGU-2021-049

electricity). Another competitor is gas which availability is benefiting from Liquefied Natural Gas (LNG) supply and from abundant reserves, in particular in the context of shale gas production in the USA.

Coal's share in the world energy mix could decrease further in the context of net-zero emission targets adopted in 2019 and in 2020 in several key markets. Following the EU (European Union) Green Deal[1] and its commitment to reach climate neutrality by 2050, three major Asian economies announced in 2020 targets for reaching climate or carbon neutrality: Japan and South Korea by 2050, China by 2060.

Against such a background, coal's role in the energy production is set to decline. Coal's geography is indeed shrinking albeit at a different pace around the world with Asia remaining a key consumer and supplier and European countries being for most of them committed to phase it out. This raises questions not only on alternative sources that will ensure security of supply but also on the consequences for cities and regions that have been for decades heavily reliant on coal mining and/or on coal use for energy supply. Hence the need for a multi-scalar approach of this shrinking geography of coal in order to highlight spatial dynamics at the global level as well as at the EU, national and local level. This contribution investigates this process of reconfiguration of the world's coal geography before providing an outlook on the specific processes at work in Europe where coal phasing-out is well underway.

Europe's declining role in the world coal geography

The generation of electricity and heat is the main use of primary coal (over two-thirds of it is used for this purpose) although its share is decreasing in several economies, especially in Europe, in China and in the USA. Coal is also crucial for the iron and steel industry and its use has increased substantially during the last thirty years, driven primarily by the strong economic growth in China.

A historical perspective shows that the geography of supply has dramatically changed since the 70s, especially in the case of Europe (Figure 4). Whereas in 1973, half of the ten first suppliers of coal were European countries, only one is European in 2018[2]. This reflects not only the increasing production in Asian countries but also the sharp decline of production in Western Europe. Globally, coal production is still on the rise. It increased by 1.5 percent in 2019 the growth in Chinese production equalling the drop recorded in EU and US production since 2018. China and Indonesia posted an annual growth while India reduced production for the first time

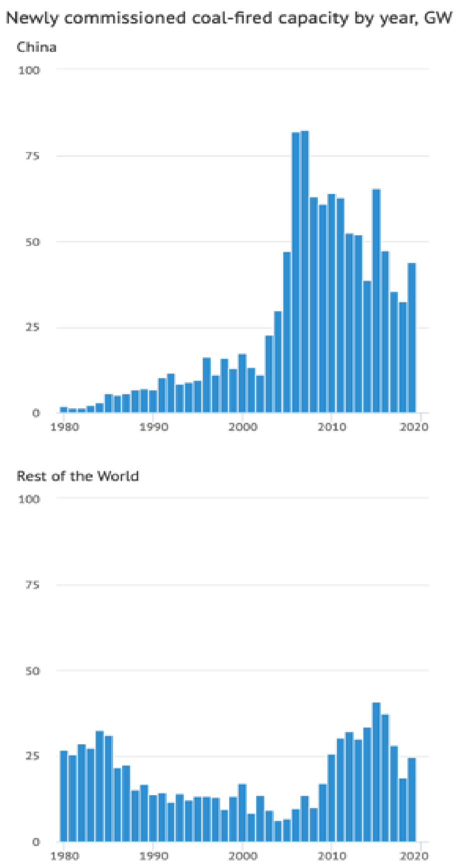


Figure 6 Coal-fired capacities installed yearly in China and in the rest of the world.
Source : https://energypost.eu/will-china-build-more-coal-to-stimulate-the-economy/ (accessed on 5 Nov. 2020)

1 European Commission, A European Green Deal, striving to be the first climate-neutral continent: https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en. Accessed on 12th November 2020.
2 IEA Atlas of Energy : http://energyatlas.iea.org/#!/tellmap/2020991907/0. Accessed on 8th November 2020.

this century and only for the second in history (IEA, 2020b).

Geographies of coal slightly differ depending on whether the focus is put on production, consumption or exports but a few economies play a key role: China, the United States, Australia. Half of world production is provided by China, followed by India (9 percent), the United States, Australia and Indonesia. These five countries accounted for nearly 80 percent of global coal production in 2019.

When it comes to consumption, China is leading too, again with half of the world consumption. Altogether China, the United States and India accounted for around 75 percent of it in 2019. China used to have the largest impact on changes in global coal consumption figures, but it was Indonesia that in 2019 increased the most its coal consumption over the previous year. Whereas Asia is set to remain the main market in the years to come, the United States and the EU set historical minimum consumption in 2019.

In terms of exports, Indonesia and Australia currently account for more than half of the global exports, with the proportion growing to two-thirds if Russia is included, ahead of Colombia, the United States and South Africa. This geography of exports has significantly changed over the last thirty years. In 1990 Australia and the United States were the main exporters with around one-fifth each. Russia's share increased after 2000, and newcomers such as Mongolia and Colombia have posted strong growth of their exports. However, the strongest growth over the past 30 years has come from Indonesia, which now accounts for almost one-third of the global coal exports market.

Regarding importing countries, China and India are the biggest importers. China buys one-fifth of the coal put on the international market every year and together with India, Japan, South Korea they absorb around half of the imports. Whereas India, China, Vietnam have seen their imports increasing significantly, the EU which used to be a major importer in 1990 has been reducing its coal imports consistently since then. Its share in global imports is around 10 percent against 35.4 percent thirty years ago. Although coal has been at the core of the industrial revolution in Europe, this continent has become of secondary importance in the World's coal's geography while Asia has become the main supplier and consumer pole.

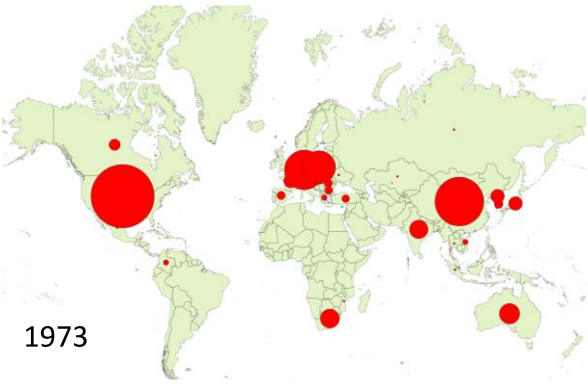
Asia has become by far the biggest market for coal

Coal's future depends indeed mainly on Asian markets and policy makers, Asia accounting for 75 percent of global demand. In several countries, the sector still benefits from substantial financial support, from private banks as well as from the local and national authorities.

Chinese economic growth has been underpinned by a strong increase of coal use, which consumption increased in twenty years (1990-2018) from less than one billion tonnes to 4 billion. While its share in the energy mix is declining, it was still close to 60 percent in 2018. Between 2011 and 2019, China consumed more coal than the rest of the world considered as a whole. Stimulus plans have indeed traditionally benefited heavy industry so that each phase of economic crisis has been followed by a surge of coal consumption and thus of emissions (Figure 5). Coal is not only a cheap provider of energy but also a contributor to China's energy security since the country can rely on the 3rd world largest reserves. With a sharp increase of consumption during the last three decades, imports have risen but they cover less than 10 percent of the country's needs.

This coal-based growth largely explains the pollution in cities as well as the country's contribution to global warming. In 2017, 81 percent of China's emissions came from coal use (70 percent in the case of India, 28 percent in the US, 29 percent in the EU) (IEA, 2020). However, profound changes cannot be ruled out. Plant utilization rate is low, environmental problems acute (Cui et al., 2020) and half of thermal power plants are not profitable[3]. Uncertainty remains regarding the likely scenarios for the years to come. In the context of the Paris agreement, China pledged to reach its emissions peak by 2030 or before and to reduce by this year the carbon intensity (emissions per unit of GDP) of 60 - 65 percent compared to 2005. In 2020, it committed to carbon neutrality (not to climate neutrality) by 2060.

However, in a speech devoted to the energy security strategy in October 2019, Prime Minister Li Keqiang's stressed the key role to be played by coal[4]. In March 2020 alone, the authorities approved the construction of 7.9 GW of coal-fired power plant capacity, more than 6.3 GW for the whole year 2019[5]. The fleet of coal-fired power stations is young (fourteen years on average) and the coal deposits are located in regions lagging behind, two factors that add to the reasons why a fast phasing-out of coal might be difficult to achieve (R. Balme, G. Romano, 2014).



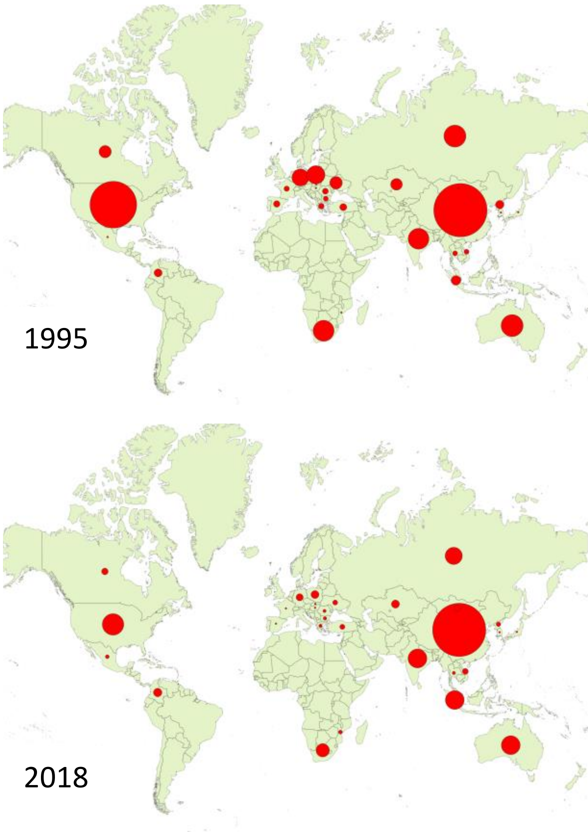


Figure 7 Spatial distribution of coal supply Source : IEA

Financing coal-fired power plants is also becoming increasingly difficult. Private banks, including in Asia, are concerned about being portrayed as ignoring climate concerns. In 2018, they financed 3/4 of wind and photovoltaic projects in India while 2/3 of mining projects got support from public banks[6]. Between 2005 and 2015, Indian public banks provided 82 percent of the financing of coal-fired power plants[7]. Taking into account the numerous coal fired plants built recently as well as projects in the pipeline, phasing-out could prove difficult and risky, with the rise of stranded assets on balance-sheets of private and public banks.

3 Stephanie Pfeifer, chief executive of the Institutional Investors Group on Climate Change, quoted by David Stanway, 'China coal-fired power capacity still rising, bucking global trend', Agence Reuters, 20th November, 2019.

4 'China vows to upgrade energy production, consumption, ensure energy security', Xinhua, 11th October 2019, http://www.xinhuanet.com/english/2019-10/11/c_138464713.htm. Accessed on November 3rd 2020.

5 Global energy monitor: https://globalenergymonitor.org/coal/. Accessed on 5th November, 2020.

6 'Asian governments are the biggest backers of the filthiest fuel', The Economist, 22nd August, 2019.

7 'Down and dirty', The Economist, 22nd August, 2019.

Russia, a key provider to Asia and to Europe

Countries neighbouring China have been benefiting from the Chinese demand for coal. In Russia (where the biggest world coal reserves are located), the Kuznets basin (Kuzbass) in the Kemerovo region provide 60 percent of national production, ahead of the Kansko-Achinsk coal basin in the Krasnoyarsk region, with the remainder of production coming from the Russian Far East where production takes advantage of rail connections to China. More than half of Russia's exported coal goes to the EU but China and South Korea are increasingly significant customers.

This growing importance of Asia has induced a modernization of the seaports in the Far East (Vanino, Posiet, Murmansk[8], Vostochny). Before reaching these ports, coal is transported by rail for at least 4,000 km at a cost that undermines its competitiveness. To serve Asian markets, coal mines located in the Far East have therefore a role to play but coal extracted there is of lower quality. The Transiberian express and the BAM (Baikal Amour) are being modernized, with China providing financing for the infrastructure and for coal-mining activities (for example in the Ogodzhinskoye region, which borders China). China has also built-up a partnership with Mongolia.

Other suppliers of China such as Indonesia and Australia have become the world's top coal exporters[9]. Despite the narratives and the policy decisions put forward in the name of climate mitigation, some countries have indeed seen their exports of coal growing significantly. Australia, South Africa, the Philippines saw exports tripled between 2018 and 2019. Mozambique is competing with Australia for supplying the Indian market from the ports of Beira and the new port of Nacala. Unless a sudden shift occurs on Asian markets (especially in India and in China), coal's decline might require some time whereas data regarding the US market show a bleak outlook there.

A bleak outlook on the US market

Despite the narrative built upon a revival of the 'beautiful clean coal'[10], American coal has declined over the last 20 years, its cost-effectiveness being affected by the surge of shale gas and of renewables. By 2019, coal production had fallen back to its 1978 level. States halting production are no longer a rarity: Kansas in 2017, Arkansas in 2018, Arizona in 2019[11]. This decline in coal can be explained as much by the decline in its use in US thermal power plants as by the drop in exports. Short term trends remain uncertain, however.

Higher natural gas prices can provide opportunities for coal to start growing again. Thus, EIA forecasted in 2020 that coal's share of electricity generation would fall from 24 percent in 2019 to 20 percent in 2020 but increase again to 25 percent in 2021, pushing upwards the GHG emissions of the US economy[12]. However, renewables have already overtaken coal as the number of jobs is concerned. Restructuring remains an issue as coal workplaces are heavily concentrated in a few States (40 percent of production came from Wyoming in 2019, the other producing states being West Virginia, Pennsylvania, Illinois, Kentucky).

The World geography of coal has thus radically changed within a few years. China's role in the world market was negligible in the early 2000s. Twenty years later, about 20 percent world's imported coal was reaching its market. In the meantime, Europe's share fell to less than 10 percent. Contrary to the trends noticed in Asia, Europe imports and consumes less and less coal. No European country has escaped its (too) slow

8 Thomas Nilsen, 'Europe's clean energy shift troubles construction of giant coal port in Murmansk', The Barents Observer, October 26, 2020.

9 31.7 percent and 27.4 percent respectively in 2019 (IEA, 2020b).

10 'The Myth of Donald Trump's Revival for 'Beautiful Clean Coal'', Environment & Energy Report, Bloomberg Law, 29.10.2018.

11 U.S. Energy Information Administration, Annual Coal Report, November 2018.

12 U.S. Energy Information Administration, Short-term energy outlook, November 10, 2020. https://www.eia.gov/outlooks/steo/

decline. Mines are closing and coal-fired power stations (responsible for around 18 percent of European GHG emissions[13]) see their competitiveness undermined by decreasing prices in the renewables and gas sectors. Hence the general process of coal phasing-out that is taking place in Europe, albeit at different paces.

Pathways to a coal-free European Union

In 2020, coal mining was still an economic activity in nine out of the twenty-seven Member States (as well as in the UK) and coal-fired electricity was still part of the power mix in twenty out of twenty-seven countries. However, Europe is in sharp contrast with Asia as coal[14] is being phased-out at a pace considered too slow by many environmental NGOs but much faster than in many other developed economies. Clearly, the EU is on its way towards a coal free area and some policy instruments of the EU climate policy might prove instrumental in this respect.

National pathways: the same trend at different paces

The EU has gone through a steady decline in coal mining due first and foremost to the depletion of resources and thus to higher costs. 277 million tonnes were mined in 1990, 65 million tonnes in 2019. In 1990, thirteen Member States of the current EU were producing hard coal. In 2019, there were only two left: Poland and Czechia but even for these 2 countries, perspectives are bleak. Compared with 2012, Poland decreased its production by 22 percent and Czechia by 70 percent[15].

In Germany, the country's last hard coal mine closed in December 2018. In Spain, the European Commission approved in 2016 the Spanish government's plan of October 2013 to grant more than €2 billion for the orderly closure of twenty-six coal mines by 2018[16]. By the end of 2018, all Spanish coal producers had closed their mining operations[17], the last mines being located in the Asturias. At his peak, the industry employed in the 1990s more than 50,000 miners.

However, brown coal mines are still in activity in several Member States, especially in Germany but downward trends prevail in this matter too. In 1990, fourteen Member States were producing brown coal. In 2018, six were still doing so: Germany (43 percent of the EU production), Poland, Czechia, Bulgaria and Greece and Romania.[18]

Imports remain significant as coal-fired electricity generation is still widespread across the EU (in twenty out of twenty-seven Member States) and contributed 14.6 percent to the EU's power mix in 2019[19] but coal fire generation too is declining.

A pioneer country in the coal-based Industrial Revolution, the United Kingdom was the first country in the world to commit to phase-out coal, shortly before the Paris Agreement in 2015. Since

13 Beyond Coal. Europe Beyond Coal. (2017). at https://beyond-coal.eu/data/. Accessed on 12th October 2020.

14 A significant part of hard coal (47 percent in 2019) and the majority of brown coal (83 percent in 2019) is used for power production. Hard coal (more specifically coking coal) is essential to produce coke oven coke for the steel and iron industry. Four major types of coal are usually considered : anthracite - the highest rank of coal (often referred to as hard coal), bituminous coal, subbituminous coal, lignite the lowest rank of coal (often referred to as brown coal) almost exclusively used as a fuel for steam-electric power generation. https://www.usgs.gov/faqs/what-are-types-coal?qt-news_science_products=0#qt-news_science_products. Accessed on 12.10.2020.

15 European Commission, Eurostat, Consumption and production of hard coal, https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Coal_production_and_consumption_statistics#Consumption_and_production_of_hard_coal. Accessed on 18th November 2020.

16 The European Commission considered that this decision was in line with EU rules on state aid, in particular Council Decision 2010/787/EU (case SA.34332).

17 https://euracoal.eu/info/country-profiles/spain/. Accessed on 10th November 2020.

18 European Commission, Eurostat, Consumption and production of hard coal, https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Coal_production_and_consumption_statistics#Consumption_and_production_of_hard_coal. Accessed on 18th November 2020.

19 Coal power plants made up 31 percent of EU ETS emissions in 2019.

then, several countries have already stopped using coal (Belgium in 2016, Austria in 2020, sometimes earlier than scheduled such as Sweden in 2020) and 11 have committed to phase out coal before 2030[20]. EU coal power generation fell 24 percent in 2019 and emissions already reflect the declining use of coal. For the year 2019, data from the Union's registry of the emissions trading scheme (ETS) show that emissions dropped by 24.5 percent in comparison with 2018. The strongest absolute decline happened in Germany, with 54 million tonnes of CO2 less than the previous period. This confirms the downward trend noticed since 2012 when the EU's CO2 emissions from coal power stations peaked. Since then, coal-based CO2 emissions have dropped by 47 percent[21].

Several reasons explain this progressive decline of coal in the European economy. Political decisions have played a role in the context of climate change mitigation narrative but phasing-out has not been government-driven everywhere. Depletion of resources as well as costs associated with tougher EU environmental regulations are instrumental. In Austria, the companies operating the two coal plants closed them in 2019 and 2020 without being forced to do so. In Belgium, the last coal plant closed in March 2016 ending a process of progressive closure of aging power plants in the context of tougher by EU regulations.

The COVID-19 pandemic has accelerated the process, coal-fired power output dropping 32percent in the EU during the first semester of 2020, while highlighting a divide between Western and Eastern Europe. Whereas Western European countries were numerous to phase-out coal in the 80s and the 90s, communist regimes were keen to keep it as a key instrument for economic development and political self-reliance. During the pandemic and in the context of decline of coal consumption in Germany, the Czech Republic became the third largest producer of coal-based electricity in Europe, Bulgaria the fourth. Poland could have been second behind Germany, but because of a sharp drop in production in Germany, it became the European country producing the most coal-based electricity.

Thus, in the European geography, coal-fired power generation is progressively becoming a Central European specificity. In 2020, four Central European countries (Czech Republic, Romania, Bulgaria, Croatia) had not decided yet upon a coal exit date[22] while for the first time Poland put forward a deadline (related exclusively to the mines closure) : 2049[23].

Will coal-based generation plants be cost-competitive until then? The EU climate, competition and environmental policies have affected the profitability of the coal sector in different ways, hence speeding-up the phasing-out of this source of energy. It is certainly not in the remit of the European Commission to decide upon the energy mix of a Member State[24] but different EU policy instruments aiming at lowering GHG emissions are affecting cost-effectiveness of coal fired power-plants.

EU policy instruments are playing a key role in the phasing-out of coal

Among the factors that explain the decline of coal across Europe, EU policy instruments have indeed

20 Portugal by 2021, France by 2022, Slovakia by 2023, Italy and Ireland by 2025, Greece by 2028, The Netherlands and Finland by 2029, Hungary, Slovakia and Denmark by 2030. Europe beyond coal, Overview: National coal phase-out announcements in Europe

21 Felix Reitz, European coal in structural decline, Europe Beyond Coal, 24. 06 2020. https://beyond-coal.eu/2020/06/24/european-coal-in-structural-decline/. Accessed on 18th November 2020.

22 Bloomberg New Energy Finance, Investing in the Recovery and Transition of Europe's Coal Regions, White Paper, 06.07.2020.

23'Poland agrees to shut coal mines by 2049', Euractiv, 26.09.2020, https://www.euractiv.com/section/electricity/news/poland-agrees-to-shut-coal-mines-by-2049/. Accessed on 12 November 2020.

24 Article 194 of the Treaty on the Functioning of the European Union (TFEU) states that each EU country maintains its right to 'determine the conditions for exploiting its energy resources, its choice between different energy sources and the general structure of its energy supply'.

been playing a key role. The Emission Trading Scheme (ETS) has a limited impact on European emissions because of a large supply of allowances (especially of free allowances[25]) which has prevented carbon prices from reaching a threshold that would weigh on the competitiveness of coal-fired power plants. In addition to serious design flaws, the ETS suffered from the financial and economic crisis of 2018 which depressed the demand. However, the introduction of a Market Stability Reserve (MSR) in 2019 led to a sharp rise of carbon price. The steady increase in industrial output in the EU since January 2017 led to a rise in demand for quotas and contributed to the perception of a tightening market. Prices surged also strongly against the background of the speculation from market players who were anticipating further increases in CO2 prices and have been taking long positions on the ETS market.

Not all design flaws have been tackled though. The market has been experiencing strong volatility as no carbon price floor provides a protection against sudden price drops[26]. Thus, a lack of visibility due to energy market fundamentals shifting (for example a decrease in the cost of renewable energy and storage technology) could depress demand for quotas and depreciate their price. However, while financial data at the scale of thermal power stations is not readily available, the financial impact of the ETS should not be overlooked in the context of low gas prices. In Poland, the main public company[27] declared having spent more than €160 million additional during the first quarter of 2020 despite a reduction in its emissions of 5 percent and due to the increase in the price per tonne of carbon[28]. In Germany, Vattenfall referred in 2020 to the European carbon market to close its Moorburg plant (near Hamburg), a plant inaugurated only five years earlier[29].

On the top of the ETS, EU environmental regulations have also taken their toll. In July 2017, the European Commission adopted 'Best Available Technique'[30] decision which amended a 2010 Directive related to the standards to be observed in terms of pollution by a series of industrial installations including coal-fired power stations[31]. These new standards, to be applied before the end of 2021, have induced costly adaptation work for around 80 percent of European thermal power plants. As a consequence, several European energy companies have brought forward the end date for the closure of their coal-fired power stations.

Polish authorities have tried to water down EU climate initiatives. They launched the 'yellow card' procedure against the legislative initiative 'Clean Energy for All Europeans', arguing that the principle of subsidiarity had been ignored by the EU[32]. In 2019, the European Council endorsed the project of a climate neutral Union by 2050 but Poland refused to join this initiative before seemingly sharing this strategic vision for itself[33]. The EU commitment to achieve carbon neutrality might indeed accelerate the phasing-out of coal

25 Free allowances have been discussed by the ECA (European Court of Auditors, 2020).

26 Article 29a of the EU ETS Directive provides for the possibility of convening a meeting at EU level in the case of excessive price fluctuations.

27 Polska Grupa Energetyczna.

28 Maria Wilczek, 'After government forbids Russian imports, Polish state firms switch to pricier domestic coal', Notes from Poland, 4th June 2020.

29 Michael Bauchmüller, 'Vattenfall will umstrittenes Kohlekraftwerk Moorburg stilllege', Süddeutsche Zeitung, 4th Sep. 2020.

30 European Commission. Commission implementing Decision (EU) 2017/1442 of 31 July 2017 establishing best available techniques (BAT) conclusions, under Directive 2010/75/EU of the European Parliament and of the Council, for large combustion plants. (2017). at <http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32017D1442&from=EN>

31 European Parliament and the Council of the European Union. Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions (integrated pollution prevention and control) (Recast). (2010).

32 Under the yellow card procedure, national parliaments can object to a draft legislative act on grounds of the principle of subsidiarity. If one-third of the national parliaments raise an objection the European Commission must review the proposal. This procedure was introduced in the Lisbon Treaty (2009).

33 Frédéric Simon, Warsaw says 'committed' to EU's climate neutrality goal, Euractiv, 15th September 2020.

across Europe since it implies an upward revision of European objectives regarding emissions to be cut by 2030. In September 2020[34], the European Commission confirmed that the adoption of a 55 percent threshold (reduction in emissions) for 2030 (instead of 40 percent as previously agreed) would imply that by 2030 'the consumption of coal [would] have to be reduced by more than 70 percent compared to 2015 and that of oil and gas of more than 30 percent and 25 percent respectively'[35]. Thus, the green deal might have far-reaching consequences for Europeans coal power plants. The new EU target would imply a near total phase-out of coal power plants, a scenario that would also require from Germany that it brings forward its coal phasing-out currently scheduled for 2038 at the latest or that production capacities remain connected only to ensure grid stability and security of supply.

Whatever scenario prevails, coal phasing-out will raise economic and social challenges that might spur local crisis as coal mining related activities are concentrated in a few European regions which economic fabric, tax revenues and social cohesion might be affected.

Conclusion

The geography of coal has gone through a reshaping process in which India and China have overtaken the EU, Japan, South Korea as the main markets. In Europe, coal phasing-out is underway and this decline is linked both to policy initiatives and to the deteriorating economics of coal. How coal has shaped regional and social identities should not be overlooked as phasing-out means the end of a long story (coal mining started in many European countries during the 19th century and sometimes much earlier, as in Spain where it first began in the 16th century). Hence the need to highlight social and political challenges linked to the energy transition and that might look at first hand of little importance in the light of the low number of jobs that remain reliant on coal related activities across Europe.

Besides the challenges faced by regions affected by the phasing-out of coal, one important question regarding climate change remains: will gas replace coal? In 2019, the absolute growth of gas was higher than the growth of renewables. Roughly 40 percent of coal power was replaced by renewables, 60 percent by gas. Most of the increase of gas generation was due to higher competitiveness of existing plants, rather than capacity additions[36] but new fossil gas power plants might be an option in some Member States. Hence the necessity for European policies not only to gear the transition so that coal is phased-out, social consequences are tackled but also in a way that alternative energy infrastructures won't be considered tomorrow as stranded assets... just like some coal plants today.

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34 Communication from the European Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the regions, Stepping up Europe's 2030 climate ambition, Investing in a climate-neutral future for the benefit of our people, {SEC(2020) 301 final} - {SWD(2020) 176 final} - {SWD(2020) 177 final} - {SWD(2020) 178 final}, Brussels, 17th September 2020.

35 Sören Amelang, Kerstine Appunn, Julian Wettengel, 'EU climate target of -55percent would mean near-exit from coal in 2030', Clean Energy Wire, 5th October 2020.

36 Felix Reitz, op.cit.

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Regional Challenges in Energy Transitions

Part II Denkanstöße

Die Überlagerung alter und neuer Energieräume. Regionen des Kohleausstiegs aus der Perspektive einer Forschung zu energieräumlichen Dispositiven

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Bis vor wenigen Jahren konnte die Energieforschung und insbesondere die Forschung zu Energiewenden dafür kritisiert werden, kaum auf räumliche Aspekte einzugehen. Seit einigen Jahren hat sich dies im Zuge eines „spatial turn" in der Energieforschung (Bridge 2018: 12) geändert. Neuere Forschungsansätze berücksichtigen nun, dass sich die Beziehungen zwischen Energie und Gesellschaft in räumlich jeweils unterschiedlicher Weise darstellen. Dies betrifft etwa die Differenzen zwischen Energieräumen hinsichtlich ihrer sozio-materiellen Ausstattung mit Infrastrukturen, aber auch die Tatsache, dass Energiepolitiken in ganz unterschiedlicher Weise territorialisiert sind und in spezifischen lokalen, regionalen, nationalen und supranationalen Kontexten verfolgt werden. Durch Energiewenden werden zudem räumliche Muster sozialer, kultureller und wirtschaftlicher Prozesse und Alltagspraktiken rekonfiguriert, was in räumlicher Hinsicht zu ungleichen Verteilungen von Lasten und Chancen führen kann (Bridge/Gailing 2020; Gailing/Moss 2016). Die raumbezogene Energieforschung ist ein schnell wachsendes und heterogenes wissenschaftliches Feld (Calvert 2016; Castán Broto/Baker 2018), das die übergreifende Rolle von Räumen und grundlegende Kategorien der spezifischen Räumlichkeit von Energiewenden analysiert.

Konfigurationen des Energiesystems sind stets mit starken nationalen „socio-technical imaginaries" (Jasanoff/Kim 2015) verbunden. Aber gleichzeitig materialisieren sich Technologien und Infrastrukturen, indem sie eng mit bestimmten Orten verknüpft sind, auf unterschiedliche lokale und regionale Erwartungshaltungen treffen und von Gemeinschaften vor Ort politisiert werden. Demnach ist das Verständnis der Rolle von Städten und Regionen wesentlich dafür, sozio-technische Realitäten und Zukünfte der Energiewende analysieren und auch gestalten zu können. Im Fall eines Forschungsprojektes des Leibniz-Instituts für Raumbezogene Sozialforschung (IRS) „Neue Energieräume – Dimensionen sozioräumlicher Beziehungen in

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regionalen Energiewenden" (vgl. Gailing et al. 2020) haben wir die räumliche Organisation von Energiewenden untersucht. Darunter sind nicht nur die veränderten physischen Raumbezüge zunehmend dezentral ausgerichteter Stromerzeugungssysteme und Verteilnetzstrukturen zu verstehen, sondern auch die Konstituierung energiepolitischer Handlungsräume, die Prägung neuer Energielandschaften sowie der Wandel der skalaren Beziehungen von Energiepolitik und -wirtschaft.

In der Forschung zu sozio-materiellen Transformationen – aber auch in der Transitionsforschung allgemein – ist oftmals die Vorstellung vorherrschend, technologischer und damit zusammenhängender gesellschaftlicher Wandel vollziehe sich in linearer Weise durch den Übergang des einen Systems zum anderen. Dass dieses Bild kaum der Realität entspricht, zeigt sich nicht nur in den vielfältigen Konflikten rund um die Energiewende, sondern auch in jenen Regionen, in denen es zu einer Überlagerung des hergebrachten mit dem neuen Energiesystem kommt. Für den Erfolg einer Energiewende ist es unerlässlich, dass sich erneuerbare Energien auch in jenen Räumen durchsetzen, die noch besonders stark vom fossilen (oder fossil-nuklearen) Energiesystem geprägt sind. In diesen Regionen überlagern sich „alte" und „neue" Energieräume, d.h. es handelt sich um Regionen, in denen sowohl eine traditionelle, auf fossilen oder nuklearen Brennstoffen basierende Stromerzeugung als auch eine erneuerbare Energieerzeugung stattfindet.

Ein prägnantes Beispiel hierfür sind die Kohleregionen. Das Rheinische Braunkohlerevier zwischen Aachen und Köln in Nordrhein-Westfalen trägt seine Prägung durch den Braunkohleabbau bereits in seinem geographischen Namen. Hier stehen vier der klimaschädlichsten Kraftwerke in Europa; einer der dortigen Tagebaue ist das größte Loch in Europa und das tiefste in Deutschland. Dennoch gibt es in dieser Region bereits seit einigen Jahren zahlreiche Projekte, die eine Transformation hin zu erneuerbaren Energien anstreben. Die Energiezukunft dieser Region war in den letzten Jahren umstritten, was in widerstreitenden Visionen seinen Ausdruck fand: Während manche eine radikale Transformation mit einem schnellen Ausstieg aus der Kohle befürworteten, plädierten andere dafür, den Braunkohleabbau unverändert fortzusetzen oder sogar zu forcieren. Wieder andere entwarfen das Zukunftsbild einer präventiven Transformation, d.h. einer Transformation des Energiesystems in Richtung des Ausbaus erneuerbarer Energien, während zugleich das Braunkohlerevier und die Kraftwerke noch über eine sehr lange Zeit vorhanden sein sollten. Diese letzte Position wurde durch die nationalen Entscheidungen zum Kohleausstieg der letzten Jahre gestärkt, denn der Ausstiegspfad aus der Braunkohle sieht einen Zeitrahmen bis 2038 vor. Die Parallelität zwischen einem „alten" und einem „neuen" Energieraum wird also festgeschrieben, wenn auch eine Veränderungsrichtung hin zu einem dekarbonisierten Energiesystem ausgewiesen wird.

Mit einer Perspektive der Dispositivforschung habe ich versucht, diese widersprüchliche sozio-materielle Situation im Rheinischen Braunkohlerevier zu erfassen. Das Konzept des Dispositivs wurde von Michel Foucault entwickelt. Die zwei wichtigsten Aspekte eines Dispositivs sind erstens der Fokus auf Arrangements verschiedener materieller und nicht-materieller Elemente sowie auf die Beziehungen zwischen ihnen und zweitens die Betonung der strategischen Funktion der Arrangements, die stets eine Antwort auf einen Notfall oder ein Bedürfnis darstellen. Materielle Objekte spielen im Dispositiv eine wichtige Rolle, aber sie können nur im weiteren Kontext von Subjektivierungen, Diskursen und Imaginationen an Bedeutung gewinnen. Dispositive sind demnach immer sozio-materielle Konfigurationen (vgl. Gailing 2016; Manderscheid 2014).

Eine Dispositiv-Perspektive einzunehmen, bedeutet, strategische Netzwerkbeziehungen zu erforschen, in denen Macht kollektiv produziert und in sozio-materielle

Arrangements eingeschrieben wird. Was hat es nun mit dem Dispositiv des „alten" Energieraums im Rheinland auf sich? Seine strategische Funktion bestand ursprünglich darin, die Energieversorgung der alten Bundesrepublik insbesondere in den Industriegebieten Nordrhein-Westfalens zu sichern. Braunkohle war eine der wenigen nationalen Energieressourcen Westdeutschlands. Das Dispositiv besteht aus einem Netzwerk aus verschiedenen materiellen und nicht-materiellen Elementen:

1. in materieller Hinsicht die Braunkohle als Ressource, die Tagebaue, die Förderbänder und Eisenbahntrassen zum Transport der Kohle zu den Kraftwerken sowie die Kraftwerke selbst,
2. die Diskurse und Subjektivierungen rund um den Braunkohleabbau: Die Diskurse sind in der Region traditionell mit Argumenten zum Arbeitsplatzerhalt und zur wirtschaftlichen Entwicklung verbunden, in der nationalen Debatte mit Aspekten wie der Sicherung der Energieversorgung (insbesondere der Grundlast) und – zunehmend – mit Diskussionen um hohe Treibhausgasemissionen. In Bezug auf die Subjektivierungen stehen im Mittelpunkt: Bergbautraditionen, starke gewerkschaftliche Aktivitäten (gemeinsam mit RWE) für den Erhalt der Gruben und der Kraftwerke, lokale politische Eliten als Teil eines starken politischen Netzwerks, das von RWE unterstützt wird, viele kulturelle und soziale Aktivitäten, die von RWE gesponsert werden, Protest gegen die bestehenden Tagebaue – vom lokalen Protest gegen Staubemissionen bis zur globalen Klimabewegung.

Die strategische Funktion des neuen Energieraums ist dagegen in der Lösung der Herausforderungen der Klimakrise zu verorten. Auf regionaler Ebene kommen hier allerdings stets Argumente einer tragfähigen regionalen Wirtschaftsentwicklung hinzu. Was zeichnet das Dispositiv des neuen Energieraums aus?

1. In materieller Hinsicht geht es um die vielfältigen Infrastrukturen der Energiewende: dies reicht von kleinen PV-Anlagen auf Dächern, die einst im Protest gegen RWE errichtet wurden bis zu neuen großen Windparks, die von sehr unterschiedlichen Akteuren wie den rheinischen Kommunen oder RWE selbst entwickelt und gebaut wurden.
2. Die Diskurse und Subjektivitäten sind einerseits mit dem Protest gegen RWE verbunden, wie er sich beispielsweise in ikonischer Weise im Hambacher Forst gezeigt hat, andererseits mit neuen Geschäftsmöglichkeiten für kleine und mittlere Unternehmen im Sektor erneuerbarer Energien und mit sozio-technischen Visionen für ein neues virtuelles Kraftwerk und die Entwicklung von Smart Grids.

Dies zeigt bereits, dass das Dispositiv des neuen Energieraums noch deutlich unschärfer und brüchiger erscheint als das gefestigte Dispositiv des alten Braunkohlereviers. Während der „alte" Energieraum mit den Orten der Tagebaue, Kraftwerke und Infrastrukturen verbunden ist, sind die „neuen" Energieräume des Protests oder der transformativen Governance flexibler und können mit Diskursen und Praktiken verbunden werden, die sich auf unterschiedliche Orte und Infrastrukturen beziehen. Ihr Charakter als Dispositiv ist noch unklar.

Energieräume sind Arenen für konkurrierende Sozio-Materialitäten und Zukunftsvorstellungen. Dabei können unterschiedliche Visionen konfrontativ aufeinanderprallen, wie im Falle von RWE und seines Netzwerks auf der einen und der Klimabewegung auf der anderen Seite. In anderen Fällen ist eine Parallelität unterschiedlicher Visionen zu konstatieren wie etwa beim Ausbau von „smart grids" und großer Windparks auf der einen Seite und dem gleichzeitigen Erweitern der Abbaugebiete auf der anderen Seite in den letzten Jahren. Schließlich kann es dabei in ganz grundlegender Weise zu einer diskursiven und/oder sozio-materiellen Integration des „neuen"

Energiesystems in das „alte“ kommen, wie der „präventive“ Transformationsprozess im Rheinischen Revier in den letzten Jahren gezeigt hat.

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Coal phasing-out and regional development issues

How coal has shaped regional and social identities should not be overlooked while discussing the social impact of the on-going transition. Hence the need to focus on different pathways adopted by national and regional governments to adjust to the new context. While focusing on the sub-national level, this contribution aims at highlighting some of the challenges raised and to connect them to some findings from the literature dedicated to economic geography.

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In the EU, climate and energy policies implemented in the aftermath of the Paris Agreement have accelerated the phasing-out of coal in most of the Member States raising challenges for regional and local stakeholders to adjust to the new context. Overall, 41 regions in 12 EU Member States were reliant on coal-mining in 2016, providing jobs to about 240 000 people. A territorial approach is all the more required that phasing-out of coal does take place evenly across the EU. Whereas the number of jobs related to coal has sharply declined over the last 30 years, some areas are still heavily reliant on it without reaping the benefits of the increasing share of renewable energies in the European energy mix.

While focusing on the sub-national level, this contribution aims at highlighting some of the challenges raised and to connect them to some findings from the literature dedicated to economic geography.

Coal phasing-out and regional development issues

Overall, 41 regions in 12 EU Member States were reliant on coal-mining in 2016, providing jobs to about 240,000 people (180,000 in the mining of coal and lignite and 60,000 in coal- and lignite-fired power plants) (Alves Dias et al., 2018) (Figure 6). Declining of the industry has led in several areas to long-term depopulation, high rates of structural unemployment and loss of attractiveness. Recultivation adds to the challenge as degradation of land and bodies of water as well as high levels of air pollution implies long-term significant investments. From the social point of view, coal was (or is) providing steady and well-paid jobs to their workers, as well as a sense of identity, community and pride (Bruegel, 2020). The transition can be painful when it is perceived as a threat by local communities both for the economic structure and for the regional identity. However, some research suggests that opposition from local populations might be overstated, at least in the case of Germany.

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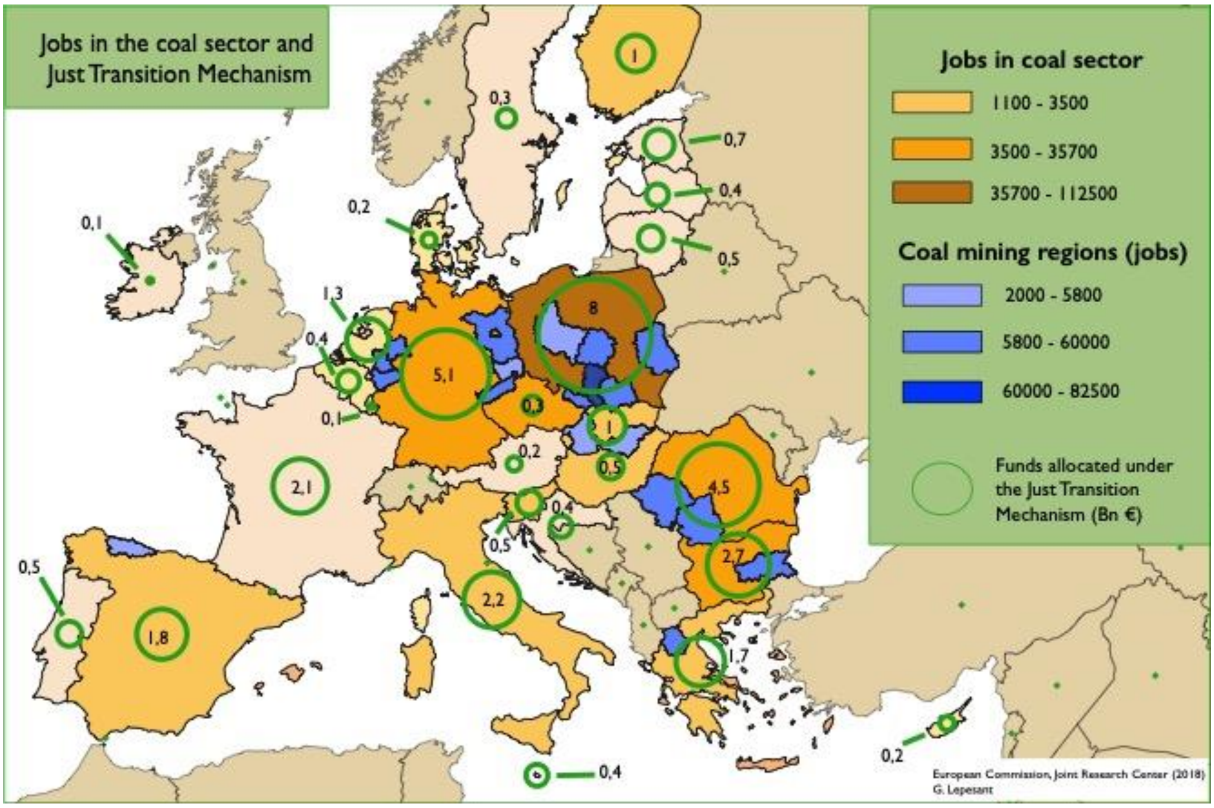

Figure 8 Jobs in the Coal Sector and Just Transition Mechanism, Source : G. Lepesant; European Commission Joint Research Center

According to Rinscheid and Wüstenhagen (2019), the German civil society would have supported a faster exit from coal. They admittedly note differences according to political affinities, ages and regions, but note that even in areas directly affected by a rapid energy transition, an earlier exit than in 2038 would be met with the support of a majority of inhabitants. How then to explain the compromise found for a phasing-out of coal in 2038 at the latest? Rinscheid and Wüstenhagen see a response in how the Commission has been set-up: few elected representatives, few citizens while employers (BGA[1]) and trade unions (IGBCE[2]) were very well represented. The balance of power was thus in favour of stakeholders keen to a lengthy transition. While involving stakeholders in the decision-making process helps to engineer a compromise, such corporatist approaches might be inadequate regarding the necessity to act decisively in the field of climate change (Breetz et al., 2018).

How affected regions will adjust to the phasing-out of coal remains a key issue since employment in coal related activities is concentrated in a few areas across the EU. Europe has accumulated a long experience of industrial crises. Globalization and automation of production have resulted in massive job losses affecting in particular the old industrial regions (Midlands, Ruhr, North-East of France). In most of the regions still reliant on coal, some similarities emerge: trade unions oppose job loses that could not be offset by gains in other sectors, business representatives are split between the support to the old and to the new economy, policymakers hesitate between short-term support to the existing sectors and a long-term vision.

1 Bundesverband Großhandel, Außenhandel, Dienstleistungen.
2 Industriegewerkschaft Bergbau, Chemie, Energie.

European regions affected by the phasing-out of coal are benefiting from EU funds especially since the introduction of the 'Just Transition' mechanism proposed by the European Commission and starting from 2021 onwards[3]. This Mechanism[4] focuses on regions and sectors affected by the transition given their dependence on fossil fuels, including peat and oil shale or greenhouse gas-intensive industrial processes. Other funds are available (structural funds in the framework of the Cohesion policy, Innovation Fund and Modernisation Fund financed by the revenues provided by the ETS). They won't be enough to ensure a smooth transition in regions affected by restructuring.

The challenge of breaking out of locked-in paths

A key challenge relates to the capacity of regions to break out of locked-in paths by initiating new technological pathways. Old industrial regions are indeed characterized as primarily one of negative lock-in (Hassink, 2010). As highlighted by Grabher (1993), inter-firm linkages, industrial atmosphere and local political support for specific branches are key elements of a successful regional development but in times of crisis can prevent a region from breaking-out of lock-in. Grahber identifies three types of 'lock-in': functional lock-in where inter-firms networks in declining industries tend to block the diversification of the economic fabric, the cognitive lock-in where a mindset precludes imagination to move towards new development pathways, and political lock-in where dense relationships between decision-makers and business circles aim at preserving the existing structures despite the need for change (Campbell, Coenen, 2017).

A large body of literature has elaborated on the reasons why some areas prove to be resilient while others find it difficult to tackle high unemployment and loss of attractiveness and where inertia prevails. 'Stubborn obstacles to innovation' (Grabher, 1993, p.256) have been highlighted in different case studies. The evolutionary turn in economic geography has shed light on the path-dependent nature of regional development (Boschma R. and Martin R., 2010, Martin R. and Sunley P., 2006). Self-reinforcing mechanisms may indeed steer a regional effect along one path rather than another (Martin, 2010). This path-dependent nature of technological change has been theorized in the literature on socio-technical transitions, especially through the concept of 'socio-technical regimes' (Geels, 2002, Simmie, 2012). This concept has been particularly forceful to explain why energy systems might remain locked-in to fossil fuel-based technologies (Unruh, 2000). In this respect, the role of politics should not be overlooked as highlighted by Rodriguez-Posé A. (2013) in his analysis of the role of the institutions. As shown in different empirical case studies (Harfsta and Wirtha, 2011; Morton and Müller, 2016), governance issues are key in this respect.

Experiences across Europe suggest a number of pathways that regions may draw upon to escape lock-in. Some have turned to tourism (Zasavje in Slovenia), leisure, sport (Steirische Eisenstrass in Austria), others to culture (like the Guggenheim Museum built in Bilbao in the heart of a region formerly specialized in the naval and steel industry). Coal regions capacity to cope with external transformative pressures and to foster a regional structural revival will depend on their capacity to absorb shocks, to draw on the skills found in the existing industries as well as on the interplay between policy makers and business circles at different levels. Where this revival can be built upon previous industrial restructuring experiences (such as in Ruhr region) or upon an

3 Proposal for a regulation of the European Commission to the European Parliament and of the Council establishing the Just Transition Fund, Brussels, 14th January 2020 COM(2020) 22.

4 The Mechanism consists of three pillars: (1) a Just Transition Fund implemented under shared management, (2) a dedicated scheme under InvestEU, and (3) a public sector loan facility with the EIB Group to mobilise additional investments to regions concerned.

already diversified economic basis (such as in Silesia), this process should be smoother than in areas with few alternatives left.

Conclusion

Phasing-out of coal is a historical process in the sense that coal has very much contributed to the industrial revolution and to the shaping of the European industrial geography. The challenge is now to find alternative activities in a context where the territorial logic of renewable energies follows different patterns and where the jobs they provide are not always as numerous as jobs at stake in coal related activities.

Declining of the industry has led in several areas to long-term depopulation, high rates of structural unemployment and loss of attractiveness and the transition can be perceived as a threat by local communities both for the economic structure and for the regional identity. Hence, the need to link international and European changes to regional development issues in order to better understand how European regions can adjust to the new context induced by the energy transition.

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Just Transition in Silesia: from coal-centric to coal-exit development pathways

The history of coal in the Silesian region reaches the XVIII century. Given that coal mining has shaped both the economic development of the region and local identity of Silesia for several centuries, it is understandable that transformation of the region and the process of decoupling its growth from coal is a contentious topic. The restructuring of the Silesian economy is a long-term process which has started in the 1990s. It includes not only a gradual phase-out of coal mining but also much broader sectoral realignment from traditional industries towards modern manufacturing and services, in line with a broader transition which Poland has been undergoing since abandoning centrally planned economy and launching the process of integrating with the European Union. Today, these processes are already advanced, but significant challenges remain. 2021 is a crucial year for charting further transition pathways for the region, as two stakeholder processes are set to conclude in the coming months. The first one is the preparation of Territorial Just Transition Plan, and the second is developing mining restructuring strategy.

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Historical background: trans-formational challenges for Upper Silesia

Upper Silesia is one of the oldest industrial regions in Poland. Coal for the heating purposes was mined in the region as early as the late Middle Ages. With the clearing of forests in the 17th and 18th centuries, it began to increasingly replace wood in the local metallurgy, which developed early on thanks to the availability of iron and zinc ores in the region. At that time, however, it was a poorly organized activity, carried out not by professional miners, but rather by peasants, who usually worked as farmers. The industrial mining of hard coal and smelting of metals in the region can be traced back to the mid-18th century when relatively large mines were established to support the development of the iron industry. Due to the infrastructural bottlenecks Upper Silesian coal mining was relatively small then, with production not exceeding several thousand tons per year in both the German (later Oberschlesien) and Polish (later Zagłębie Dąbrowskie and Zagłębie Krakowskie) region. Coal mining was much better developed in the German Lower Silesia, which had at its disposal relatively well-developed water transport infrastructure. In consequence, tens of thousands of tons of coal per year were mined in this region, not only for the local market but also for Wroclaw and Berlin (Jeżowski, 1961). The turn of the eighteenth and nineteenth centuries were also the beginnings of the Upper Silesian mining culture. Its development was stimulated by the emergence of a class of professional miners and the Prussian regulations dedicated to mining, that – among

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others - guaranteed people working in the mining industry the privilege of personal freedom together with the exemption from serfdom and military service or taxes (Michalkiewicz, 1984). Miners unable to work due to old age or disability were also granted small pensions and widow allowances. In the territories of the former Polish-Lithuanian Commonwealth (in the Kingdom of Poland) this type of reform was carried out in 1817 when the Mining Corps was established. Corps' member, like in Prussia, were exempted from serfdom, taxes and military service, while at the same time they were being guaranteed funds for medical treatment as well as payments of allowances and pensions for widows and orphans from the special fund established for this purpose (Michalkiewicz, 1984). During that time, in both parts of Upper Silesia, the custom - guaranteed by law and continued to this day - of wearing a special miner's uniform began to take shape.

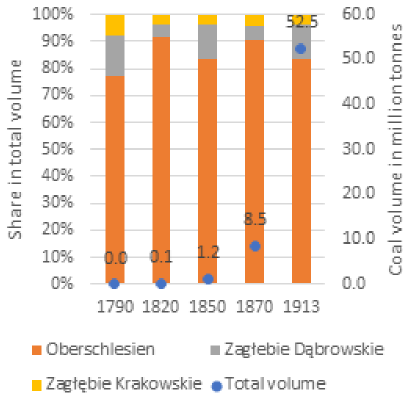

Figure 9 Coal production in Upper Silesia 1790-1913

Source: WiseEuropa based on data compiled from Frużyński (2012)

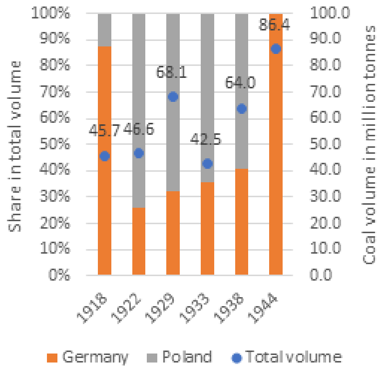

Figure 10 Coal production in Upper Silesia 1918-1944

Source: WiseEuropa based on data compiled from Frużyński (2012)

The semi-industrial nature of Upper Silesia was shaken during the Napoleonic Wars when the region lived through its brief economic collapse, partial depopulation and the bankruptcy of some of the early industrial plants and mines. However, France's defeat in the Russian campaign and Prussia's post-1810 armaments program led to a rapid economic recovery and – in a few years - increased coal production to around 100,000 tons per year – a level well above the results recorded at the end of the 18th century, but still slightly inferior to the performance of the mining sector in the nearby Lower Silesia (around 150,000). Mining also developed in the Dąbrowskie Basin (Przemasza-Zieliński, 2006). The region belongs to the Silesian Voivodeship today, and during this period it was located within the borders of the Russian dependent Kingdom of Poland. Around 1820, only 5,000 tons of coal were mined there per year, but by the mid-nineteenth century, almost 150,000 tons were already being used mainly in the heavily supported iron industry. The real revolution for Upper Silesia – both in the part controlled by Prussia (Oberschlesien), Russia (Dąbrowskie Basin) and Austria (Cracow Basin) – turned out to be the railway boom of the 1840-1870 period (Dylewski, 2012). Over the course of several years, the region has been connected to the fast-growing industrial cities: Wroclaw, Berlin, Krakow, Vienna and Warsaw, which have become an absorbent market for Silesian coal, iron and zinc. This period was, therefore, a time of great boom in mining, which benefited both from the increasing demand for coal and from doubling its price. In 1873, almost 8 million tons of coal were mined in 142 mines in the Prussian part of the region – almost four times more than in neighbouring Lower Silesia and twenty times more than in the Dąbrowskie Basin, which industrialization during this period was slower due to competition from coal imported from parts of the Prussian region and the delayed modernization of the Russian partition.

A significant acceleration of economic development in the Kingdom of Poland began after 1870 thanks to the rapid industrialization of Łódź and Warsaw districts initiated by the expropriation reforms in the countryside and the introduction of protective duties on the border with Prussia on industrial goods. This changed the situation in the Dąbrowskie Basin, causing a rapid increase in coal mining, which in 1913 mined almost 7 million tons employing 25,000 people. During this time, 63 mines located in the Prussian province of Oberschlesien employed 123,000 miners extracting 43.8 million tons of coal per year (Frużyński, 2012). Thanks to the development of mining, iron and zinc metallurgy, and after 1870 also the chemical and metal industry just before the outbreak of the First World War, the Prussian part of Upper Silesia became one of the richest regions of Germany. The development of the Dąbrowskie Basin was less spectacular and diverse, but at the end of the nineteenth century, it also gained the status of one of the most industrialized regions of Tsarist Russia, while providing basic raw materials for the well-developed – compared to the rest of the Romanov empire – Warsaw and Łódź districts. A much less economically significant region was the Cracow Basin, which, as a part of Austrian Silesia, was clearly second in terms of the development of its Czech part. Simultaneously, thanks to large-scale immigration from less industrialized neighbouring areas, the development of mining, iron and zinc smelting, and chemical industries, as well as the intensive development of railway infrastructure, all three parts of Upper Silesia became some of the most heavily urbanized parts of Europe. Strong urbanization and the industrialization of the region are features that distinguish it from other parts of Poland, constituting its relative advantage over some post-mining districts in Europe like Welsh Glamorgan County.

The years 1914-1946 were a breakthrough for Upper Silesia both economically and politically. Back then, the region was of key strategic importance both for reborn Poland, for which coal became a major export commodity (Kaliński, 2000), and for Germany, because of its position on the map, away from the front lines for much of the First and Second World Wars. Industrial production in Silesia was also fluctuating in the wake of the political and economic events of the period. It was booming between 1914-1917 and 1940-1944 when the strong fuel demand of much of the German economy had to be met and during the so-called roaring 20s from 1922 to 1929, when both Germany and, to a lesser extent, Poland, were experiencing a period of relative prosperity. However, after these short-lasting episodes of prosperity, there were sharp production collapses during the chaos surrounding the end of both wars and the Great Depression of the 1930s. As a result, between 1918 and 1922 Silesian mines extracted about 10%, and in 1933 even 20% less coal than before the Great War. However, preparations for the Second World War in 1933-1939 and the War itself in the period of 1939-1944 led to an overrun of the amount of coal produced in Upper Silesia compared to

1913 by 20% and 65% respectively. During that period, there were significant technological changes in the mining industry itself, which resulted in a noticeable increase in the mining efficiency not only during the war but also after 1945, when the whole region, for the first time, fell within the borders of one country – the Polish People's Republic.

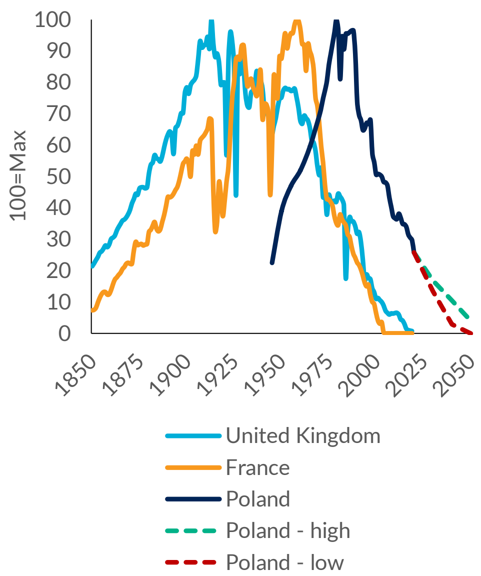

Figure 11 Steam coal extraction in Poland and selected EU countries during 1850-2020

Source: WiseEuropa based on Eurostat and Bukowski et al. (2015)

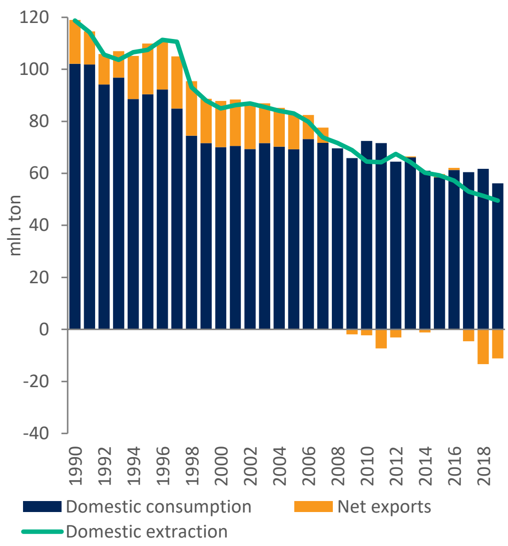

Figure 12 Extraction, domestic use and net export of steam coal in Poland, 1990-2018

Source: WiseEuropa based on Eurostat and ARP

In the economic landscape of The Polish People's Republic, Upper Silesia occupied a central place. This was due to the very high internal demand for coal from the rapidly electrifying economy and the soviet-based heavy industry patterns. Strenuous industrialization required the authorities of the People's Republic of Poland to purchase a number of licenses, machines and equipment from the western European countries. This translated into a sufficiently high export revenue, which could only be sourced from natural resources – especially hard coal. The rank of Upper Silesia on the economic and political map has therefore increased significantly, and the region has begun to enjoy relatively high prosperity compared to the rest of the country: higher wages, better supply of basic goods and improved infrastructure while becoming the site of many flagship central investments - both industrial (e.g. in energy and metallurgy) and social (health, sport and culture). Many privileges were also enjoyed by the miners themselves, who – compared to the employees of other industries - received from the Polish People's Republic special allowances for salaries, better holiday conditions, dedicated pension plans and even entertainment in the form of domination of sports leagues by the heavily subsidized mining clubs. However, export pressures and the inherent characteristics of the centrally planned economy meant that the exploitation

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of coal deposits in Silesia took place at increasing environmental and economic costs. As early as the 1980s, many functioning mines were so low-performing that their operation had no economic justification. Given the high position of the industry in the struggling economy of the Polish People's Republic, high bargaining power of miners and the distorted price signals (low energy prices in the internal market), became evident problems just before the collapse of the socialist system in 1989. The stabilization reforms carried out between 1989 and 1990 under the so-called Balcerowicz's plan, revealed the real structure of costs and revenues at the company level and the real form of supply and demand curves at the level of the national economy. These pointed to many structural challenges that the region was facing: too large and unproductive capacity in the steel industry, very energy-intensive manufacturing, as well as a huge variation in the efficiency of mining between different coal mines. In 1990, Upper Silesia was therefore in a similar situation to many regions of the traditional industry in North America or Western Europe 20 years earlier. Domestic energy demand has fallen, many companies have reduced production and employment, and a number of mining towns faced the need to close their 100-year-old mines and struggle with high unemployment.

This situation changed in about 2000 when many investments of international corporations have started to flow into Upper Silesia. They have chosen the region based on the depth of the regional labour market, good infrastructure, the existing industrial base and its location relative to other industrial centres in Poland, the Czech Republic and the Federal Republic of Germany. This largely mitigated the effects of the restructuring of mining and heavy industry, which, despite 30 years of reforms, is still far from being completed. Although the region has undergone major changes since the early 1990s, it still faces serious problems: mining damages, high levels of environmental pollution, the rapid ageing of the population of major cities, mass youth emigration, and low territorial cohesion. At the same time, the still-functioning mining companies are so weak organizationally and financially that they are unable to carry out their restructuring programs on their own. As they continue to employ around 100-150 000 people in the region (combined with the related industries), this problem is one of the most serious structural challenges of the modern Polish economy, strongly impacting how the country approaches EU climate policy.

Current developments: new strategic dimensions

2020: a new chapter for Polish coal-exit discussions (?)

Lack of sectoral reforms focusing on downsizing extraction and shifting it towards most efficient mines, even despite the ever-increasing climate ambition at the EU level and gradually decreasing competitiveness of Polish mines, have left the sector on the verge of another crisis in 2020 even before the COVID-19 pandemic shock. Most of the sector recorded losses, with the key producer – Polish Mining Group, PGG – finding itself on the brink of insolvency (Oksińska, 2020). Similarly to other companies, PGG was able to secure aid in May via a short-term, small-scale furlough-support scheme which was a part of initial anti-crisis measures provided by the Polish government to all enterprises in response to the first wave of pandemic ("PGG has lost 5x", 2020). However, the structural problems with high costs and low productivity of mining posed challenges for the Group to obtain further financing from the governmental cross-cutting support package

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(so-called Anti-Crisis Shield). In mid-2020, it became clear that short-term fixes are no longer viable and the sector requires a long-overdue mining restructuring strategy. The access to the governmental support has thus been made conditional upon presentation of such strategy to the Polish Development Bank and its notification by the European Commission (Mieżejewski, 2021).

As a result, the new chapter for the Polish coal-exit discussions has been opened, offering a chance to address both the short-term crisis-related- and deeply-rooted structural problems of the mining sector (Bukowski & Śniegocki, 2020). However, the initial phases of the process do not offer solutions needed to realise that potential. Although, given that it is not possible to subsidize mines under the current EU's state aid rules, in the summer of 2020 it seemed that the crisis would be resolved by presentation of the strategy for closure of unprofitable Silesian mines and operation plan for economically viable ones, the situation developed differently. The suggested approach has met with strong opposition from the trade unions, which led to the start of the prolonged political negotiation process between the unions and the government. This has shifted the focus of the restructuring strategy from adjusting the economic situation of Silesian coal mines to market realities, towards securing the unions' priorities – especially maintaining operations of mines and delaying decline of employment in the sector as long as possible, even via subsidies if necessary. Despite the risks associated with the need to take into account EU state aid rules, a long negotiation process and far-reaching demands from the unions, the negotiations between the government and the unions on the final shape of restructuring strategy began in Q3 of 2020 (Ministry of State Assets, 2020). Neither the pace nor the scale of the solutions that have been put on the table by the end of January 2021 will, however, allow for the preparation of the sector for the challenges associated with the decarbonisation of the Polish economy in line with the 2030 and 2050 EU climate targets.

There are two main axes of the ongoing discussions – the overarching framework outlining pace and the rules of restructuring and the Social Contract that will enable operationalisation and implementation of the framework:

- **The framework:**
  On 25th September 2020, the mining unions and the government signed an agreement on the transformation of the mining industry. According to the document, the last steam coal mine in Silesia is to close in 2049 and underground miners will have a guarantee of employment in the sector until retirement. The agreement gives a mandate for the preparation of the Social Contract and safeguards that the provisions of the Contract will govern the provisions of the final version of the Energy Policy of Poland until 2040, that is currently being prepared by the government (Baca-Pogorzelska, 2020). Importantly, it is being emphasised that the implementation of the actions outlined by the framework is conditional upon the approval from the European Commission for the state-aid needed to support operations of the Polish mines.
- **The Social Contract:**
  Despite the initial deadline for the publication of the Contract on 15th of December 2020, the discussions have been postponed to January 2021 and are still ongoing beyond the initially planned schedule. At the beginning of 2021, both sites have presented their own proposals

of the Social Contract – the document submitted by the Ministry of State Assets has been rejected by the unions' representatives, who tabled their response for the Ministry ("Unions have presented their vision", 2021). The proposal for the Contract prepared by the unions indicated that the majority of mines will be operating until 2035 and establishment of the investment fund that would support their current operations. In the document, the focus was also being placed on the system of social protections for employees of the mining sector as well as on the development and investments in the "clean coal" technologies. The unions' proposal envisages that the activities will be financed inter alia from the EU ETS revenues and the European Recovery and Resilience Facility. Currently, further talks in the form of working meetings with representatives of several ministries are being planned for early February and according to the announcements the agreement is expected to be reached by mid-February.

From the economic perspective, given the stagnation of coal prices on the international market, the low efficiency of Silesian mines and the high generation costs in old coal-fired plants coupled with their inability to compete on the international market, such efforts to maintain operations of Silesian coal mines well into the 2040s cannot be justified. Simultaneously, from the legal perspective, in the current shape, provisions of both the framework and the Social Contract entail actions, which are explicitly prohibited by *inter alia* the EU state aid rules (which in current shape allow for coal financing until 2040) and the rules governing the disbursement of the EU funds (i.a. do no significant harm rule associated with Recovery and Resilience Facility) (European Commission, 2020c). Thus, it is highly unlikely that the agreement will materialise in the near future, and both sides will have to return to the negotiating table.

Current provisions entailed in the restructuring strategy do not scale up the pace of the coal-exit in Silesia and more generally in Poland. Conversely, they aim to sustain the current status quo of the mining sector and counteract market forces, which, without such state intervention, would lead to a much faster decline of the mining sector in Poland following the trends recorded by other EU countries. Such inherently flawed process of designing the restructuring strategy for the sector hinders not only the process of Just Transition of the Silesian coal region but also allows for a disproportionate impact of trade unions on the final shape of the national energy strategy, threatening the possibility to decarbonise Polish economy in the economically effective and efficient manner.

Territorial Just Transition Plans: Silesia

Currently, at the strategic level, measures regarding the Just Transition of Polish coal regions are included in the National Energy and Climate Plan (NECP) and in the draft Polish Energy Policy until 2040. Both documents identify the most important categories of challenges related to the transformation of mining regions, however, the recently presented assessment of the Polish NECP prepared by the European Commission highlights the need to refine and provide additional information on the effects of the transformation (European Commission, 2020b).

At the same time, the NECP presents only the national-level overarching framework for the transformation of coal regions, leaving a detailed plan of actions necessary to be implemented in individual voivodeships to be specified in the Territorial Just Transition Plans (TJTP). The role of TJTP is to determine the transformation strategy of a given coal region, which should be consistent with the NECP and the goal of climate neutrality in 2050 (European Commission, 2020a). Plans should focus on supporting the most severely affected areas by identifying key socio-economic and environmental challenges and by precisely defining restructuring tools and methods. Preparation of TJTP is a condition that has to be met in order to access the European Just Transition Fund, from which Poland will receive the largest share of funds.

In December 2020, Marshal Office of the Silesian Voivodeship has informed that it aims to present TJTP to the European Commission by June 2021 and will be prepared to present its project already at the beginning of 2021 ("Presentation from the 6th meeting", 2020). Local authorities emphasise that TJTP for Silesia will not only guide the investments supported from the Just Transition Fund allocated to the region (EUR 2 bln) but also from ERDF and ESF+. Importantly, according to the announcements made by the Ministry of European and Development Funds, in 2021-2027 Silesia will receive the largest share of EU funds (EUR 4.4 bln) when comparing to other European regions ("Billions of the region", 2021).

Awaiting the official document, several organisations are calling for the Plan to prioritise the following investment challenges:

1. expansion and diversification of the local industrial base with highly productive low-emission sectors and development of an advanced services segment.
   Recent estimates show that expansion and diversification of the regional economic activity can lead to the creation of 75-85 thousand new vacancies. For comparison, it is estimated that in 2019 ca. 75 thousand employees worked in the mining sector in Silesia (IBS & WWF, 2021).
2. improvement of competitiveness of higher education institutions and research institutes coupled with reskilling of the mining sector employees
   This means increasing the academic status of regional higher education institutions and research institutes, as well as reprofiling some of them to support sectors not connected directly with the mining sector as a necessary step to ensure the creation of modern industrial commons, i.e. networks of close connections between the centres generating human, social, and physical capital (Bukowski, Śniegocki, & Wetmańska, 2020).

The announcements regarding the TJTP released to date, allow to assume that the planned structure of spending so far will resemble the priorities known from previous cross-cutting Regional Operational Programs. On one hand, this is beneficial as it will allow for the Plan to tackle a wide range of challenges whilst taking into account social aspects of the regional development, but on the other hand, it remains to be seen to what extent the Plan will manage to offer solutions tailored to the specificity of the given regions in transition. This will be especially challenging given the uncertain impact of parallel talks between the government and trade unions on the future of Silesian mining. Without a realistic timeline of further mine closures, it is still not known which local communities will face the transition shocks in the near future, when will these shocks happen and what will be their scale. This is currently the key obstacle to designed well-tailored, coordinated and timely support within the Silesian TJTP.

Conclusions

The future of just transition in Silesia is currently being determined by two parallel processes. The first of them is the development of the Territorial Just Transition Plan by regional authorities in cooperation with the broad range of stakeholders. The Plan focuses on the mitigation of the negative consequences of the decline of carbon-intensive industries by supporting economic diversification and social inclusion in the affected local communities. The second process focuses on determining the pathway for coal mining restructuring, and in particular specific dates for mine closures as well as potential subsidy schemes which may allow extending the timeline of coal mining exit up to 2049. The latter process is dominated by the mining trade unions, which have been engaged in an extensive negotiation process with the government.

Both processes were launched in response to long-term structural challenges, and are being implemented at the time when the significant resources for supporting the just transition formation are abundant. While both processes could be designed in a way which is mutually reinforcing and aiming to reduce the dependency of the region's economic development on the mining sector, this has not been the case. While the preparation of the TJTP is following EC's guidance and build on well-established regional capacities in inclusive management of the EU funds, the preparation of the mining sector deal is being dominated by the mining trade unions which are focused on extending the functioning of the sector for as long as possible, despite legal barriers and economic costs of introducing continued sectoral support up to 2049.

While both processes are yet to conclude in 2021, they already offer an important example of both good and bad practices in managing transition on the regional level. Resulting delays and uncertainties around the future of transition in Silesia highlight the need to ensure that any discussions on regional just transition are inclusive, covering not only representatives of declining carbon-intensive industries (in Polish case: trade unions and the national government, which holds the controlling stake in all the major mining companies), but also regional and local authorities, representatives of other sectors and civil society.

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Energiepolitik des Landes Brandenburg nach dem Kohleausstieg

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Brandenburg ist seit jeher ein Energieland. Auch im Rahmen der Energiewende nimmt das Land eine Spitzenstellung ein. Kaum ein anderes Bundesland hat den Ausbau der Erneuerbaren Energien stärker vorangetrieben. Diesen fortschrittlichen Weg wird Brandenburg auch weitergehen. In der Energiestrategie 2030 sind die wesentlichen Ziele zum weiteren Ausbau der Erneuerbaren Energien sowie zur Reduzierung von CO2-Emissionen festgelegt. Die Energiewende wird jedoch nur dann gelingen, wenn sie von breiten Teilen der Bevölkerung unterstützt und die Betroffenheit Einzelner ernst genommen wird. Die brandenburgische Energiestrategie sieht bis 2030 einen Ausbau der Leistung der installierten Photovoltaikanlagen von 3,5 GW und der installierten Windenergieanlagen von 10,5 GW vor. Das PV-Ziel wurde mit aktuell 3,7 GW bereits überert füllt, bei Wind sind es aktuell 7,3 GW, was einen Erfüllungsgrad von 70 Prozent bedeutet. Wir stehen also bereits sehr gut da.

Herausforderungen in der Energiewende

Der Ausbau der Erneuerbaren Energien stellt eine wichtige Komponente im Rahmen der Energiewende dar. Wichtig ist in diesem Zusammenhang jedoch auch die Nutzung der Energie, also die Synchronisierung mit dem Verbrauch. Solar- und Windenergie sind volatile Energieträger und ihre Erzeugung von Tages- und Jahreszeit sowie vom Wetter abhängig und nicht immer planbar. Deshalb müssen technologische Lösungen zur Speicherung sowie der Netzausbau aber auch die Flexibilisierung des gesamten Systems – also die bessere Abstimmung von Erzeugung und Lasten – künftig eine noch größere Rolle spielen.

Aufgrund des in jüngster Zeit zu beobachtenden Einbruchs beim Ausbau der Windenergie ist es allerdings von Bedeutung, dass so schnell wie möglich eine Verständigung zu den entscheidenden Fragen etwa bei der Regionalplanung, bei den Genehmigungsverfahren sowie bei den Abstandsregelungen zu Wohngebieten erfolgt. In zentralen Fragen sind wir bereits ein ganzes Stück weitergekommen. So sollen die Planungs- und Genehmigungsverfahren zum Ausbau der Erneuerbaren Energien und der Netze beschleunigt werden. In Brandenburg haben wir zur Erhöhung der Akzeptanz dafür gesorgt, dass betroffene Kommunen bei der Planung über die regionalen Planungsgemeinschaften stärker beteiligt werden und Erlöse aus dem Ausbau der

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Windkraft auch im Ort verbleiben. Die im letzten Jahr eingerichtete Beratungsstelle Erneuerbare Energien bei der Energieagentur des Landes soll zu einer Dialog- und Servicestelle für die Energiewende weiterentwickelt werden.

Abbildung 13 Mark Landin, Windpark Quelle: Rauenstein 2006, Wikimedia Commons https://commons.wikimedia.org/wiki/File:Mark_Landin,_Windpark.jpg

Umbau der Energiewirtschaft von Kohle auf Erneuerbare Energien

Die Landesregierung in Brandenburg hat sich das zentrale Ziel gesetzt, den Umbau der Energiewirtschaft von Kohle auf Erneuerbare Energien zügig voranzutreiben.

Mit dem Kohleausstiegsgesetz steht jetzt ein verlässliches Enddatum für die Braunkohleverstromung in Brandenburg fest. Spätestens im Jahr 2038 soll das Kraftwerk Schwarze Pumpe vom Netz gehen. Das Kohleausstiegsgesetz, das die Beschlüsse der Kommission „Wachstum, Strukturwandel und Beschäftigung" umsetzt, ist am 14. August in Kraft getreten. Kernstück des Kohleausstiegsgesetzes ist das Kohleverstromungsbeendigungsgesetz. Es wurde erlassen, um die Erzeugung elektrischer Energie durch den Einsatz von Kohle (sowohl Braunkohle als auch Steinkohleanlagen) sozialverträglich, schrittweise und möglichst stetig zu reduzieren und zu beenden, um dadurch Emissionen zu verringern. Gleichzeitig soll eine sichere, preisgünstige, effiziente und klimaverträgliche Versorgung der Allgemeinheit mit Elektrizität gewährleistet werden.

Die konkrete zeitliche Umsetzung des Kohleausstiegs sieht vor, dass die Braunkohle- und Steinkohlekraftwerksleistungen im Jahr 2022 auf 15 GW und im Jahr 2030 auf 9 GW bzw. 8 GW zurückgeht. Spätestens 2038 soll weder Braun- noch Steinkohle in Deutschland verstromt werden. Eine kontinuierliche Verringerung wird dadurch gewährleistet, dass in den Jahren, in denen weniger Braunkohlekraftwerke vom Netz gehen, mehr Steinkohlekraftwerke stillgelegt werden. Zur rechtlichen Realisierung des Ausstiegs sind für beide Kohlearten verschiedene Lösungen vorgesehen. Braunkohlekraftwerke werden über vertragliche Lösungen abgeschaltet, während Steinkohlekraftwerke über Ausschreibungsverfahren stillgelegt werde, wofür die jeweiligen Betreiber finanziell kompensiert werden. Als Anreiz für frühzeitige Stilllegungen werden die jeweiligen Höchstpreise degressiv gestaltet.

Zur Begleitung des Kohleausstiegsprozesses ist gleichzeitig mit dem Kohleausstiegsgesetz das Strukturstärkungsgesetz verabschiedet worden. Dieses Gesetz setzt die strukturpolitischen Empfehlungen der Kommission „Wachstum, Strukturwandel und Beschäftigung" um. Zur Unterstützung des Strukturwandels erhalten die Braunkohleländer Sachsen, Sachsen-Anhalt und Brandenburg bis zum Jahr 2038 Finanzhilfen von bis zu 14 Mrd. Euro für Investitionsprojekte, die sie in eigener Zuständigkeit umsetzen. Zudem unterstützt der Bund die betroffenen Regionen in den drei Bundesländern durch weitere Maßnahmen in eigener Zuständigkeit mit bis zu 26 Mrd. Euro bis 2038, etwa durch Erweiterung von Forschungs- und Förderprogrammen, den Ausbau von Verkehrsinfrastrukturprojekten oder die Ansiedlung von Bundeseinrichtungen. Von diesen insgesamt 40 Mrd. Euro entfallen nach dem Verteilungsschlüssel über 10 Mrd. Euro auf Brandenburg bzw. die Lausitz, die dort bis 2038 zur Verfügung stehen.

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Kohleausstieg in der Lausitz

Durch die Förderprogramme hat die Lausitz sehr gute Möglichkeiten, den bevorstehenden Strukturwandel proaktiv zu gestalten. Mit Blick auf den Kohleausstieg, der mit der Abschaltung der ersten Blöcke im Kraftwerk Jänschwalde bereits begonnen hat, müssen bereits in den nächsten Jahren die Voraussetzungen für Wirtschaftsansiedlungen und Arbeitsplätze geschaffen werden. Dabei kommt es darauf an, schnell Planungsvorlauf zu schaffen und gleichzeitig langfristig tragfähige, nachhaltige und zukunftsfeste Perspektiven für Wirtschaft und Beschäftigung zu sichern. Dies schließt das Ziel ein, bis zum Jahr 2050 Treibhausgasneutralität zu erreichen.

Ein entscheidender Baustein für diese Zukunftsstrategie ist, dass die Lausitz auch in Zukunft Energieregion bleibt. Hierfür spricht zum einen die gute Infrastruktur, insbesondere was die Anbindung an die Netzknoten des Stromnetzes angeht, aber auch die dort vorhandene Fachkräftestruktur. Statt um Braunkohle wird es in Zukunft um Erneuerbare Energien, Speichertechnologien und Wasserstoff gehen. Mit der Ansiedlung von energie- und klimarelevanten Instituten in der Region (Fraunhofer Institut für Energieinfrastruktur und Geothermie, DLR-Institut für CO2-arme Industrieprozesse) sind bereits die ersten Schritte getan.

Ausbau Erneuerbarer Energien

Darüber hinaus stellt der Kohleausstiegspfad aber auch energiepolitische Herausforderungen an das gesamte Land Brandenburg. Auf Bundesebene soll bis zum Jahr 2030 der Anteil der Erneuerbaren Energien am Bruttostromverbrauch auf 65 Prozent ansteigen. In Brandenburg beträgt der Anteil bereits jetzt über 90 Prozent. Das Land hat also bereits jetzt die besten Voraussetzungen, seinen Energiebedarf nachhaltig und klimaverträglich zu decken. Ein großer Teil des in Brandenburg produzierten Wind- und Solarstroms bleibt jedoch nicht im eigenen Land, sondern wird in andere Bundesländer exportiert. Wir werden uns deshalb auch für eine Verbesserung der Rahmenbedingungen für eine regionale Grünstoffvermarktung einsetzen, damit möglichst viel des hier erzeugten Grünstroms auch im Land verbleibt. Das erspart zum einen Netzausbau. Außerdem werden Ansiedlungsvorhaben wie die Tesla-Gigafactory dazu führen, dass die Last in Brandenburg steigt.

Ausblick auf zukünftige Energiepolitik in Brandenburg

Im Rahmen der fortschreitenden Energiewende werden jedoch neben der klassischen Stromversorgung zunehmend auch die anderen CO2-emittierenden Sektoren wie Verkehr und Wärme, aber auch nichtenergetischen Industrieprozesse relevant, sodass die Nachfragebedarfe nach grüner Energie weiter stark ansteigen werden. In diesem Zusammenhang sind für uns insbesondere die Anwendungsbereiche für Wasserstoff interessant. Wasserstoff hat aus heutiger Sicht in der Zukunft das größte Potential, um die Herausforderungen der Energiewende zu schultern, die Dekarbonisierung voranzubringen, um so die Klimaziele von Paris zu erreichen.

Aktuell arbeitet die Landesregierung an der Aktualisierung und Weiterentwicklung ihrer Energiestrategie (Energiestrategie 2040), um diese an die geänderten gesetzlichen und energiepolitischen Rahmenbedingungen anzupassen und strategische und technologische Antworten auf die Fragen der fortschreitenden Energiewende und des begonnenen Strukturwandels für das Energie- und Industrieland Brandenburg und die Lausitz zu skizzieren. Darüber hinaus befindet sich auch ein Klimaplan in Erarbeitung der die Weiterentwicklung der bestehenden Fachstrategien der Landesregierung zu einer verbindlichen Klimastrategie zusammenfasst.

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Conflicts in Energy Transitions

Part III Beiträge aus der Nachhaltigkeitslehre

Conflicts in Energy Transitions – Eine Reflexion über das online-Seminar für Masterstudierende vom SoSe 2020

Das Seminar „Conflicts in Energy Transitions“, welches im Sommersemester 2020 von Prof. Dr. Michael Böcher und Dr. Ulrike Zeigermann angeboten wurde, stellte sich - in digitaler Form - den aktuellen Diskussionen über erneuerbare Energien, deren Konfliktpotenzialen und Zukunftsausblicken. Das Seminar wurde in drei Themenabschnitte unterteilt, um Struktur in die Komplexität des Themenfeldes zu bringen, sowie das asynchrone Lernen zu fördern. Diese Themenfelder werden im Folgenden vorgestellt und es wird diskutiert, inwiefern dieser Aufbau den Studierenden das selbstverantwortliche Bearbeiten der Module, welche alle vier Wochen in synchroner - und aufgrund der Covid-19-Pandemie in digitaler Form - besprochen wurden, ermöglichte.

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Aufbau des Seminars

Da Studierende und Lehrende im Sommersemester 2020 aufgrund der Covid-19-Pandemie auf - bis dato - ungewohnte Lern- und Lehrmethoden zurückgreifen mussten, wurde das Seminar online mit starkem Fokus auf das Selbststudium angeboten. Um Struktur in die Komplexität des Themas zu bringen, wurde das Seminar vorab in drei Themenabschnitte unterteilt. Diese drei Teile beinhalteten vorbereitete Module (siehe Abbildung 14) auf der E-learning-Plattform Moodle zum asynchronen Lernen, wissenschaftliche Texte, aber auch Aufgaben zur Überprüfung der Lernfortschritte. Für jeden Teil waren drei Wochen Bearbeitungszeit vorgesehen und in der vierten Woche fand ein synchroner digitaler Austausch über die Lerninhalte statt.

So wurde den Studierenden im ersten Teil des Seminars „*Introduction to Conflicts in Energy Transitions*“ die Möglichkeit gegeben, sich mit der Verbindung von Konflikten und natürlichen Ressourcen, Protestbewegungen, sowie den widersprüchlichen öffentlichen Zielen in der Energiewende auseinander zu setzen. Am Ende dieses ersten Teils fand ein gemeinsames – virtuelles – Treffen statt, um nicht nur die einzelnen Themen zu besprechen, sondern auch die vorbereiteten Aufgaben zu den selbst ausgewählten Energiequellen. Die Aufgabe dieses ersten Teils sollte in Form von Postern eingereicht werden (siehe Abbildung 15). Sie bestand darin, die Herausforderungen und wesentlichen Informationen zu der gewählten Energiequelle zu präsentieren, ihr Konfliktpotenzial zu identifizieren und zu diskutieren, sowie vergangene und aktuelle Protestbewegungen zu reflektieren. Ziel der Aufgabe war es, das erlernte Wissen aus dem ersten Themenabschnitt auf die ausgewählten Beispiele anzuwenden.

Im zweiten Teil des Seminars „*Regional and International Conflicts in Energy Transitions*“ fokussierte sich das Seminar auf die internationale Betrachtung von Sicherheit, Kooperation und Konflikten. Jedes Modul sollte dabei von einer Zweiergruppe bearbeitet werden, wobei die Inhalte ebenso auf Postern

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zusammengefasst wurden, welche ca. vier Wochen nach der ersten Abgabe eingereicht werden sollte. Anders als bei der ersten Abgabe, in der die Struktur der Poster durch die zu beantwortenden Fragen der Lehrenden vorgegeben wurde, waren die Studierenden bei der Gestaltung der zweiten Poster freier. Dabei wurde beispielsweise beim Thema *Security and Geopolitics of Energy Policy* der Fokus auf Chancen/Herausforderungen und zukünftige Szenerien gelegt, beim Thema *Energy in EU Foreign and Security Policy* wiederum auf internationale Sicherheitsmaßnahmen. Die Auswertung der Poster fand in der zweiten Live-Session statt.

Der dritte und letzte Themenabschnitt des Seminars: *„Contested Futures for Energy Transitions“*, diente somit der Zusammenfassung, mit Ausblick auf zukünftige Szenerien. Dabei wurde der Inhalt des letzten gemeinsamen Treffens von den Lehrenden, Prof. Dr. Michael Böcher und Dr. Ulrike Zeigermann gestellt, welcher anschließend kollektiv debattiert wurde. Prof. Böcher referierte dabei über die internationalen Auswirkungen von nuklearer Energie, wobei er nicht nur über die Ereignisse in Fukushima, sondern auch über das Potenzial von nuklearen Waffen sprach. Folgend stellte Dr. Zeigermann umstrittene Wege für eine nachhaltige Energiewende und soziale Gerechtigkeit dar.

Die Studierenden hatten die Möglichkeit das Seminar, mit dem Einreichen der Abgaben sowie der aktiven Bearbeitung der Module und Teilnahme, mit 4 CP abzuschließen. Für 6 CP sollte am Ende des Semesters eine Hausarbeit eingereicht werden.

Themenabschnitt	Module			
I. Introduction to Conflicts in Energy Transitions	**Energy transitions**	**Energy and natural resources conflicts**	**Conflicting public goals in energy transitions**	**Social Protest in energy transitions**
	Überblick zum Thema Energiewende und den verschiedenen Formen von Energiequellen	*Natürliche Ressourcen und ihre Rolle in gewalttätigen Konflikten*	*Widersprüchliche politische Ziele und Interessen in Bezug auf Energiewende(n)*	*Widerstände und Protestbewegungen in der Energiepolitik*
II. Regional and International Conflicts in Energy Transitions	**Security and geopolitics of Energy Policy**	**Energy in EU Foreign and Security Policy**	**Governing energy transitions I – Actor constellations in energy politics**	**Governing energy transitions II – Institutions**
	Sicherheits- und geopolitische Zukunftsmodelle für Energiesicherung	*Europäische Klimapolitik und der Energy-Security-Nexus*	*Akteure in der Energiepolitik und Energiesicherung*	*Die Rolle von Institutionen und ihr Einfluss auf die Energiewende*
III. Contested Futures for Energy Transitions	**Diverse pathways for energy transitions**	**Stakeholders and power in energy transitions**	**Marginalised groups in energy transitions**	**New directions for energy transitions**
	Nukleare Energie, ihre Nachteile sowie Möglichkeiten	*Das Gedankenspiel einer gleichberechtigten Energiewende ohne Energiearmut*	*Eine außereuropäische Betrachtung zum Thema Energie-zugang (z.B. in Afrika)*	*Fragen zu Sicherheit, gerechte Verteilung, sowie Schnelligkeit der Energiewende*

Abbildung 14 Aufbau und Inhalte des Seminars 'Conflicts in Energy Transition‘, eigene Darstellung von Djamila Jabra

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Djamila Jabra 19.5.2020

Nuclear Energy

Conflicts in Energy Transitions
Prof. Dr. Michael Böcher and Dr. Ulrike Zeigermann

Introduction

- Nuclear power reactors use the heat produced from splitting atoms to generate steam to drive a turbine (World Nuclear Association).
  - The nuclear fuel can be used in a reactor for several years.
  - The power from one kilogram of uranium is about the same as 1 tonne of coal.
  - On average, a reactor supplying a person's electricity needs for a year creates about 500 grams of waste (it would fit inside a soda can) (World Nuclear Association).
  - The power plants are largely reliable and can run for month without interruptions.
- Nuclear power have made up more than **85% of Germany's electricity generation over the years and in 2018, 10,5% of the world´s electricity** (World Nuclear Association).
- It is an **environmentally friendly** form of electricity generation (World Nuclear Association).
  - The nuclear industry expected to benefit from these climate commitments as it is virtually carbon-emission free, after the plant is constructed.
- **No greenhouse** gases are produced (World Nuclear Association)
  - Only very small amounts are produced across the whole nuclear life cycle
  - Clean electricity without air pollution and small amount of waste
- **The Process:** A nuclear reactor is driven by the splitting of atoms, a process called fission, where a particle (a 'neutron') is fired at an atom, which then fissions into two smaller atoms and some additional neutrons (World Nuclear Association).
- **Critique:** Nuclear power is a non-renewable and risky energy source, but also the concerns about the sustainability and health risks related to electromagnetic radiation and nuclear waste storage are common critique points (Krick 2017: p. 12).

DEFINITION

„a powerful form of energy produced by changing matter into energy by splitting the nuclei (= central parts) of atoms. It is used to produce electricity."
- (Oxford Learning Dictionaries).

„Nuclear power has historically been one of the largest contributors of carbon-free electricity globally and it has significant potential to contribute to power sector decarbonisation."(IEA).

„Nuclear reactors come in many different shapes and sizes - some use water to cool their cores, whilst others use gas or liquid metal."(World Nuclear Association).

1986: *Chernobyl*
2011: *Fukushima*

What are conflicting public goals related to your energy source? Provide an example of a conflict.

The difficulties of the German energy transition (Energiewende) are „conflicting public goals" related to nuclear power.

„Energiewende"(energy transition): Is called the process of phasing out nuclear power until 2022 in Germany. With the aim of shifting energy sources from nuclear and fossil to renewable energy sources like water and solar.

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Difficulties of the transition:

- Trusting the governments decisions and transparency
- The energy transition is as a big national challenge and ethical responsibility that requires individual efforts (Krick 2017: p .13).
- Communicating and „(…) funding of applied research on energy-technological innovations that promise competitiveness of the German industry-based economy, (…)."(Krick 2017: p .13).
- The transition to renewables depends strongly on individual investments and consumption changes, which leads to high costs for private households, like rising electricity bills (Krick 2017: p .13). **This can be challenging for low-income households.**
- **To sum it up:** The transition from nuclear to renewable energy sources is, due to the illustrated arguments difficult and conflicting. However, as the public in Germany became more critical of, and active against, nuclear power, the Government has responded quickly to demands for improved safety and control, especially **after Fukushima**. So in contrast, the energy transition is depending on long lasting trust, individual efforts, research and money.
- **Further „conflicts"** are the disagreement between European countries. While Germany is planing on renewable energy sources, France and the UK for example are reasserted their commitment to nuclear power as a tool for reducing climate change (Renn, Ortwin and Jonathan Paul Marshall (2016): p. 2). Which can be explained by it's **environmentally friendly** form of electricity generation and **non producing greenhouse gases**, but concerns over safety (after Fukushima) and broader public acceptance remain obstacles to future developments, and nuclear power is facing an unclear future in many countries world wide.

Additional Facts

FACTS

„Nuclear power has not been immune to the impacts of the **Covid-19 crisis** (…)."

„Global nuclear power generation fell by about 3% in Q1 2020 compared with Q1 2019, pulled down by electricity demand reductions."

„If the recovery from the crisis is faster, electricity demand would be higher and some new reactors would be completed in 2020, leading to a reduction in nuclear power in 2020 of just over 1%."

- IEA/ Global Energy Review 2020

„All 17 of Germany's nuclear power plans, announced in September 2011 that it would no longer build nuclear power plants anywhere in the world."(Renn/Marshal).

Are there social protests related to your energy source? Characterize those conflicts and provide an illustrating example.

Mid-1970s: Major anti-nuclear power protests and demonstrations started.

- The environmental movement and public protest against nuclear power, became a strong political force.

1986: *After Chernobyl:* More critical positions against nuclear power occurred world wide.

- *For example:* The Green Party in Germany became one of the main driver towards renewable energies in the 1980.

2011: *After Fukushima:* Austria, Switzerland, Denmark and in particular Germany, shifted their climate policies further towards renewable energy (e.g.*Germany => Energiewende (energy transition)).*

- Abrupt policy changes resulted from actors taking unexpected strategic opportunities, as when anti-nuclear campaigners used the public outrage after Chernobyl and Fukushima to press forward new policy initiatives.

- **Example:** *„Nuclear Power ? No Thanks"/„Smiling Sun"* **=>Since 1975**
  - The „Smiling Sun" Logo was designed by the danish activist Anne Lund, which became the most common worldwide symbol in the anti-nuclear power movement.

2

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Abbildung 15 Poster zum Seminar 'Conflicts in Energy Transitions' von Djamila Jabra

Auswertung

Das Sommersemester 2020 und die pandemiebedingte Umstellung etablierter Lehrmethoden, war nicht nur für Lehrende, sondern auch für Studierende eine stetige Herausforderung. Selbstorganisation, Disziplin, technische Neuheiten und die Ungewissheit, die das erste Corona belastete Semester mit sich brachten, führten aber auch dazu, vermeintlich veraltete Strukturen neu zu gestalten.

Anfängliche Sorge ob die technischen Möglichkeiten es auch online zu einem realitätsgetreuen Seminar machen können, verflogen schnell. Da beispielsweise die Kommunikation mit den Lehrenden erfahrungstechnisch immer gut war, denn es konnten stets Fragen gestellt, sowie Hilfestellungen erfragt werden, die zeitnah beantwortet wurden. Diese Flexibilität äußerte sich vor allem in Form von Onlinesprechstunden, als auch in einer - im Vergleich zu anderen Semestern - auffallend schnelleren Kommunikation per Mail. Dabei kam es zu keinem Zeitpunkt zu technischen Schwierigkeiten, da die erste Live-Session des Seminars Ende Mai stattfand, und so bereits erste Erfahrungen in Bezug auf Onlineunterricht gesammelt werden konnten.

Inhaltlich kann festgehalten werden, dass der Aufbau des Seminars stets sinnvoll und nachvollziehbar strukturiert war. Die Lernziele und Schwerpunkte wurden schnell klar, indem die Studierenden beim Grundwissen über Energiequellen anfingen, um folgend ein besseres Verständnis der aufkommenden Konflikte und Zukunftschancen auf verschiedenen politischen Ebenen zu erlangen. So waren auch die zwei Perspektiven auf das Thema, die von Prof. Dr. Michael Böcher und Dr. Ulrike Zeigermann zur Verfügung gestellt wurden, von Vorteil. Zwar treffen sich beide thematisch beim Thema Nachhaltige Entwicklung und Umweltpolitik, jedoch waren ihre individuellen Ansätze zu dem Thema hilfreich um die eigene Reflexion weiter zu frühen. Da Dr. Zeigermanns Forschungsschwerpunkt auf internationalen Menschenrechte, sowie Sicherheits- und Entwicklungsforschung liegt, waren diese Gedankengänge auch beim Anregen weiterer Diskussionen deutlich zu erkennen. Prof. Böcher auf der anderen Seite, regte Gedankenspiele in Bezug auf Zukunftsszenerien an, um die Wahrscheinlichkeiten aus verschiedenen politischen Blickwinkeln abzuwägen.

Darüber hinaus war ein kleines, für viele vielleicht belangloses Detail, die englische Sprache. Vor allem für Peace und Conflict Studies und European Studies, die eine Brandbreite an internationalen Studierenden in ihren Jahrgängen haben, bot es die Möglichkeit, weitere Seminare über Nachhaltigkeit und Umweltpolitik zu besuchen, um so auch in Interaktion mit Studierenden außerhalb ihrer Studiengänge zu kommen.

Um auf den Arbeitsaufwand des Seminars einzugehen, erschien dieser zunächst sehr hoch, war jedoch beim genaueren betrachten durchaus angemessen, um die Komplexität des Themas ausreichend abzudecken. Dies schließt auch die einzureichenden Abgaben ein, da einem nicht nur die Chance geboten wurde, seinen eigenen Schwerpunkt zu wählen, sondern auch kreativ bei der Gestaltung der Poster zu werden. Denn tatsächlich setzten auch heute noch viele Seminare auf Referate und Hausarbeiten, wobei die Studierenden in diesem Seminar außerhalb ihrer Komfortzone agieren konnten. Das schließt die Eigenverantwortung und das Selbststudium des Seminars mit ein, in dem auf Selbstorganisation und Disziplin gesetzt wurde.

So bot das Selbststudium zwar das individuelle Erarbeiten der Module, jedoch fehlte die „Kontrollinstanz“ ob und wie diese erarbeitet werden. Dies fiel vor allem in den Live-Sessions und den Diskussionen auf, da schnell klar wurde, dass nicht alle Studierenden sich gleichermaßen vorbereitet haben.

Darüber hinaus waren drei zweistündige Live-Sessions zu wenig, um die Komplexität der

Thematik ausreichend zu besprechen. Vor allem am Anfang des Semesters hätte eine einleitende Sitzung geholfen offene Fragen kollektiv zu besprechen. Denn in einem Onlinesemester, in dem Studierende keine direkte Interaktion mit Kommiliton:innen haben, hätte dieses nicht nur zu einem kennenlernen sondern auch zur Transparenz der Teilnehmer:innen führen können. Doch auch organisatorische, sowie eine erste Einleitung ins Thema hätten geholfen, um sich ein Bild des Arbeitsaufwands, und der Themenschwerpunkte zu verschaffen.

Zusammenfassung

So kann zum Schluss festgehalten werden, dass das Seminar *„Conflicts in Energy Transitions“* die traditionellen Seminarstrukturen aufgebrochen hat und auf Selbstorganisation und Kreativität setzte. Ernüchternd waren oftmals die studentischen Beiträge während der Live-Sessions, die leider mehr als einmal ausblieben und somit den Mehrwert der Diskussionen schmälerte. Dabei ist ungewiss ob es an der Thematik, am neunen Onlineunterricht, oder an der Anzahl der Live-Sessions lag. Vielleicht könnten dabei ein oder zwei weitere Sitzungen helfen, um Sicherheit und Struktur zu vermitteln.

Persönlich bin ich über meinen bevorzugten Forschungsschwerpunkt hinausgewachsen, so betrachte ich Energiequellen nicht nur akademisch aus neuen Blickwinkeln, sondern auch privat.

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